2nd ICST 2017

THE EMERGENCE OF SCIENCE FOR HUMAN PROSPERITY AND HEALTH

Joint International Conference on Science and Technology in The Tropic

Organized by:
University of Mataram, Indonesia and University of Malaya, Malaysia

PROCEEDINGS

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"Joint International Conference on Science and Technology in The Tropic"

Mataram, August, 23th-24th 2017

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Mataram, August, 23th-24th 2017

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KEYNOTE SPEAKERS

Keynote Speaker	Name and Institution	Country
Keynote Speaker 1	**Prof. Ir.H. Sunarpi,Ph.D** (University of Mataram,)	**Indonesia**
Keynote Speaker 2	**Prof. Dr. Dato' Azizan Abu Samah** (University of Malaya,)	**Malaysia**
Keynote Speaker 3	**Prof. Franl Lavigne** (Universite Paris)	**France**
Keynote Speaker 4	**Prof. Lim Phaikeem** (University of Malaya)	**Malaysia**
Keynote Speaker 5	**Dr. Weiwei Yu** (Third Institute of Oceanography)	**China**
Keynote Speaker 6	**Prof. Dato'Asbi Ali, Ph.D** (Management and Science University)	**Malaysia**
Keynote Speaker 7	**Prof. Dr. Akihiro Hazama, MD** (Fukushima Medical University)	**Japan**
Keynote Speaker 8	**Dr. Wenjia Hu** (Third Institute of Oceanigraphy)	**China**
Keynote Speaker 9	**Prof. Julian Heyes** (Massey University)	**New Zealand**

Joint international Conference University of Mataram, Indonesia, and University of Malaya, Malaysia
INTERNATIONAL CONFERENCE OF SCIENCE AND TECHNOLOGY (The 2nd ICST)
UNIVERSITY OF MATARAM
Mataram, August 23rd to August 25th, 2017

THE CONFERENCE PROGRAMME

TIME	AGENDA	MODERATOR	PLACE AND PIC
DAY : WEDNESDAY,AUGUST 23 RD TO AUGUST 25, 2017			
08.00-09.00	REGISTRATION	University of Mataram Dome (Prof. Sunarpi Building)	
09.00-10.00	**Opening Ceremony Location University of Mataram Dome (Prof. Sunarpi Building) Jl. Majapahit 62 Mataram**		MC Nizar
09.00-09.05	Doa	Ir. H. Rasidy, M.Si	
09.05-09.10	Indonesian Anthem	University of Mataram Choir	
09.10-09.20	Welcome Speech	The Chair of Organizing Committee Dr.rer.net Telly Savalas	
09.20-09.30	Opening Speech	Rector University of Mataram Prof. Ir.H. Sunarpi,Ph.D	
09.30-09.40	Opening dances and songs	Students of Mataram University	
09.40-10.30	MORNING TEA BREAK & POSTER SESSION		BPPU
10.30-12.00	**Keynote Speakers Plenary-1 Location University of Mataram Dome (Prof. Sunarpi Building) Jl. Majapahit 62 Mataram**	**Moderator: Muhammad Ali, S.Pt., M.Si., Ph.D**	
10.30-11.00	**Keynote Speaker-1** Science	**Prof. Ir.H. Sunarpi,Ph.D** (University of Mataram, **Indonesia**)	
11.00-11.30	**Keynote Speaker-2** Physics	**Prof. Dr. Dato' Azizan Abu Samah** (University of Malaya, **Malaysia**)	
11.30-12.00	**Keynote Speaker-3** Physical Geography	**Prof. Franl Lavigne** (Universite Paris, **France**) Long-term impact of the 1257 CE eruption of Samalas volcano in Lombok Island	
12.05-13.05	**Keynote Speakers Plenary-2 Location University of Mataram Dome (Prof. Sunarpi Building) Jl. Majapahit 62 Mataram**	**Moderator: Prof. Sri Widyastuti**	
12.05-12.35	**Keynote Speaker-4** Marine Biology	**Prof. Lim Phaikeem** (University of Malaya, **Malaysia**) The Use of "OMIC" Technologies in Understanding the Response of Microalgae towards Various Abiotic Stressors	
12.35-13.05	**Keynote Speaker-5** Oceanography	**Dr. Weiwei Yu** (Third Institute of Oceanography, **China**) The Distribution Patterns and Reference Conditions of Marine Species Richness in chinese Coastal Waters	

13.05-14.00	LUNCH BREAK & POSTER SESSION

14.00-16.25	**PARALEL SESSION Location. Prof Sunarpi Lecture Building**					
	ROOM 1	**ROOM2**	**ROOM 3**	**ROOM 4**	**ROOM 5**	**ROOM 6**
	AGRICULUTER	**MARINE SCIENCE**	**NATURAL SCIENCES**	**HEALT**	**TECH. & ENGINEERING**	**FOOD SCI. & TECH**
	Moderator: Dr. Herman Suheri	**Moderator: Dr. Aluh Nikmatullah**	**Moderator: Dr. Telly Savalas**	**Moderator: Dr. Yunita Sabrina**	**Moderator: Dr. Syahrul**	**Moderator: Dr. Rien Handayani**
14.00-14.10	001_Zainuri	032_Karnan	142_Wildan	129_Parnomangan M	101_M. Ramdhan O	039_Sukmawaty
14.10-14.20	011_IKD Jaya	033_Imam Bachtiar	007_Aris Doyan	013_Hamsu Kardiyan	010_Alex Laplaza	066_Dedy Rahmad
14.20-14.30	119_Hiryana W	045_Zaenal Abidin	009_Norma Ikrama	016_Lina Nurbaiti	110_Buan Anshari	086_Satrijo Saloko
14.30-14.40	047_Eka Widiastuti	051_Muh Risnain	021_Rosalina	018_Idiani Darmawati	027_N. Kencanawati	091_Dian Hasni
14.40-14.50	028_Lyli Ishak	069_Faturrahman	132_Imam S	029_Sujono	047_Akmaluddin	092_Murna
14.50-15.10	Discussion	Discussion	Discussion	Discussion	Discussion	Discussion
	ROOM 1	**ROOM2**	**ROOM 3**	**ROOM 4**	**ROOM 5**	**ROOM 6**
	AGRICULUTER	**MARINE SCIENCE**	**NATURAL SCIENCES**	**HEALT**	**TECH. & ENGINEERING**	**FOOD SCI. & TECH**
	Moderarot: Dr. Herman Suheri	**Moderarot: Dr. Aluh Nikmatullah**	**Moderarot: Dr. Telly Savalas**	**Moderarot: Dr. Yunita Sabrina**	**Moderarot: Dr. Syahrul**	**Moderarot: Dr. Herman Duheri**
15.15-15.25	002_Taslim Sjah	075_Edi Sulman	008_Susilawati	022_Mitrayana	054_Rudi Walujo	115_Ismed
15.25-15.35	025_Mulyati	099_Abdul Syukur	020_Hikmawati	030_Sti Idawati	058_Marenda Dwi J	121_Cesar W Refdi
15.35-15.45	031_Kusnarta,IGM	114_M Fadlillah	026_Erin Ryantin G	037_Handa Muliasari	113_Ngudiyono	141_Murad
15.45-15.55	040_Rizki Amalia N	122_Novita HN	035_Saprizal H	041_Ardiana Ekawanti	080_Gunawan	124_Wahid Y
15.55-16.05	044_BH Kusumo	123_Wiharyani W	036_Zhilal Shadiq	042_Elizabeth CS	120_Buan Anshari	093_Yusya' Abu Bakar
16.05-16.25	Discussion	Discussion	Discussion	Discussion	Discussion	Discussion
16.25-17.00	AFTERNOON BREAK & POSTER SESSION					
END OF DAY 1						

DAY : THURSDAY, AUGUST 24th, 2017							
08.00-09.00	REGISTRATION	University of Mataram Dome (Prof. Sunarpi Building)					
09.00-10.00	**Keynote/Invited Speakers Plenary-3 Location. University of Mataram Dome (Prof. Sunarpi Building), Jalan Majapahit 62 Mataram**	**Moderator: Prof. Ir. I Komang DamarJaya, M.Sc.Agr., Ph.D**					
09.00-09.30	**Keynote Speaker-6** Science	**Prof. Dato'Asbi Ali, Ph.D** (Management and Science University, **Malaysia**)					
09.30-10.00	**Keynote Speaker-7** Health	**Prof. Dr. Akihiro Hazama, MD** (Fukushima Medical University, **Japan**)					
10.00-10.30	**MORNING TEA BREAK & POSTER SESSION**						
10.30-11.30	**Keynote/Invited Speakers Plenary-4 Location. University of Mataram Dome (Prof. Sunarpi Building), Jalan Majapahit 62 Mataram**	**Moderator: Prof. Ir. M. TaufikFauzi, Ph.D**					
10.30.11.00	**Keynote Speaker-8** Marine Biology	**Dr. Wenjia Hu** (Third Institute of Oceanigraphy, **China**)					
11.00-11.30	**Keynote Speaker-9** Post-Harvest Technology	**Prof. Julian Heyes** (Massey University, **New Zealand**)					
11.30-13.00	**LUNCH BREAK AND POSTER SESSION**						
13.00-15.35	**PARALEL SESSION Location. Prof Sunarpi Lecture Building**						
	ROOM 1	ROOM2	ROOM 3	ROOM 4	ROOM 5	ROOM 6	ROOM 7
	AGRICULTURE	AGRICULTURE	NATURAL SCIENCES	HEALT	TECH. & ENGINEERING	MIXED TOPICS	MIXED TOPICS
	Moderator: Prof. Taslim Sjah	Moderator: Ir. Bambang HK	Moderator: Dr.Imam Bachtiar	Moderator: Made Sriasih	Moderator:	Moderator: Dr. Ihsanawati	Moderator: Dr. L. Zulkifli
13.00-13.10	046_Fitria Z	079_M Sudantha	065_Syamsuddin	050_IA Eka W	056_Warsa	043_Niniek Fp	063_Muhammad Ali
13.10-13.20	017_Liana S	053_Dika S	073_Sri Seno H	060_Mashur	136_CahyoMustiko	057_ Ahmad S	064_Muhammad Ali
13.20-13.30	052_Theresia E	082_ Lolita E S	085_Siti Rabiatulb F	061_Hamsu K	059_Shafwam A	084_Sitti Latifah	143_Syamsul Bahri
13.30-13.40	076_M. T. Fauzi	107_Jauhar F	089_Moh Liwa	062_ Purkan	034_Ahmad Fauzi	067_Indra KS	145_Muji Wahyu
13.40-13.50	078_M Sudantha	012_Suwardji	105_Ira Purnawati	072_Nurhidayati	081_Suryawan M	106_Suharti	146_Saprini
13.50-14.10	Discussion	Discussion	Discussion	Discussion	Discussion	Discussion	Discussion

	ROOM 1	ROOM2	ROOM 3	ROOM 4	ROOM 5	ROOM 6	ROOM 7
	AGRICULTURE	**NATURAL SCIENCE**	**NATURAL SCIENCES**	**HEALT**	**TECH. & ENGINEERING**	**TECH. & ENGINEERING**	**MIXED TOPICS**
	Moderator: Prof. Taslim Sjah	**Moderator: Dr. L. Zulkifli**	**Moderator: Dr.Imam Bachtiar**	**Moderator: Made Sriasih**	**Moderator:**	**Moderator: Dr. CahyoMustiko**	**Moderator:**
14.15-14.25	108_Nani H	126_Abdul S	097_Sri Wahyuni	083_Yunita S	014_Ahmad Fauzi	006_Sirajuddin HA	024_Husni
14.25-14.35	125_I W Sutresna	131_Seto P	098_Mustika H	095_Ermina	055_Warsa	068_ IW Joniarta	150_Made sriasih
14.35-14.45	128_Kisman	140_PraptiS	104_Munira	096_Yusra	088_Maria AH	102_Andreas S	
14.45-14.55	134_Ni Md Dini	023-Veni Rori S	049_Fitriah	103_Madelina A	094_Amrullah	127_Yumna Cici O	
14.55-15.05	138_B. Tri Ratna	015_Muh.Taufik	111_LelyK	004_Telly Savalas	100_Syahrul	137_Hasdi A	
15.05-15.15	149_ Merry W	148_Ihsanawati	117_ IM. Sudarma			112_I WynYasa	
15.15-15.35	Discussion	Discussion	Discussion	Discussion	Discussion	Discussion	Discussion
15.35-16.00	CLOSING CEREMONY OF						
	2nd ICST Recommendation				Chairman of 2st ICST		
	Presentation of Best Oral and Poster Prizes						
	Closing Speech				University of Malaya		
		END OF DAY 2					

DAY 3: FRIDAY, AUGUST 25TH, 2017		
08.00-12.00	Workshop on cell culture and analysis of cell death by fluorescence microscopy	Dr. Masao Miyake Fukushima Medical University, Japan
08.00-17.00	Field Trip	
END OF DAY 3		
END OF 2ND ICST PROGRAMME		

PREFACE

Bismillaahirrahmaanirrahiim
Assalaamu'alaikumwarahmatullaahwabarakaatuh.
Peace be upon us.

Praise always we pray to God Almighty for giving us the abundance of grace, guidance and inayah, so that we all can meet here in the "2nd International Conference on Science and Technology (ICST) 2017". The theme of this conference is "The Emergence of Science for Human Prosperity and Health" where this conference is joint international conference between Mataram and Malaya University.

First of all, I would like to welcome you all to West Nusa Tenggara Province specially Lombok Island, "the Island of Thousand Mosques", which is famous to its many natural resource and beautiful tourism destinations where you can enjoy them while attending the conference. This conference will be held for two days, from 23rd to 24th August 2017, and took place in campus of the University of Mataram.

So far, we received one hundred fifty papers from various universities and research institutions in Indonesia and from overseas. The paper have been selected and grouped based on the similarity of the research field, which then are presented and discussed. Presentation of the papers will be held in seven parallel classes and poster presentation. The Selected papers will be published in Malaysian Journal of Science (Special Issue) which index by Scopus, and the rest will be published in the Conference Proceedings. Additionally, selected paper in aquaculture have the opportunity to be published in Jurnal Akuakultur Indonesia.

At this moment, the organizing committee would like to express our gratitude to all of you for your participation on this conference, especially to the all keynote speakers, presenters who have submitted for both oral and posters presentations and also to all participants. Our special gratitude also goes to the Rector of the University of Mataram and Vice Chancellor of Malaya University, who have been highly supporting this conference. Critics and suggestions on the implementation of this conference will be appreciated and as much as possible we will improve the next ICST. Last but not least, the organizing committee would like to thank to all of you who have supported this conference.

Have an enjoyable conference.
Wassalamu'alaikum warohmatullahi wabarakatuh.

Chairman of 2nd ICST 2017

Dr.rer.nat. Lalu Rudyat Telly Savalas, M.Si.

OPENING SPEECH - RECTOR THE UNIVERSITY OF MATARAM
The 2nd International Conference on Science and Technology 2017

Joint International Conference on Science and Technology in The Tropic Beetwen Mataram and Malaya Universiti

Respected Guests,
Keynote speakers,
Conference participants,
and all other participants.

On Behalf of all staffs of the University of Mataram, I welcome you all to Lombok, a beautiful island in West Nusa Tenggara Province, where the University of Mataram is located. Lombok is known for its natural and cultural diversity where you can enjoy traditional cuisines, beaches, waterfalls, mountain, traditional villages and handicraft of many ethnics including Sasak, Samawa, Mbojo, Balinese, Chinese, Arabic, and many others.

As the Rector of the University of Mataram, it is a great honour for me to address the opening of "The 2nd International Conference on Science and Technology" here at the University of Mataram, which will be held from 23rd to 24th August 2017, with a theme "The Emergence of Science for Human Prosperity and Health". The main aim of this seminar is to gather scientist from all over the world to share their ideas, knowledge and experiences and to build network for possible future collaboration.

As we are aware that sharing knowledge and experiences from speakers are extremely valuable in a conference, therefore I would like to express my high appreciation, first, to the keynote speakers from overseas and from Indonesia for their willingness to come to Lombok to share their acknowledged works. Your effort and contribution to this conference are absolutely valuable. Second, my high appreciation also goes to the national speakers and all other participants, including the speakers from University of Mataram and local universities in West Nusa Tenggara Province, your participation in this conference not only will give incredible share of ideas, skills and knowledge that you have, but also will improve the academic environment that we are developing in this university. I hope this conference will be a good forum, not only for communicating and sharing ideas, knowledge and experiences, but also for building networking for future collaboration.

I would also like to take this opportunity to express my appreciation to the sponsors which have given some contribution to this conference. Last but not least, I would like to thank the organizing committee as well as all other supporters and participants, without their effort, commitment and hard work, this conference will not run well.

Finally, I wish you most successful conference, enjoy Lombok Island and hope to see you again in other forum here at the University of Mataram.

Rector of the University of Mataram

Prof. Ir. Sunarpi, Ph.D

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Agribusiness System in The Agro Tourism Area of Gumantar, North Lombok

Zainuri[1], Taslim Sjah[2*], Ahmad Syauqi[2], Jayaputra[2]

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Abstract

This paper describes agribusiness system in the agro-tourism area of Gumantar, North Lombok, Indonesia. Data were collected through structured interviews with farmer respondents, in-depth interviews with key informants, and secondary data collection from relevant sources. The study reveals that agribusiness subsystems, i.e., the subsystems of input, farm, processing, marketing, and supporting service, have not all worked satisfactorily in reaching more results as a system than the sum of all subsystems. Therefore, every subsystem of the agribusiness system requires improvement in one issue or more, and more importantly within the system, a sub system needs to be linked with other subsystems for gaining improved positive impact.

Keywords*: agribusiness linkage, agribusiness system, agribusiness subsystem, agro tourism, economic development*

1. Introduction

Indonesia has been developing its economy (Booth, 2003; Haeruman, 1997; MPR RI, 1993), and the phase of that development is now accelerating, that is, doing development in high speed, in order for the country to catch up with population development and meeting many needs of the country, as well as the need of some regions, which are currently 'behind', to level other regions in that development (Kompas, 2003; President of RI, 2011). This speedy development includes that in the sector of agriculture (Dillon, 1999; Krisnamurthi, 2008; President of RI, 2011). Agriculture in broad sense covers the sub sectors food agriculture, plantation crops, forestry, livestock, and fishery (President of RI, 2011; Soekartawi, 1995). One way in developing agriculture to be more productive or successful is believed to apply the development from upstream to downstream, from beginning to the end, in integrated way. This approach of agricultural development is called agribusiness (AHRDB, 2001; Beierlein et al., 1986; Cramer et al., 2001; McGregor, 1997). Agribusiness as a system comprises of several sub systems, including the sub systems of input, farm, processing, marketing and supporting service. These sub systems need to work together, support each other, be integrated in order to give positive impact amounted to be more than the sum of the sub systems. All sub systems play their parts while supporting other sub systems, hence all sub systems become stronger than if they work alone or do not support each other.

North Lombok has had by nature tourism objects well known by tourists of local, national, or international origins. Some of the tourism objects are the three Gilis (small islands of Trawangan, Meno, and Air), Puncak Pusuk, Sire Beach, Senaru, and Sendang Gile Waterfalls (Dinas Pariwisata Provinsi NTB, 2016). Those tourism objects are assets for North Lombok to develop further. Many facilities are built to make the objects more accessible than before. North Lombok has also other types of tourism, i.e. culinary and culture, either presented alone or in combination with other objects, so that we can see culinary in beaches or culture presentation along with culinary consumption. In culinary tourism, North Lombok has several types of foods that interest tourists to consume and are of

important for economic development as they have high production, market, and monetary value(Zainuri et al., 2016b).

Currently, another type of tourism is being developed in North Lombok (Zainuri et al., 2016a; Zainuri et al., 2017a; Zainuri et al., 2017b). This tourism is develop to capitalize the beauty of the nature, particularly the landscape, as well as attempting to get benefit from the beauty of the plants (crops) while not ignoring the economic value of the crops. Therefore, the tourism object is designed by combining of integrating high value and beauty crops with the landscape that suits crops growing. This paper describes agribusiness system in the agro-tourism area of Gumantar, North Lombok, Indonesia, from which the conditions may be improved in future.

2. Materials and Methods

This investigation was carried out in Gumantar Village, Kayangan District, North Lombok Regency. The village was selected for its potential to be developed as a tourism area, which is in this case is an agro-tourism area, by capitalizing the beauty of agricultural plants and land scape. Since this activity was also designed for gaining high income from plants or crops then the crops selection need to have this criterion (Zainuri et al., 2016a). Data for this research were collected through structured interviews with farmer respondents, in-depth interviews with key informants, and secondary data collection from relevant sources (Babbie, 2004; Jackson, 1988; Sjah, 2011). Farmer respondents were those who have land in around the agro tourism area, and were identified as many as 17 farmers. In-depth interviews were conducted to key informants considered as having sufficient knowledge on the topic investigated (Patton, 1990; Patton, 2002). Key informants here included head of farmer groups and business entrepreneurs in the location or surroundings. Secondary data were collected to complement the other two sources of data (Kumar, 1993; Nachmias and Nachmias, 1976; Sjah, 2011). Data collected were suited to the research objectives and were around the agribusiness and its sub systems. Descriptive analysis was applied for providing information and gaining understandings (Grinnell, 1993; House, 2005; Patton, 2002), especially on the working performance of the agribusiness systems and its sub systems.

3. Results and Discussions

This paper describes agribusiness system in the agro-tourism area of Gumantar, North Lombok, Indonesia. The system of agribusiness consists of the following sub systems: input, farm, processing, marketing, and supporting services (Beierlein et al., 1986; Downey and Erickson, 1987; McGregor, 1997). The implementation of these sub systems of agribusiness is described in sections below.

3.1 The Sub System of Input

In the tourism area of Gumantar, North Lombok, almost all agricultural inputs source from outside the area. Seeds of crops, such as listed in the next section, are bought from outside. The major source of seeds in the area is a company called ‘Syngenta’. Along with seeds, the company provides fertilizers of several contents and brand names. Agricultural machines (such as tractors) and tools (such as cutters) are also available from outside. While seeds and fertilizers can be dropped into the area by the providing company, most of agricultural machinery and tools are bought directly in the city (like Mataram). Most agricultural producers apply chemical (inorganic) fertilizers rather than organic fertilizers, despite many people (such as extension officers or university staffs) have recommended the use of organic fertilizers. In addition to intensive promotion by chemical fertilizer companies, farmers are more convinced by the physical appearance of plants that have been applied with chemical fertilizers.

3.2 The Sub System of Farm (Production)

Crops grown in the tourism area of Gumantar, North Lombok majorly consists of traditional crops. The survey shows there are seasonal and perennial or annual crops. The seasonal crops include corn, peanut, chilli, dryland rice, tomato, melon, mungbean, long bean, and cucumber. All 17 farmer respondents grow corn. So, corn is the main crop for the area. Along with corn, 9 farmers also grow other crops just mentioned. These other crops are grown in multiple cropping system, with some are grown with clear borders with the corn and some with unclear borders. Ones with clear borders are called unspecific farms, while ones with unclear borders are called mixed farms (Hernanto, 1994; Suratiyah, 2006).

The perennial crops include coconut, mango, custard apple, sapodilla, banana, papaya, and wood trees. The perennial crops are usually grown on the dykes or inside the paddock. They are planted in separated distant. The distant plantings do not only provide spaces between the trees and their canopies but also provide spaces for the seasonal crops. Seasonal crops on the dryland such this area, are grown by following the existence of water, which is available during the rainy season. The water from the reain avails in the area since about November or December annually. Seasonal crops generate income for farmers in a short term (about 4 months), while perennial crops provide annual income, once the crops have started its productions. Most of perennial crops produce for certain months, yet some of perennial crop can also provide income for longer period or during the year round.

3.3 The Sub System of Processing (Agroindustry)

Processing of agricultural products in the area is very limited. Virtually all products are sold in the form of fresh or raw materials. Some of the products are even sold before harvest, and then the harvests are done by the buyers. The buyers brought the fresh products out of the area to city of Mataram or elsewhere. The selling of fresh or raw agricultural products like this is not recommended since there are chances to earn better income through processing of the raw materials to one or several types of processed foods. Currently, several products or portions of products are processed, yet the processed products are only for family consumption, not to be marketed. Therefore, there has been no income from processed products so far.

The importance of doing processing of agricultural products has been informed or recommended to the local farming community in the area of tourism development of Gumantar, by local provincial and regencial governments or by university staffs, such as those from the University of Mataram. For example, there were training on creating added value of agricultural products (Sjah et al., 2012b), training on agribusiness development, which also includes creating added value of products (Sjah and Hidayati, 2015; Sjah and Hidayati, 2016; Sjah et al., 2015).

3.4 The Sub System of Marketing

Most agricultural products from the tourism area of Gumantar are marketed on the production locations (on farm gates). Buyers come to the village and make deals with agricultural producers in buying the products. Some crop products are even sold before being harvested, and in this case the harvests are done by the buyers. There are only one or two producers who sell their products to the city of Mataram or nearby cities. However, this sort of producers also plays a role of traders, usually called as local assemblers (Campbell and Fisher, 1991; Dunne, 1999; Kohls and Uhl, 1990; Sjah, 2010), or collectors (Sjah, 2013). The marketing of agricultural products are individually, not in a group or association. This marketing system, in which farmers sell raw materials (fresh products) and do sell in individual, caused price of agricultural products becomes low and in turn cause income from them low too. Farmers have a low bargaining position compared to buyers. Accordingly,

there are needs to seek ways to improve the bargaining position of farmers. There are recommendations available for improving farmer condition such as by establishing farmer associations as suggested by several literatures (see for example Barker, 1989; Kohls and Uhl, 1990; Mubyarto, 1995). Nevertheless, this recommendation has not been able to be realized due to several constraints from the farmers or others. Apparently, there are more works needs to be done for handling this issue.

3.5 The Sub System of Supporting Service

There are some supporting services available for the development of agribusiness in the tourism area of Gumantar, North Lombok. The supporting services include extension service, roads, agricultural input provision, market facilities, and visits by local government leaders. Extension services on agriculture have been long provided to the area as also to whole area in Indonesia. This work is done by government in particular, yet some voluntary extension services also available from universities or companies related to agribusiness. Roads appear sufficient to cover almost areas in North Lombok, and this condition supports the transportation of agricultural products or its processed products. The availability of roads also enables transportation of agricultural inputs into the area or elsewhere. Market places have been built in some places, especially in central towns, such as in Tanjung. Markets can absorb almost all products, fresh or processed, because customers not only from within the area but also from outside. Finally, visits by local regencial government have been occurred several times, and these visits bring a sort of encouragement for the local people to work better or to be more productive than before.

Supports that are needed but have not been provided appear in some instances. Farmers search market for their products by themselves, and therefore their capacities are limited. It would be better if market information for producer products available to farmers, especially where to sell for each agricultural product. Similarly, some farmers still access working capital from private lenders (company or others), which interest charge.

Another aspect that is lacking in the agribusiness in the area is on the planning of production, i.e. in selection of which crops to be grown in certain times. Currently, farmers have been deciding according to their experience and ‘feeling’ of what promising production to be. In the agribusiness system, it is believed that successful business should start with market and then be ended with market (see for instance Sjah et al., 2012a; Suwardji et al., 2009).

4. Conclusions and Recommendations

This study conclude that agribusiness subsystems, i.e., the subsystems of input, farm, processing, marketing, and supporting service, have not all worked satisfactorily in reaching more results as a system than the sum of all subsystems. Therefore, every subsystem of the agribusiness system requires improvement in one issue or more, and more importantly within the system, a sub system needs to be linked with other subsystems for gaining improved positive impact.

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Farming system in Dryland Area of North Lombok

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Abstract

This paper describes farming system in dryland areas of North Lombok, Indonesia. Data were obtained through structured interviews with farmer respondents as well as through secondary data collection from relevant sources for complementary. Five districts within North Lombok have all their representatives in the selected samples. The study found that farming system practiced by the agricultural producers in the area are highly influenced and be characterized by the condition of dryland or limited water availability. It is obvious that intervention for supplying water for crop irrigation or meeting other needs is a way out for improving the condition in the area and then the livelihood of the people there.

Keywords: dryland agriculture, farming system, irrigation water, mixed farming

1. Introduction

Agriculture is one development sectors in Indonesia's economy, and is being developed in high speed (Booth, 2003; Dillon, 1999; Haeruman, 1997; Krisnamurthi, 2008; MPR RI, 1993; President of RI, 2011) to keep up with population growth and development in other areas. Agriculture in broad sense covers the sub sectors food agriculture, plantation crops, forestry, livestock, and fishery (President of RI, 2011; Soekartawi, 1995). Many believe that the development of agriculture of any sector should be integrated from the first production cycle to the plate of consumers, the so-called approach of agribusiness (AHRDB, 2001; Beierlein et al., 1986; Cramer et al., 2001; McGregor, 1997). Agribusiness comprises of the sub systems of input, farm, processing, marketing and supporting service. These sub systems need to integrated from the first to the last system, in order to gain accumulated impact that will be more than the sum of impact from all sub systems. Farmers in particular deal more with the sub system of farm than other sub systems. This paper describes farming system applied by farmers in the dryland area of North Lombok, West Nusa Tenggara.

2. Materials and Methods

This study was conducted in North Lombok Regency, covering all the five districts in the regency. Focus of location selection was on the dryland. Data for this research were collected through structured interviews with farmer respondents, and secondary data collection from relevant sources (Babbie, 2004; Jackson, 1988; Sjah, 2011). Farmer respondents were sampled to be 30 farmers of corn and 30 farmers of dryland rice. When it is found that these farmers also grow other crops than initially targeted then these crops also recorded in the interview. The interviews were conducted face to face mode, to ease for visual observation and for providing more chance for expalantaion. Secondary data were collected to complement the primary data (Kumar, 1993; Nachmias and Nachmias, 1976; Sjah, 2011). Data collected were suited to the research objectives and were around the farming system. Descriptive qualitative analysis was applied for facilitating understanding on the topic of research (Grinnell, 1993; House, 2005; Patton, 2002).

3. Results and Discussions

This paper describes farming system in dryland area of North Lombok, Indonesia. This description starts with the description of climatic condition and is followed the description of production system.

3.1 Climatic Condition

Description of condition of climate in the area facilitates understanding in farming system, such as why farmers grow certain crops and not grow other crops.

According to BMKG (2013) North Lombok is included in tropical climate, with temperature ranges from 17ºC (in August 2013) to 33.8ºC (in October-November 2013). The lowest air humidity (77%) occurs in July to August and highest one (87%) occurs in December. Sunlight avails from 40% to 89%. The amount of rainfalls in 2013 reaches 2,399.5 mm/year (*BMKG*, 2013).

Rainfalls in dryland are usually lower than this figure, albeit regular records are absent. Rainfalls normally occur in December to March, peaking in January (BMKG, 2013). These 4 rainfall months are called as wet months; while the remaining months in the year are called dry months. Farmers adjust their farming activities, particularly seasonal crops plantings, to this water availability, by which agricultural producers in dryland areas start to tillage their farm lands in December for cultivation. Plantings of perennial crops are also done during the wet months, to enhance success growth of the crops. In Indonesia in general, people (including farmers and scientists) called the wet season as 'first planting season' or 'wet season'; while the remaining months are called as 'second planting season' or 'first dry season', followed by 'third planting season' or 'second dry season'. In dryland, agricultural producers left their farm lands fallow during the dry seasons (Sjah et al., 2002; Sjah et al., 2006). The planting system of seasonal and perennial crops is described in the next section.

3.2 Farming System

Crops grown in North Lombok majorly consist of traditional crops. The survey shows there are seasonal and perennial or annual crops. This study purposively targeted three crops, which currently become the target of the government of Indonesia, including rice, corn, and soybean. As this study focuses on dryland then the rice type here is dryland rice.

The survey found that there was currently no farmer were growing soybean. The reasons for not growing soybean and also reasons for growing other than soybean are reported in other paper or in other section of this report. The seasonal crops grown and the number of farmers growing are as follows: corn (44 farmers), dryland rice (38 farmers), peanut (25 farmers), longbean (2 farmers), chilli (2 farmers), tomato (1 farmer), and cassava (1 farmer). These data show that corn was the main crop grown in the dryland area of North Lombok. The second most grown crop grown in the area was rice of dryland type, albeit this crop was a targeted sample. It is interesting to identify reasons for growing these crops as to reasons for not growing corn. This sort of information could contribute to successfulness of extension program implemented currently by the government or other related parties.

Majority of crops were grown in multiple cropping system, with some are grown with clear borders with the corn and some with unclear borders. Ones with clear borders are called unspecific farms, while ones with unclear borders are called mixed farms. Some crops were also grown without combination with other crops, a term called mono cropping system (Hernanto, 1994; Suratiyah, 2006). The only crops with some farmers grew in mono cropping system were corn and dryland rice; some other corn and rice farmers grew in

multiple cropping application. The choice of multiple cropping system by farmers appears to be having relations with an effort to reduce risk in farming as in other business. The risk in dryland farming, as reported in other parts, is of various source (but mainly of water availability) and of high intensity.

Perennial crops, such as coconut, mango, custard apple, sapodilla, banana, papaya, and wood trees, were also found to be grown in the area. The perennial crops are usually grown on the dykes or inside the paddock. They are planted in separated distant. The distant plantings do not only provide spaces between the trees and their canopies but also provide spaces for the seasonal crops. Seasonal crops on the dryland such this area, are grown by adapting to the existence of water, which is available during the rainy season. The water from the rain avails in the area since about November or December annually. Seasonal crops generate income for farmers in a short term (about 4 months), while perennial crops provide annual income, once the crops have started its productions. Most of perennial crops produce for certain months, yet some of perennial crop can also provide income for longer period or during the year round. Income from seasonal crops gains after harvest in about April.

3.3 Marketing of Farm Products

Agricultural producers in the dryland areas of North Lombok have several farming objectives. The objectives are listed in Table 1, together with the number of farmers mentioned it. The farming objectives included: seeking for profit, increasing welfare or living standard, financing children schooling, and fulfilling family basic needs. These farming objectives were led by economic motivation, and all objectives can stated as economic objectives. This economic objective is clearer for the first objective than others. Surprisingly, the objective of fulfilling basic needs for farmer families is mentioned by the least number of farmers in the area. This indicates that the farmers in North Lombok are not as other farmers in other parts of developing countries, where most people are struggling to live, i.e. to meet their basic needs, and also in accord with Maslow's hierarchy of needs (Goble, 1970; Maslow, 1987; Wilson, 1972), which places the human physiological needs, including food, clothing and shelter, as the largest and most basic at the bottom of his pyramid of human needs.

Table 1. Farming objectives of farmer respondents

Farming objective	Response of 60 farmers	
	(n[1])	% of respondents
1. Seeking for profit	38	63
2. Increasing welfare or living standard	16	27
3. Financing children schooling	8	13
4. Fulfilling basic needs	6	10
Total	68	

Note: [1]Some respondents expressed more than one farming objective

As the farmer faming objectives are mostly economic then it is logical that most products resulted by their farms are to be marketed. Only small proportion of productions are served for own family consumption. In other words, their farming activities were oriented for business, and therefore were implemented in commercial way.

Marketing that is implemented by farmers for their products are described here. Most agricultural products from the farmers are marketed on the production locations (on farm gates). It is most common that buyers come to the village and make deals with agricultural producers in buying the products. Some crop products are even sold before being harvested. For this case and for majority of farmers, the harvests are done by the buyers. Thus, this in one side, reduced cost in farmer part, yet it also losses chance to secure a better price for their

products. Occasionally only one or two farmers who sell their products to the city of Mataram or nearby cities. This sort of producers also plays a role of traders, usually called as local assemblers (Campbell and Fisher, 1991; Dunne, 1999; Kohls and Uhl, 1990; Sjah, 2010), or collectors (Sjah, 2013). The marketing of agricultural products are individually, not in a group or association. This marketing system, in which farmers sell raw materials (fresh products) and do sell in individual, caused price of agricultural products becomes low and in turn cause income from them low too. Farmers have a low bargaining position compared to buyers. Accordingly, there are needs to seek ways to improve the bargaining position of farmers. There are recommendations available for improving farmer condition such as by establishing farmer associations as suggested by several literatures (see for example Barker, 1989; Kohls and Uhl, 1990; Mubyarto, 1995). Nevertheless, this recommendation has not been able to be realized by almost all farmers in the area since the farmers have several constraints. External intervention appears to be thing that needs to be done for helping the farmers.

4. Conclusion and Recommendation

The study found that farming system practiced by the agricultural producers in the area are highly influenced and be characterized by the condition of dryland or limited water availability. It is obvious that intervention for supplying water for crop irrigation or meeting other needs is a way out for improving the condition in the area and then the livelihood of the people there.

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Improving Maize Yield in Tropical Drylands Through Optimum Sunlight Interception by The Plant Canopy

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Abstract

A critical factor determining maize yield is the ability of its canopy to intercept sunlight during grain filling. This research explored options to increase the ability of maize plants to intercept sunlight, especially at the end of vegetative growth. Two series of experiments to investigate seed position at planting and its relation to leaf orientation were conducted in seedling trays. The seed position resulting in the most homogenous orientation of the first four leaves was chosen for a subsequent field trial in which the effect of row planting orientations (north-south and east-west) and row patterns (single row and double row) was evaluated under rainfed conditions in Lombok, Indonesia. Results of the experiment showed that the most homogenous leaf orientation was observed when seeds were lying flat, caryopsis pointed south, embryo up. The orientation of the first four leaves was homogenous, toward north-south. It was observed from the field experiment that the canopy of the plants with north-south row orientation intercepted much more sunlight than that of the east-west orientation. At the end of the vegetative stage, the canopy of the plants planted in double rows intercepted 15% more sunlight than that in the single row. Maize grain yield in the double row was 25% higher than that grown in a single row.

Keywords: double row; leaf orientation; planting orientation; single row; vegetative growth.

1. Introduction

World maize production has been increasing in response to rising demand, particularly for animal feed. In addition to its use for animal feed, maize is also a staple food in much of South America and Africa, and its use extends to many other food products (Shiferaw et al., 2011). The highest maize production is dominated by the USA, followed by China, Brazil, India and Argentina. In South-East Asia region, Indonesia is the country with the highest maize production, above The Philippines and Vietnam (World Atlas, 2016) and it ranks eighth in word production. As in China, most of maize produced in Indonesia is utilized as animal feed.

In tropical countries that grow significant amounts of maize, such as Brazil, Mexico, Indonesia and South Africa, the crop is mainly produced by small scale farmers in dryland areas. Smallholder farmers in these regions are exposed to high climatic variability and have low adaptive capacity to climate change impacts. The occurrence of climate change has brought about rainfall reduction in some regions accompanied by some extreme weather events that influence maize yield (Li et al., 2011). Hence, rain water harvesting technology and its management have become important considerations in maize production in dryland areas. In addition to water availability, sunlight and photosynthetic capacity are important determinants of maize yield, and need to be optimized to improved yields in dryland areas.

Most smallholder farmers in Indonesia still use plant populations of traditional varieties of maize when they grow modern hybrid varieties. The modern varieties have been engineered to accommodate higher plant populations due to their narrow leaf angle (Pugano and Maddonni, 2007). With high plant populations and a narrow leaf angle, the modern maize hybrid can maximize light interception, especially during grain filling, which can increase maize grain yield (Andrade et al., 2002). Therefore, it is necessary to develop high yielding maize production technology by maximizing sunlight interception, particularly in dryland regions that are being negatively impacted by climate change.

Light interception by the maize canopy can be increased by planting seed in narrow rows or increasing plant population to bring about complete canopy cover (Westgate et al., 1997). For modern hybrid varieties, intraspecific competition among plants after canopy cover can increase plant yield (Toler et al., 1999). This may be due to the leaf architecture of modern maize varieties tending to have a narrow angle (*upright*), permitting high photosynthesis activity (Stewart et al., 2003). The result of a high photosynthesis activity on maize with upright leaves is a high grain yield. This paper reports the results three experiments aimed at finding an appropriate technique to increase sunlight interception and maize grain yield through exploring seed position, planting orientation and planting pattern in rainfed maize.

2. Materials and Methods

Two series of experiments using seedling trays were conducted before conducting a field experiment. The first experiment evaluated planting orientation of maize seeds in relation to coleoptile emergence and leaf orientation at an early stage of maize vegetative growth. Five treatments of maize seed caryopsis orientation were; A) lying flat, caryopsis east, B) lying flat, caryopsiswest, C) upright, caryopsisdown, and D) upright, caryopsis up, as well as E) seeds put randomly as control.In the second experiment, the orientation of caryopsis and embryo was evaluated on the coleoptile emergence and leaf orientation at the early stage of maize vegetative growth. Five treatments of maize seed caryopsis and embryo orientations were; A) lying flat, caryopsis pointed south, embryo up, B) lying flat, caryopsis pointed south, embryodown, C) upright, caryopsis down, embryo pointed east, D) upright, caryopsis down, embryo pointed south, and E) randomly as control. Both experiments used a completely randomized design. All the treatments were replicated three times and data collected were subjected to Analysis of Variance.

The seedling trays were filled with growing media, a mixture of soil and organic manure. Each seedling tray had 50 planting holes arranged in 10 rows of 5 holes with 5-cm distance between holes. Maize seeds were planted at 2.5 cm depth in the first, third and fifth hole in each row, leaving two holes unplanted. Seeds were planted in every second row. Hence, there were 15 plants per seedling tray (experimental unit) with a distance of 10 cm between any two plants. Seeds were planted with position as treatments with east-west row orientation.The plants were watered daily, fertilized with N-P-K (15-15-15) Phonska as necessary at planting time.

During the experiments, daily temperature (minimum and maximum) was recorded to determine Growing Degree Days (GDD) required in the early vegetative growth. Coleoptile emergence time and orientation of the first four leaves to row direction were determined. Total heat required for the emergence of coleoptile was determined based on the formula;

$$THR = \frac{\sum_{i=1}^{n}(c_i \times d_i)}{TC}$$

THR = Total heat required (^{o}day), c_i = number of coleoptile emerging at the day of i, d_i = GDD for i days, and TC = total coleoptile emerging.

The third experiment was a field experiment conducted at Gumantar village, Kayangan sub-district, North Lombok (8.253654 S, 116.285695 E). The experimental site was dominated by soils with a high sand fraction and very low organic matter. Since the experiment was conducted during the dry season (May to August 2016), irrigation water was required. Water was supplied by a deep pump well located near the experimental units. This practice has been considered as very expensive by the local farmers and only dryland farmers that have sufficient money are able to grow maize during the dry season in that area. The

experimental location was an open area with full sunlight to replicate normal field conditions of light interception, evaporation and transpiration.

This experiment evaluated the optimum seed position and orientation at planting based on the results of the second seedling tray experiment (seed lying flat, embryo up, caryopsis pointed south) with two row planting orientations (north-south and east-west) and two planting models (single row and double row). Treatments were arranged in a Split-plot design with planting orientations as main plots and planting models as sub plots. Each treatment was replicated three times, therefore there were 12 experimental units of 3.5 x 3.5 m plots.

At planting time, Phonska N-P-K (15-15-15) fertilizer was applied at a rate of 300 kg ha^{-1}along with Urea fertilizer at a rate of 100 kg ha^{-1}. Thirty-five days after planting (DAP) Phonska was reapplied at the same rate as at planting time. Then Urea was reapplied 56 DAP at a rate of 200 kg/ha. Before application of the second fertilization, hand weeding was done in all the experimental plots.

Watering was done with a gradient system, namely by supplying small water canals between experimental plots. In the early stages of growth, watering was performed once per week and as plants grew bigger, watering was undertaken twice per week up to cob maturity stage. The irrigation practice in this experiment provided an optimum water requirement for maize crops to grow on a dryland and that condition only can be achieved when the rainfall during the rainy season (December to March) is normal at about 700 mm. Pest and disease control was done only when necessary.

Plant variables observed were plant height, number of leaves, leaf area, and percentage of light interception at the end of the vegetative growth. Light interception was measured by using AccuPAR (PAR/LAI Ceptometer Model LP-80, Decagon Devices), during a bright day, full sunlight from 12.00 to 13.00, by measuring PAR (Photosynthetically Active Radiation) light at the above and below canopy in each treatment. Plant yield variables consisted of: cob length, cob diameter, cob weight, seed weight per cob, seed weight per plant, and seed weight per plot. Cob length, cob diameter, cob weight was determined immediately after harvest. Seed dry weight was measured after the seeds were dried with about 14% moisture content. Maximum and minimum temperatures were recorded daily.

3. Results and Discussion

The first and second experiments that evaluated the effect of seed position on coleoptile emergence and leaf orientation were terminated when the plants formed four complete leaves. Results showed that seed planting orientation, caryopsis and embryo orientation significantly influenced coleoptile emergence time (vegetative emergence – VE) (Tables 1 and 2).In the first experiment, which focused solely on caryopsis orientation, treatment C (upright, caryopsis down) showed the amount of heat required for VE was the lowest, 65.67 ^{o} day. This means that when the seeds were in the position upright with caryopsis down, plants reached VE phase the fastest, although the amount of heat unit required was not significantly different with that of treatment A (lying flat, caryopsis pointed east) or of treatment B (lying flat, caryopsis pointed west). Plants in these three treatments reached VE phase at the range of heat amount slightly above that of reported by Nielsen (2002), namely 37.8 – 65.5 ^{o} day. Nevertheless, the amount of heat required to reach VE phase by seeds in treatments A, B, and C was much less compared to that in treatment D (upright, caryopsis up) or treatment E (random).In general, results of this study indicated that when seeds were positioned with caryopsis not up, the time required to reach VE phase was shorter compared with that of required to reach the same phase when seeds were positioned with caryopsis up.

Table 1. The effect of caryopsis orientation on total heat required for VE phase

Treatment	Description	Total heat for VE phase (^{o} day)
A	Lying flat, caryopsis east	68,73 a*)
B	Lying flat, caryopsis west	66,98 a
C	Upright, caryopsis down	65,67 a
D	Upright, caryopsis up	87,98 b
E	Caryopsis random	78,36 c
	$LSD_{0,05}$	3,803

*) Numbers followed by different letters are significantly different

The lower amount of heat required to reach VE phase by seeds positioned with caryopsis not pointed up was strengthened by the results of the second experiment. Table 3 shows that except for treatment B (lying flat, caryopsis pointed south, embryo down), all treatments required lower amount of heat to reach VE phase compared with seeds planted randomly (control). In the treatment with embryo down (treatment B), the amount of heat required was much more than that of in other treatments. A faster time to reach VE phase in seeds positioned with the caryopsis not pointed up and embryo not down was also reported by Toler et al. (1999) and Torreset al. (2011).

A faster time to reach VE phase when seeds are positioned with caryopsis not pointed up or embryo not face down is strongly related to maize seed structure. Ritchie et al.(1986) explained that in maize seed, coleoptile orientation is in opposite of caryopsis point, while radical orientation is toward caryopsis tip.When the caryopsis of maize seed does not point up (meaning that coleoptile does not point down, and radical does not point up), VE phase will process relatively faster compared with when caryopsis pointed up or lying flat with embryo face down. In treatments where the caryopsis did not point up (treatment C in Experiment 1 and treatment C and D in Experiment 2), the radical grew directly downward and the coleoptile grew directly upward without bending, which permitted faster penetration of the soil surface. In contrast, in treatment D (Experiment 1), the radical first grew upward then bent downward and the coleoptile grew downward then bent to grow upward. Consequently, much more time was required to reach soil surface (VE phase). In the case of treatment B, in which the embryo faced down (Experiment 2), the radicle did not bend to grow downward, but the coleoptile passed through the tip of the seed then bent to grow upward.Therefore, seed orientation at planting time influenced plant homogeneity in reaching VE phase.

Table2. The effect of caryopsis and embryo orientation on total heat required for VE phase

Treatments	Description	Total heat for VE phase (^{o} day)
A	Lying flat, caryopsis pointed south, embryo up	71,26 a*)
B	Lying flat, caryopsis pointed south, embryo down	93,99 b
C	Upright, caryopsis down, embryo east	73,34 a
D	Upright, caryopsis down, embryo south	71,79 a
E	Random (control)	88,98 c
	$LSD_{0,05}$	3,467

*) Numbers followed by different letters are significantly different

In this study, leaf orientation was determined with estimation of an angle range formed by the first four leaves on row direction (east-west).Leaf orientation was classified into two

groups; leaf orientation considered perpendicular to plant row with angle range (±) 60^o – 90^o (Torres et al., 2011) and the other with angle range (±) 45 - $<60^o$.

Results show that the seed orientation had a considerable influence on maize leaf orientation at an early vegetative phase. Experiments 1 and 2 revealed that frequency of plants with leaf angle perpendicular to plant row was higher in treatment C (caryopsis pointed down – Table 3) and in treatment A (lying flat, caryopsis pointed south, embryo face up – Table 4). The lowest frequency of plant with leaf orientation perpendicular to plant rows, on the other hand, was observed in treatment D (caryopsis pointed up – Table 3) and treatment B (lying flat, caryopsis pointed south, embryo face down – Table 4). In this study, frequency of plants with leaf angle orientation perpendicular to plant rows was highest where the caryopsis is pointed down and radical perpendicular (facing) plant rows. This result was slightly different from that of reported by Torres et al. (2011) who found that leaf orientation perpendicular to plant rows occurred when the radical was down and parallel with plant rows. Seeds planted with the caryopsis down probably do not undergo much trans-position during germination, resulting in homogenous leaf orientation.

Table 3. Leaf angle (from plant row) of maize planted with differing caryopsis orientation

Treatments	Description	Frequency of plants with leaf angle 60 - 90^o
A	Lying flat, caryopsis east	68.15ab*)
B	Lying flat, caryopsis west	71.11 a
C	Upright, caryopsis down	75.56 bc
D	Upright, caryopsis up	62.22 abc
E	Caryopsis random (control)	66.67 c
	$LSD_{0,05}$	9,902

*) Numbers followed by different letters are significantly different

Table 4. The effect of caryopsis and embryo orientation on leaf angle

Treatments	Description	Frequency of plants with leaf angle 60 - 90^o
A	Lying flat, caryopsis pointed south, embryo up	88.89 a*)
B	Lying flat, caryopsis pointed south, embryo down	68,89 b
C	Upright, caryopsis down, embryo east	84.44a
D	Upright, caryopsis down, embryo south	80.00 ab
E	Random (control)	71.11 b
	$BNT_{0,05}$	11.29

*) Numbers followed by different letters are significantly different

Light interception by the maize canopy can be optimized by planting seeds with the caryopsis pointed down and radical perpendicular plant row, so that the leaf orientation is perpendicular to plant row direction. With this type of leaf orientation maize can produce much more grain compared with maize where leaves are randomly oriented or parallel to plant rows (Toler et al., 1999; Torres, 2012). Achieving homogeneity of leaf orientation that is perpendicular to plant rows provides an opportunity to increase plant populations per unit area, further increasing maize yield. Toler et al. (1999) reported that for the same area, plants with leaf orientation perpendicular to plant rows intercepted 10-25% more light, had 15% higher plant population, and leaf areas was 8% larger than plots with leaves randomly oriented and parallel to plant rows. Hence, it is reasonable to expect maize yield increase

through increasing population of plants with leaf orientation perpendicular to plant rows by managing seed orientation at planting time.

In the field experiment, plant height and leaf area index, which were measured at the highest rate of vegetative phase (42 days after planting = DAP) and at the end of vegetative phase (60 DAP), were not significantly influenced by plant row orientation. Plant row orientation had a significant effect only on percentage of light interception by the plant canopy (Table 5). Canopies of plants in north-south row orientation intercepted much more light than those in east-west row orientation. At 42 DAP, plants in north-south row orientation intercepted 11% more sunlight than those in east-west row orientation. The ability of the plant canopy to intercept sunlight increased as the age of plants increased as the difference in light interception between plants in north-south and east-west row orientation was 15% greater at 60 DAP than at 42 DAP.

Plant height was not significantly influenced by row pattern. Table 5 shows that row pattern significantly influenced leaf area index and percentage of light interception. Plants grown in double rows resulted in much higher leaf area index and light interception than those grown in single row. The higher leaf area index of plants grown in double rows compared with that in single rows was merely due to higher plant population per unit area.

The canopy of plants grown in north-south row orientation intercepted more light than those grown in east-west orientation. This was in accordance with the results of Jaya et al. (2001) who reported that light interception coefficient of plants grown in north-south row orientation was higher than that of plants grown in east-west row orientation. Consequently, to maximize sunlight interception, maize planting orientation will be better in north-south direction. In this experiment, however, light interception at the end of the vegetative phase reached just 79%. This value is still far below that suggested by Jeschke (2014) who asserted that 95% light interception was achievable from the end of the vegetative phase until grains filling. The lower light interception found in this study was not due to low plant population but rather by low leaf area index resulting from less than maximum plant growth.

Table 5. The effect of row orientation and planting pattern on plant height, leaf area, and percentage of sunlight interception by plant canopy at 42 and 60 DAP

Time of observation	Treatment	Variables		
		Plant height (cm)	Leaf area index	% light interception
42 DAP	**Orientation**			
	North-South	149,7	1,94	47,30
	East-West	149,2	1,96	42,37
	$LSD_{0.05}$	-	-	*0,42*
	Rows			
	Single row	149,0	1,70[a*)]	42,98[a]
	Double rows	149,8	2,20[b]	46,68[b]
	$LSD_{0.05}$	-	*0,0013*	*0,42*
60 DAP	**Orientation**			
	North-South	225,5	3,24	81,35[a]
	East-West	198,5	3,16	70,95[b]
	$LSD_{0.05}$	-	-	*0,62*
	Rows			
	Single row	212,0	2,68[a]	73,08[a]
	Double rows	212,0	3,71[b]	79,21[b]
	$LSD_{0.05}$	-	*0,0046*	*0,62*

*) Numbers in the same column with the same treatment, followed by different letters are significantly different

Plant yield variables at harvest, such as fresh cob weight, fresh cob weight per plot, cob length, and cob diameter were not significantly influenced by row orientation (Table 6). Meanwhile, plants grown in a double row pattern resulted in cob weight per plot significantly higher than those grown in a single row pattern due to the difference in plant populations.

Dry yield variables such as seed weight per cob, percentage of seed per cob, seed weight per plot, and weight of 1000 seeds were not significantly influenced by planting orientation. Maize yield (seed weight per plot) was only significantly influenced by row pattern. Plants grown in double row pattern resulted in yield about 25% higher than those in single row did (Table 7).

Table 6. The effect of row orientation and row pattern on maize yield variables at harvest

Treatments	Variabel			
	Fresh cob weight (g)	Fresh cob weight /plot (kg)	Cob weight (cm)	Cob diameter (mm)
Orientation				
North-South	254,50	12,13	17,27	46,87
East-West	281,97	12,23	18,17	44,67
$LSD_{0.05}$	-		-	-
Rows				
Single row	265,33	10,42 [a]	17,93	45,77
Double rows	271,13	13,95 [b]	17,50	45,77
$LSD_{0.05}$	-	*0,029*	-	-

*) Numbers in the same column with the same treatment, followed by different letters are significantly different.

Table 7. The effect of row orientation and row pattern on dry maize yield variables

Treatment	Variabel			
	Seed weight/cob (g)	% seed/cob	Seed weight/plot (kg)	Weight of 1000 seeds (g)
Orientation				
North-South	154,77	78,06	7,97	393,83
East-West	162,67	77,55	7,65	388,67
$LSD_{0.05}$	-	-	-	-
Rows				
Single row	167,93	77,30	6,93 [a*)]	399,67
Double rows	149,50	78,31	8,68[b]	382,83
$LSD_{0.05}$	-	-	0,024	-

*) Numbers in the same column with the same treatment, followed by different letters are significantly different

Results presented in Table 7 show that the increase in plant population by using double rows was not sufficient to proportionately increase plant yield. The yield increase was 25% compared with a plant population increase of 28% from planting in double rows. Less than optimum plant growth is suggested as the main cause of the proportionately lower yield increase, as the plant canopy was only able to intercept 79% of the light at the end of the vegetative phase. As mentioned previously that percentage of light interception at this phase should achieve 95% (Jeschke, 2014). High sunlight interception at the grains filling phase can increase plant photosynthetic capacity in such a way that plant yield increase (Andrade *et al*.,

2002). The other possibility is that the plant population used was not optimum enough for NK22, a variety with a narrow leaf angle.

4. Conclusion

It can be concluded that maize seeds planted lying flat, caryopsis down and pointed south can reach Vegetative Emergence (VE) phase faster and the orientation of the first four leaves is perpendicular to plant row direction. This planting configuration allows plants to intercept more sunlight. Further improvement of sunlight interception can be achieved by using a north-south plant row orientation and increasing plant populations up to 98.000 plants/ha through using double row planting. In this study, the increase in plant population from 71.000 (single row) to 98.000 plants/ha (double row) could increase maize yield by 25%. This has the potential to significantly improve productivity of smallholder farmers growing maize in tropical, dryland farming systems.

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Potential of Ant Plant (*Myrmecodiapendans*) Infuse as an Acute Diarrhea Medicine: An experiment on Rat as a model

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Abstract

Diarrhea is the most deadly diseases for the children. Diarrheais gastrointestinal infections caused by viruses, bacteria or parasites.Diarrhea could spread through dirty hands, contaminated food or water and contact with feces directly. The Ant plant and other herbs were used as a traditional medicine to cure diarrhea in some rural areas in Indonesia. Therefore, the aims of the research were to prove the potential of ant plant infuses to recovery the acute diarrhea on rat. This research used 25 rats that divided into 4 groups based on treatment: as Control (-) with water, Control (+) with Attapulgite, Dose I*(ant plant infuse)*0,45grams. $KgBW^{-1}$, Dose II 0,9grams. $KgBW^{-1}$, Dose III 1,8gram. $KgBW^{-1}$. The data (frequencies of defecate, consistency of feces and the length of diarrhea) were analyzed by the Mann- Whitney test. The result showed that the ant plant infuses was able torecover the acute diarrhea. The effective dose of Ant plant infuse was 0.9 gram. $KgBW^{-1}$.

Keywords: Diarrhea, Ant Plant hypocotyl, attapulgite

1. Introduction

Regarding to MDG's to eradicate the child mortality up to 2/3 part in 1990-2015, the government stated the policy to reduce mortality and morbidity on diarrhea by conduct the diarrhea management in the health institution and the house as well. The basic diarrhea management should performed to prevent and to cure dehydration, by zinc and food supplement, to cure the cause and complication also educate the hygiene to people. Diarrhea is a disease cause of the bad hygiene in the food and the environment. In the developed country, 2 million children were death by diarrhea (Walker et.al, 2012). Diarrhea in Indonesia is elevated from 374 per 1000 people in 2003 to 432 per 1000 people in 2006 (Adisasmito, 2007). During diarrhea, there was disturbing in the nutrient absorption, lead to malnutrition furthermore a big risk to growth failure of the child. Nutrient status on child is getting worse. Diarrhea in malnutrition, is more dangerous because higher frequencies, longer, and worse during diarrhea.

The curing effort including of symptom and causative therapy by modern medicine or traditional medicine. Medicine therapy that used to on diarrhea were rehydration therapy with loperamid or absorbent also diet management. For traditional medicine therapy as WHO reported that 60 % of Capital Country and 80 % of Developed country were using the traditional medicine. WHO also recommended the traditional therapy, including herbal medicine in the maintenance of public health, preventive and curative for some diseases. The traditional therapy for diarrhea used bio active substances in plant, by Indonesian people. Abundant of Indonesian plant were used to cure diarrhea.

The Ant plants one of the plants used to cure diarrhea. The ant plant found in peninsula Malaysia to Philiphine, Cambodia, Sumatra, Kalimantan, Java, Papua, Cape York (Subroto and Saputro, 2007[b]).The Ant plant contained flavonoide active, tannin, tocopherol, glicoside, vitamin, and minerals such as Ca, Na, K, P, Zn, Fe, Mg, and polyshacarida. The abundant of tannin and flavonoide leads to the taste similar with tea if boiled or as infusion. Flavonoid may role directly as antibiotic by disturbing the microorganism or viral function and as antioxidant against free radical. Some plants that used as an antidiarrheal because of

tannin in it. Tannins have a function as an astringent or polyphenol to bind and to precipitate protein (Subroto and Saputro, 2007[a]). Astringent has a function to reduce diarrhea by shrinking the mucous membrane of intestinal ((Tjay&Raharja, 2007). The acute diarrhea without good management is the cause of child death. Ten to 15 % of acute diarrhea leads to bad nutritious status and death. This study was conducted to address the potential of ant plant to cure the acute diarrhea on rat as a model.

2. Materials and Methods

2.1 Grouping The Subject

Twenty five male rats of Wistar strain, ± 200 grams body weight, 2 months old, were divided into 5 groups. After a week aclimatitation, rats were added 3 ml oleum ricini to induce acute diarrhea. When the stool was juicy, the rat adds some treats. Control (-) added by aquadest, control (+) added by attapulgite normal dose (54mg.KgBW^{-1}), Dose I 0.45 gr.KgBW^{-1} (ant plant infusion), Dose II 0.9 gr.KgBW^{-1}, Dose III 1.8 gr.KgBW^{-1}. The treatment was repeated 3 times every 6 hours. The observation for the number of recovered rat, the consistency of stool and the frequency of defecation was conducted 4 times in 6 hours, 12 hours, 18 hours and 24 hours. The research was conducted at
animal laboratory, Universitas Muhammadiyah Yogyakarta.

2.2 Statistical analyses

Data are analyzed by Mann-Whitney test and statistical significance was set upon $p < 0.05$.

3.Results and Discussions

There were many functions of ant plant to the human body. The beneficial substance of the ant plant in example are flavonoid fractions, tocopherol and alpha-tocopherol, saponins. This study was reported that ant plant infusion able to reduce or to cure the diarrhea, as shown in table 1.The number of recovered rat after added ant plant infusion was higher than added aquadest or attapulgite normal dose. The table 1 also showed that the increasing recovered number of rat in line with the increasing of dose ant plant infusion, also in line with the time of adding the infusion. Chi Square test showed that there is no significant of the treatment ($p=0.123$), because after did treatment, rats were recovery to normal. But in this study we showed the acute diarrhea will better if add the ant plant infusion especially in first 6 hours.

Table 1. The Number of Recovered Mice

The observation		Control (-)	Control (+)	Dose I	Dose II	Dose III
		Number of rats	Number of rats	Number of rats	Number of rats	Number of rats
6 hrs	Recovered mice	0	1	2	2	2
	Diarrhea mice	5	4	3	3	3
12 hrs	Recovered mice	2	3	3	3	4
	Diarrhea mice	3	2	2	2	1
18 hrs	Recovered mice	4	4	5	5	5
	Diarrhea mice	1	1	0	0	0
24 hrs	Recovered mice	4	5	5	5	5
	Diarrhea mice	1	0	0	0	0
note :	Control (-) : Add aquadest					
	Control (+) : Add Attapulgite (54 mg/KgBB)					
	Dose I : 0.45 gKgBW-1	Dose II : 0.9 gKgBW-1	Dose III: 1.8 gKgBW-1			

The frequency of defecate showed that there were worse in the first 6 hours in Control (-), as shown in table 2. After did treatments with ant plant infusion the frequency of defecate were reduce and to be normal.

Table 2. The Frequency of Defecation

Duration	Frequency	Contol (-)	Control (+)	Dose I	Dose II	Dose III
		Number of Rats	Number of Rats	Number of Rats	Number of Rats	Number of Rats
6 hrs	Many times	5	3	0	0	0
	Moderate	0	2	3	3	3
	Normal	0	0	2	2	2
12 hrs	Many times	0	0	0	0	0
	Moderate	5	3	2	2	1
	Normal	0	2	3	3	4
18 hrs	Many times	0	0	0	0	0
	Moderate	2	1	1	0	0
	Normal	3	4	4	5	5
24 hrs	Many times	0	0	0	0	0
	Moderate	1	0	0	0	0
	Normal	4	5	5	5	5

note : Control (-) : Add aquadest

Control (+) : Add Attapulgite (54 mgKgBW-1)

Dose I : 0.45 gKgBW^{-1} Dose II : 0.9 gKgBW-1 Dose III: 1.8 gKgBW-1

The increasing of dose ant plant infusion following by the reducing of the frequency of defecate also the longer of treatment following by the reducing of the frequency of defecate. The Mann Whitney test showed that there were significant different between control (-) to the Dose I, II, III in the 12 hours, ($P<0.05$) 18 hours ($p<0.05$). So, acute diarrhea would be better if added the ant plant infusion. As we showed in table 3 the consistency of stool, in the first 6 hours consistency of stool control (-) was juicy and slowly reduced the water in the 12 hours, so the consistency of stool became moderate. But in the first 6 hours, dose I, dose II and Dose III the consistency of stool were better as the increasing of dose. The Mann Whitney test showed $p< 0.05$ between control (-) and dose I, II, III was significant different.

Table 3.The Stool Consistency

Duration	Consistency of stool	Contol (-)	Control (+)	Dose I	Dose II	Dose III
		Number of Rats	Number of Rats	Number of Rats	Number of Rats	Number of Rats
6 hrs	juicy stool	5	5	3	2	2
	moderate aquos stool	0	0	2	3	3
	litle bit aquos stool	0	0	0	0	0
	Normal	0	0	0	0	0
12 hrs	juicy stool	5	0	0	0	0
	moderate aquos stool	0	5	2	0	0
	litle bit aquos stool	0	0	3	5	5
	Normal	0	0	0	0	0
16 hrs	juicy stool	0	0	0	0	0
	moderate aquos stool	0	0	0	0	0
	litle bit aquos stool	5	5	0	0	0
	Normal	0	0	5	5	5
24 hrs	juicy stool	0	0	0	0	0
	moderate aquos stool	0	0	0	0	0
	litle bit aquos stool	2	5	5	0	0
	Normal	3	0	0	5	5

note : Control (-) : Add aquadest

Control (+) : Add Attapulgite (54 mg KgBW-1)

Dose I : 0.45 gKgBW-1 Dose II : 0.9 gKgBW-1 Dose III: 1.8 gKgBW-1

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So ant plant was able to cure the acute diarrhea, because the ant plant contained tannin. Tannin have an effect as an astringent/Chelator. The chelator able to shrink the intestinal mucosa membrane leads to reduce the excretion of diarrhea and was able as an antibacterial and antiinflamation (Tjay and Rahardja, 2002). Tannin stimulate the water reabsorbtionin the intestinum (Kumar, et al,2011). Tannin damaged protein, result in tannat lead the protein resistance, following by reducing water excretion, accompanying by the increasing of water and NaClreabsorbtion. (Chitme, *et al*, 2004). Tannin in tea contained *epigallocatechin-3-gallate* (EGCG), polyphenol hidrofil, colorless and bitter.as an astringent able to curve diarrhea (Steinmenn*et al*, 2012). The EGCG also able to inhibit prostaglandin production that stimulated by oleumricini. Flavonids in the ant plant also able to inhibit the intestinum motility and hydroelectric secretion by inhibite prostaglandin production. Bakhriansyah and Rahmah, 2011 reported that sago root (*Metroxylonsagu*) infusion contained tannin, Flavonoid and saponin, also able to cure the acute diarrhea. The tannin was able to inhibit the secretion of chloride that induced by forskolin and toxin. Tannin also inhibit protein transmembrane.

Ant plant contains several chemical compounds such as flavonoids, tannins, and polyphenols having antioxidant activity. Moreover, the extract of ant plant able to inhibit the activity of xanthine oxidase and uric acid (Simanjuntak*et al.*, 2010). Sujono et al (2014) proved that the flavonoid quercetin has a protective effect in gentamicin- induced nephrotoxic rats. The flavonoid compounds identified in ant plant, were kaempferol, luteoline, quercetin and apigenin.

4. Conclusion

The ant plant infuse was able to reduce the frequency of defecate, recovered the consistency of stool and cure the acute diarrhea. The effective dose of antplant infuse was 0.9 gKgBW-1.

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Three Dimensional Media and Computer Simulation for The Concept of Heat in Physical Learning

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Abstract

Heat is energy that moves from substance with higher temperature to substance with lower temperature. A teacher needs a learning medium to explain the concept of the heat to the students. This study aims to develop learning media in the form of three dimensional media and computer simulation. The media development model used is the four-D model (Define, Design, Develop, Disseminate). This paper will discuss the Define stage in the development of learning media for the concept of heat in the learning of physics, namely three dimensional media and computer simulations to explain the influence of heat on the form of substances. At this stage has been determination and definition of requirements required in the learning based on needs analysis, student analysis, task analysis, concept analysis, and the formulation of learning objectives.

Keywords: three dimensional media, computer simulation.

1. Introduction

The term temperature is often used in everyday life, as well as the term heat. However, sometimes we disrupt the notion of temperature as heat, but they are different. Water that is 10^oC is said to be cold and the water is 90^oC hot. The water temperature becomes 90^oC, because the water is heated by using fire or electric heater. When we heat water, we add a certain amount of heat to the water. Due to the addition of this heat, water temperature will increase or there is a change in temperature. From this fact, it is clear that temperature and heat are two different things. Temperature states the degree of heat or cold of an object or the size of cold heat of an object, while heat or heat is one form of energy that can cause temperature changes. Based on the above definition can be said that: objects that heat the high temperature and cold objects have low temperatures.

Teachers need learning media to explain the concept of "heat" to the students in physics learning in the classroom. The purpose of this research is to develop learning media in the form of three dimensional media and computer simulation. This paper will discuss the results of learning media development in the first stage of the four stages of development of learning media is the Define stage.

2. Materials and Methods

Model of learning device development in this research using four-D model (Define, Design, Develop, Disseminate) as suggested by Thiagarajan, Semmel, and Semmel in Trianto (2008) and Ibrahim (2003). In this first year (year 2017) has done the stage of Define (Definition) and stage Design (Design). In the Define stage has been done determination and definition of requirements required in learning based on the needs analysis, student analysis, task analysis, concept analysis, the formulation of learning objectives.

3. Results and Discussion

The results obtained at the define stage has been defined and defined the requirements required in the learning that is based on: needs analysis, student analysis, task analysis, concept analysis, the formulation of learning objectives.

3.1 Needs Analysis

The purpose of this analysis is to find out the basic problems necessary to prepare the learning materials. Based on the problem then selected learning materials relevant to the problem to be studied. In the needs analysis that needs to be reviewed is the high school curriculum, approaches in learning, challenges and demands in the future.

3.1.1 High School Curriculum

The 2013 curriculum develops two learning processes namely direct learning process and indirect learning process. The direct learning process is a learning process that develops the knowledge, thinking ability, and psychomotor skills of learners through direct interaction with learning resources designed in the syllabus and Learning Implementation Plan in the form of activity-based learning activities. Characteristics of activity-based learning include: interactive and inspirational; fun, challenging, and motivate learners to participate actively; contextual and collaborative; provide sufficient space for the initiative, creativity, and independence of learners; and in accordance with the talents, interests, abilities, and physical and psychological development of learners.

In direct learning, learners learn to observe, ask, gather information, associate or analyze, and communicate what has been found in the analysis activities. Direct learning process produces knowledge and skills directly or called instructional effect.

Indirect learning is a process that occurs during learning but is not designed in specific activities. Indirect learning is generally concerned with the development of values and attitudes. In the Types of values and attitudes to be developed are not taught directly in the lesson, but are still designed and planned in the syllabus and Lesson Plans. Indirect learning deals with lessons concerning Basic Competencies developed from Core Competencies-1 and Core Competencies-2.

In the process of Physics learning with scientific-based scientific approach, the attitude aspect is intended for learners to know about 'why'. The skill area is meant for learners to know about 'how'. Meanwhile, the realm of knowledge is meant for learners to know about 'what'. The final outcome of Physics learning is the improvement and balance between the ability to be a good human (soft skills) and human beings who have the skills and knowledge to live adequately (hardskills) of learners that include aspects of attitude, skills, and knowledge competencies. By developing these three aspects of competence, it is expected to form productive, creative, and innovative students.

3.1.2 Approach in Learning

Activity and creativity of learners depends on the activity and creativity of teachers in developing teaching materials, and create a conducive learning environment. Teachers can use various approaches in increasing the activity and creativity of learners (Mulyasa, 2004). The approach used in this study is student-centered approach, while the learning model used is inquiry learning model with real experiments and virtual experiments method.

Jufri (2010) writes the general stages of the implementation of inquiry based learning consists of 6 stages / activities. The stages in question are Phase 1: identification and problem formulation; Stage 2: hypothesis formulation; Stage 3: data collection; Stage 4: data interpretation; Stage 5: the development of conclusions; Stage 6: repetition.

According to Suprihatiningrum (2013), the experimental method is done by practicing recipe book which can be a practical manual or instructions in operating the tool. Students are required to experiment or observe a process and results. This method aims to equip students with scientific methods. According to Sanjaya (2008), as a teaching method, the simulation can be interpreted as the way of presenting the learning experience by using artificial

situations to understand certain concepts, principles or skills. Rusman (2012) states that in the simulation method, the subject matter is packaged in the form of simulations of learning in the form of animation that explains the content in an interesting, lively, and blend elements of text, images, audio, motion, and harmonic color combinations. Sridadi in Rusman (2012) argues that the simulation is a computer program (software) that serves to mimic the behavior of a specific real system (reality).

In the real experiments method the students conduct the investigation activities with the help of three dimensional media, while on virtual experiments method the students perform the investigation activity with the help of computer simulation. In its implementation, this computer simulation serves as a repetition activity for consolidation of investigation activities in real experiments. Computer simulation to be used in this research is PhET simulation.

Physics Education Technology (PhET) is an interactive simulation of physiological phenomena, based on research provided free of charge. We believe that a research-based approach, combining our previous research results and what we do ourselves - enables students to connect the real-life phenomena and underlying science, which will ultimately deepen their understanding and heighten their interest in physics (http: // phet.colorado.edu/in/about). We have two main objectives for PhET simulation: first, PhET simulations increase student engagement and improve learning; second, the PhET simulation is specifically designed to support students in building robust conceptual physics understanding through exploration (Perkins, et.al., 2006). Research Ajredini, et.al. (2013) found that there was no significant difference between the knowledge gained through real experiments and through computer simulations.

3.1.3 Challenges and Demands in The Future

At high school level, physics is considered important to be taught as a separate subject with some considerations. First, in addition to providing knowledge to students, Physics subjects intended as a vehicle to foster the ability to think useful for solving problems in everyday life. Second, the subjects of Physics need to be taught for a more specific purpose of equipping learners of knowledge, understanding and a number of abilities required to enter higher education and develop science and technology. Physical Learning is conducted in scientific inquiry to cultivate thinking ability, work and be scientific and communicate as one important aspect of Life Skills. Physics subjects aims to learners have the following abilities.

1) Establish a positive attitude towards physics by realizing the regularity and beauty of nature and glorifying the greatness of God Almighty
2) Cultivate a scientific attitude that is honest, objective, open, tenacious, critical and can cooperate with others
3) Develop experiences to be able to formulate problems, propose and test hypotheses through experiments, design and assemble experimental instruments, collect, process, and interpret data, and communicate experimental results orally and in writing
4) Develop reasoning skills in thinking of inductive and deductive analyzes using the concepts and principles of physics to explain natural events and solve problems both qualitatively and quantitatively
5) Mastering the concepts and principles of physics and have the skills to develop knowledge, and confidence as a provision to continue education at a higher level and develop science and technology.

3.2 Student Analysis

Student analysis is a study of student characteristics that include reasoning ability, background knowledge, and level of cognitive development of students. High school students in general have passed the level of junior high school education (SMP). In Junior High School, students have studied a number of basic materials of physics and biology on science subjects as their initial knowledge in secondary education.

High school students in particular class 1 aged between 16-19 years. According to Nur (1998) in Trianto (2008), the developmental stages of Cognitive Piaget consists of 4 stages: sensorimotor stage (0-2 years), preoperational (2-7 years), concrete operations (7-11 years), and surgery formal (11 years to adulthood). In Nur (2004) it is said that based on Piaget's cognitive development theory, students undergo a transition phase from the use of concrete operations to the application of formal operations in reasoning. Furthermore it is said that formal operational thinkers have the following characteristics: 1) Be able to formulate many related hypotheses, have combinatorial logic, reason with concrete concepts and relationships and concrete and abstract relations, reasoning about abstract characteristics and theories, 2) Be able to understand the abstract meaning and principles underlying formal concepts, relationships, and theories, 3) Be able to provide logical arguments about ideas that are inconsistent with personal facts or beliefs or are subject to change; can reason based on testimony, 4) Given a set of conditions, objectives, and resources, can plan long and complex procedures, 5) Conscious and critical of its own reasoning, it can display reflective thinking on the problem-solving process and examine inferences by checking sources, using other known information, or seeking solutions from other points of view.

3.3 Task Analysis

Task analysis is performed to detail the content of teaching materials in the form of outline, consisting of content structure analysis and procedural analysis. Development of Curriculum of High School Physics is done in order to achieve the dimensions of knowledge competence, scientific work, and scientific attitude as daily behavior in interacting with society, environment and technology utilization.

According to Kementerian Pendidikan Dan Kebudayaan(2016), the framework of developing Basic Competence of Natural Sciences refers to Core Competence as the element of organizing Basic Competence vertically and horizontally. Vertical organization Basic Competence in the form of interconnection Basic Competencies between classes must meet the principle of learning, which occurs a continuous accumulation between competencies learned learners. Horizontal organization in the form of the relationship between Basic Competence of a subject with Basic Competence of other subjects in the same class so that there is a process of mutual strengthening. The development of basic competencies is based on accumulative principles, reinforced and enriched inter-subjects and levels of education (horizontal and vertical organizations). All basic competencies and learning processes are developed to achieve Core Competencies.

Core competence consists of 4 (four) aspects, namely: Core Competence -1 (spiritual attitude), Core Competence -2 (social attitude), Core Competencies -3 knowledge, and Core Competencies -4 (skills). Basic Competence of Spiritual Attitude and Basic Competence of Social Attitude on Natural Science Subject is not formulated, but indirect teaching result from knowledge and skill, so it is necessary to plan its development. Core Competencies -3 Knowledge and Core Competencies -4 skills detailed further in Basic Competencies subjects. Basic Competence Development is not limited by the formulation of Core Competencies, but adapted to the characteristics of subjects, competence, material scope, psychopedagogi. However, the formulation of Basic Competencies should refer to Core Competencies.

Competence of spiritual attitudes and social attitudes, is achieved through indirect teaching that is exemplary, habituation, and school culture, taking into account the characteristics of subjects and the needs and conditions of learners. The growth and development of attitude competence is done throughout the learning process, and can be used as teacher consideration in developing the character of the students further.

In the context of the subjects of High School Physics, the curriculum of High School Physics covers the plan of arranging Physics subject matter, and the way of Physics learning to achieve competence. The general arrangement plan is manifested in the form of a Physics learning syllabus, while a more detailed regulatory plan is manifested in the form of a Physical Learning Implementation Plan. Preparation of Physics Learning Implementation Plan is the task and authority of teachers, with reference to syllabus, teacher book, student book, learning resources available, and the characteristics of learners.

The scope of subjects of Natural Sciences is studied from elementary school, junior high school and senior high school. Physics materials studied at elementary school level based on the theme and phenomenon of simple Physics, at the level of Secondary School based on Physics phenomenon with qualitative approach, while at the level of Physics High School based on Physics with quantitative approach.

As mentioned above that: The Competence of Spiritual Attitude and the Competence of Social Attitude, achieved through indirect teaching on learning of Knowledge Competency and Skill Competence through exemplary, habituation, and school culture by taking into account the characteristics of subjects, as well as the needs and condition of the participants educate. The growth and development of attitude competence is done throughout the learning process, and can be used as teacher consideration in developing the character of the students further. For class XI, the material: Temperature, Heat and Heat Transfer. Time allocation: 4 hours lesson / week. Lessons for Knowledge Competencies and Skills Competencies are as follows.

Basic competencies	Learning materials	Learning Activities
3.5 Analyzing the influence of heat and heat transfer which includes the thermal characteristics of a material, capacity, and conductivity of heat in daily life 4.5 Plan and experiment on the thermal characteristics of a material, particularly related to the capacity and conductivity of the heat, along with the presentation of the results and their physical meanings	Temperature, Heat and Heat Transfer: • Temperature and expansion • Heat correlation with the temperature of the object and its for • Black Azas • Heat transfer by conduction, convection, and radiation	• Observing demonstrations of railway expansion, ice heating into water, metal conductivity (aluminum, iron, copper, and tin), impressions of literature studies on the effects of heat on changes in the temperature of objects, the effect of changes in the temperature of objects on the size of objects (expansion) , and heat transfer by conduction, convection and radiation • Conducting experiments on the effects of heat on temperature, shape, and size of objects, determining the heat type or heat capacity of the metal and exploring about the Black principle and heat transfer • Processing data and analyzing experimental results on heating type or heat capacity of metals using a calorimeter • Produce reports of experimental results and present them

3.3 Concept Analysis

This analysis is done by identifying the main concepts to be taught, arranging systematically in the form of concept maps.

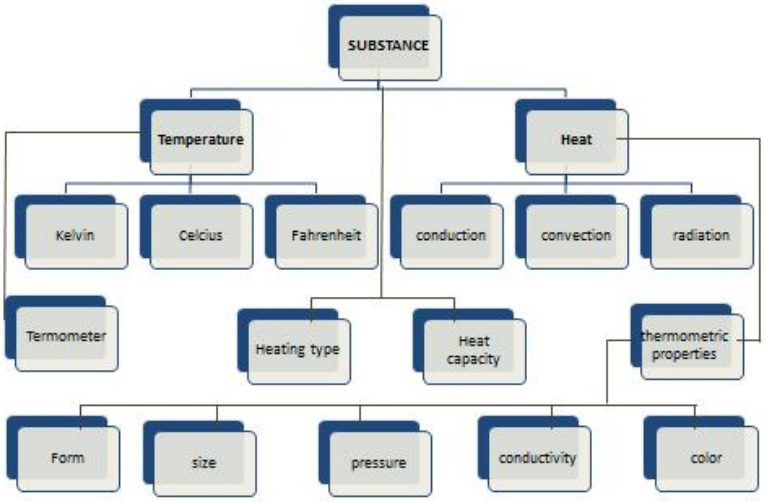

Figure 1. Concept Analysis

3.4 Formulation of Learning Objectives

This stage is done to convert task analysis and concept analysis into performance criteria, learning scope, and learning subject matter consisting of attitude, knowledge, and skill. The preparation is based on the Curriculum 2013.

Basic competencies	Learning objectives
3.5 Analyzing the influence of heat and heat transfer which includes the thermal characteristics of a material, capacity, and conductivity of heat in daily life	1. Explain temperature and temperature gauge. 2. Explain the temperature scale. 3. Explain the influence of temperature on the expansion of solids, liquids, and gaseous substances. 4. Using the expansion equation to solve the problem. 5. Explain the influence of heat on a substance. 6. Explain the Black Principle and use its equations in solving the problem. 7. Explain the heat transfer and related events. 8. Using equations on heat transfer to solve problems.
4.5 Plan and experiment on the thermal characteristics of a material, particularly related to the capacity and conductivity of the heat, along with the presentation of the results and their physical meanings	1. Measure temperature by using thermometer 2. Conducting activities to prove the expansion of the substance 3. Conducting experimental activities on the effects of heat on changes in the form of substances 4. Determining the heat of a metal type by experiment (Black Principle) 5. Conducting experiments of heat transfer by conduction, convection, and radiation 6. Experiment to determine the heat equation

4. Conclusion

In the define stage has been done determination and definition of requirements required in learning based on the needs analysis, student analysis, task analysis, concept analysis, the formulation of learning objectives. Define stage in development of learning media for the concept of heat in physics learning, namely three-dimensional media and computer simulation to explain the effect of heat on the form of substance has been completed so that it can be continued to the next stage of Design, Develop, and Disseminate.

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The Effect of Fractionated Solvent Combination and Sample Concentration on Sun Protection Factor (SPF) Value of Corn Silk Methanol Extract

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Abstract

This research aims to determine the Sun Protection Factor (SPF) value on each fractionated solvent combination and sample concentration in corn silk methanol extract. By knowing the SPF value of samples so their potential as a natural sunscreen will represent. In addition, by combining and varying the fractionated solvent and sample concentration, we will know the best treatment to have the best protection to be a sunscreen. Corn silk powder was macerated with methanol until it obtained corn silk methanol extract (E1). After that, corn silk methanol extract was fractionated with toluene (E2), ethyl acetate (E3) and water (E4). Each extract then measuring their SPF value by invitro using spectrophotometer UV-VIS in 100 ppm and 1000 ppm variated concentration. SPF value of extracts then compared with SPF value of quercetin (C1) and β-karoten (C2). The result showed SPF value of extracts E1, E2, E3, E4, C1 and C2 in 100 ppm are 2,08; 1,33; 3,12; 1,95, 5,71 and 29,52. While SPF value of extracts E1, E2, E3, E4, C1 and C2 in 1000 ppm are 14,55; 7,42; 19,75; 13,91; 37,93 and 38,7. Fractionated solvent combination of corn silk methanol extract with toluene, ethyl acetate and aquades influence on their SPF value of sample. The highest SPF value of corn silk methanol extract showed SPF value in ethyl acetate fractionation. While SPF value of samples in 1000 ppm showed the higher SPF value of samples than in 100 ppm. So, the highest SPF value in this research is in ethyl acetate fractionation in 1000 ppm sample concentration.
Keywords: Corn Silk, SPF, Sunscreen

1. Introduction

There are a phenomenm like ozon layer depletion that is caused by the increasing of free radical in earth. It affects on the increasing possibility of disease and health problem in our body.An exposure of UV-rays radiation can be dangerous to skin because it can be caused several type of skin disorders such as erythema, pigmentation, photosensitivity, photoaging, and skin cancer (Satiadarma&Suyoto, 1986; Saewan&Jimtaisong, 2013).That effect mainly is caused by exposure of UV-A (320-400 nm) and UV-B rays (290-320 nm). So, it needs a skin protector or it called sunscreen. Sunscreen efectivity can be symbolized by SPF (Sun Protection Factor). SPF is the comparative measure of how much UV is required to burn the skin when the skin is protected and when it is not protected by sunscreen.

Actually, corn silk have a lot of bioactive compounds.Corn silk contains proteins, carbohydrates, fiber, vitamin B, vitamin C, vitamin K, minerals such as Na, Fe, Si, Zn, K, Ca, Mg and P, sitosterol and stigmasterol, alkaloids, saponins, tannins, flavonoids, anthocyanins, protocatechine, vanilic acid, hasperidin derivatives, and quercetin(Guo et al, 2009; Ebrahimzadeh et al, 2008). It is also containing the other secondary metabolites such as phenols, terpenoids, and glycosides (Sholihah et al, 2012). Corn silk also contains maysin, β-carotene, beta-sitosterol, geraniol, hordenin, limonene, menthol *and* viteskin (Rahmayani, 2007). It needs solvent with various polarity to extract the compound in samples, so in this research it uses variation extract like methanol, ethyl acetate, toluene and water.

2. Materials and Methods

3.

2.1 Materials

The materials in this research are sample of corn silk aged 80-90 days, methanol, aquadest pH 7, toluene, ethyl acetate, ethanol 96%, quercetin, β-carotene, filter paper, filter cloth, aluminum foil, label, cotton, and tissue.

2.2 Instrumentation

Instrumentationin this research are blender, analytical scale (Denver Instrument), shaker (Heidolph), rotary evaporator (IKA HB 10), (Turbo Mixer), spectrophotometer-UV.

3.3 Procedure

2.3.1 Sample Preparation

Fresh corn silk sample of sweet corn was selected in 80-90 days. Then sample was separated from damage part then it was dried and protected from sunlight for 3 days, then cut sample roughly and smoothly with a blender.

2.3.2 Extraction

Sample (150 g) was macerated using 750 mL ofmethanoland used shaker for 4 x 24 hours, wherein every 24-hour the solvent replaced with new ones in the same amount. The obtained filtrate then evaporated with a rotary evaporator at the temperature of 40°C and the obtained extract of ethanol soluble fraction (E1).10 g of extract E1 is dissolved with ethyl acetate in a 100 mL volumetric flask. Then, the fraction was evaporated using a rotary evaporator at the temperature of 40°C and it obtained methanol extract combinated with ethyl acetate (E2).10 g ekstract of E1 is dissolved in methanol:water (1:9) in 100 mL flask and then fractionated with filter flask using toluene (1:1). After it was form two layer, the toluene fraction was stored and the other fraction was fractionated again with ethyl acetate in same composition. Each extracts then evaporated with rotary evaporator vacuum in 40^{o}C. This procedure produce 3 fraction that is toluene fraction (E2), ethyl acetate fraction (E3) and water fraction (E4).

2.3.3 Determination of SPF (Sun Protection Factor) Value

SPF determination is performed by in vitro method with Spectrophotometer-UV. The sample preparation method by (Petro, 1981) which has been modified. The SPF value from extract is compared with controls quercetin (C1) and beta-carotene (C2). Each samples (E1, E2, E3, E4, C1 and C2)then makes into 100 ppm (1 mg of samples dissolve into 10 mL ethanol 96%) and 1000 ppm sample concentration(10 mg of samples dissolve into 10 mL ethanol 96%). Then it was determined the absorbance of each samples using UV-Vis spectrophotometer at λ 290 nm-320 nmin 5 nm interval measurement. SPF value were calculated using a mathematical equation of (Mansur et al, 1986) using normalized function that defined by (Sayre et al, 1979). The formula of SPF determination is:

$$SPF = CF \times \sum_{290}^{320} EE\ (\lambda) \times I\ (\lambda) \times Abs\ (\lambda) \quad (1)$$

Where: CF = correction factor (10); EE = erythemal effect of the spectrum at a wavelength (λ); I = intensity of the solar spectrum at a wavelength (λ); Abs = absorbance of the solution at a wavelength (λ).

Normalized function used in the calculation of SPF shown in Table 1.

Table 1. Normalized function used in the calculation of SPF (Sayre et al, 1979)

λ	$EE(\lambda)$ x $I(\lambda)$
290	0,015
295	0,0817
300	0,2874
305	0,3278
310	0,1864
315	0,0837
320	0,018
Total	**1**

* the values of EE (λ) x I (λ) are constants

3. Results and Discussion

3.1 SPF Value of Corn Silk Extracts in 100 ppm Samples Concentration

SPF value of corn silk extracts in 100 ppm sample concentration are showed in this Figure below.

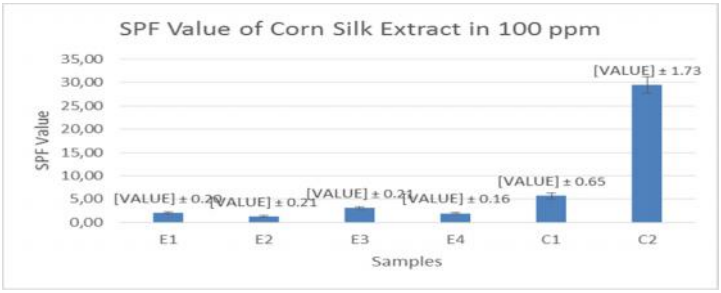

Figure 1. SPF Value of Corn Silk Extracts and Control in 100 ppm Concentration Notes: E1 (methanol fraction), E2 (toluene fraction), E3 (ethyl acetate fraction), E4 (water fraction), C1 (quercetin), C2 (beta carotene)

Based on the result that is showed in Figure 1, the highest SPF value of corn silk extracts are the extract from ethyl acetate fractioned (E3) which is 3.12 ± 0.21 and then followed with the methanol extracted (E1) in 2.08 ± 0.20, the water fractioned (E4) in 1.95 ± 0.16 and the toluene fractioned (E2). SPF value in control showed highest SPF value in beta-carotene control (C2) in 29.52 ± 1.73 and then followed with quercetine control (C1) in 5.71 ± 0.65. Comparing the SPF value between control and extracts of corn silk, so there are the significantly differences value especially between SPF value in extracts of corn silk (E1, E2, E3, E4) and SPF value in beta-carotene control (C2). This is caused beta carotene compound is more stable, pure and absorpable with UV light than the compound in corn silk extract because beta carotene consist of isoprene (diene) unit that is can absorb the UV light by electron resonance. Type protection of sample fraction in corn silk extract in 100 ppm is classified into minimal protection in 1-4 range of SPF value. It based on the table of Sun Protection Factor (SPF) value's assessment according to *Food and Drug Administration* (FDA) that shown in Table 2.

Table 2. Sun Protection Factor (SPF) Value's Assessment According to Food and Drug Administration (FDA) (Wilkinson & Moore, 1982)

Type of protection	SPF Value
Minimum protection	1 – 4
Moderate protection	4 – 6
Extra protection	6 – 8
Maximum protection	8 – 15
Ultra protection	>15

3.2 SPF Value of Corn Silk Extracts in 1000 ppm Samples Concentration

SPF value of corn silk extracts in 1000 ppm showed the highest SPF value than SPF value of corn silk extracts in 100 ppm concentration. The trend of increasing and decreasing SPF value of corn silk extracts in 1000 ppm concentration also showed the same trend in SPF value of corn silk extracts in 100 ppm. In control, the highest SPF value is showed in beta carotene control (C2). In extracts of corn silk, the highest SPF value is showed in ethyl acetate fractioned (E3). Ethyl acetate fractioned showed the highest SPF value because ethyl acetate are semipolar compound so it is possible to extract more compound that have polar (like phenolics, flavonoids, etc) and nonpolar (like carotenoids, etc) characteristics, so the equilibrium of compound are required in order to increase the SPF value of samples. The SPF value of corn silk extracts and control are showed in Figure 2.

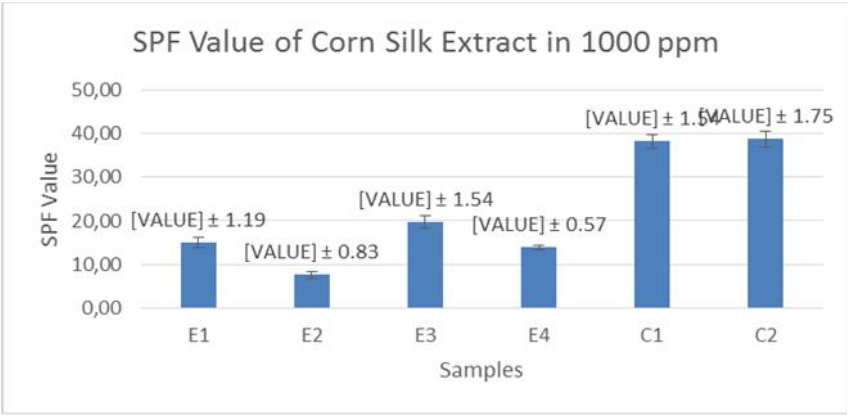

Figure 2. SPF Value of Corn Silk Extracts and Control in 1000 ppm Concentration Notes: E1 (methanol fraction), E2 (toluene fraction), E3 (ethyl acetate fraction), E4 (water fraction), C1 (quercetin), C2 (beta carotene)

Type protection of SPF value in 1000 ppm concentration especially for E1 and E3 extracts are classified into ultra protection (SPF>15), for E4 extract is classified into maximum protection (SPF 8-15), and E2 extract is classified into extra protection (SPF 6-8). All SPF value of corn silk extracts in 100 ppm and 1000 ppm showed the lower SPF value than SPF value of control. But it showed that the increasing of concentration samples can be increase the SPF value of each samples. It is because the absorbance in spectrophotometer is higher in the higher concentration of samples. It is related with the content of compound in each extracts that can be absorb UV light.Based on Taufikurohmah and Nurhayati (2008), the conjugated double bond in compound can be resonance while it is expose with UV light.

4. Conclusions

The conclusions of this research are fractionated solvent combination of corn silk methanol extract with toluene, ethyl acetate and water influence to theirSPF value of samples.

Ethyl acetate fraction showed the highest SPF value in 100 and 1000 ppm sample concentration.SPF value of extract in 1000 ppm sample concentration is higher than SPF value of extract in 100 ppm. It showed significant result in increasing the potential of sample as a sunscreen.

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Uniformity Evaluation of Self Compacting Concrete Properties in Beam-Column Structural Elements Using Non-Destructive Testing

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Abstract

Self-compacting concrete (SCC) is a new type of concrete which can easily flow and consolidate without any compaction due to the present of high content of water reducing while keeping a low water-cement ratio. There are many advantages using SCC during construction practice; for instance reducing cost and maintaining the good working environment. Therefore, use of SCC has been increased since it was introduced in 1980's. However, segregation and settlement have to be concerned in such congested section or complicated reinforcement like in beam-column structural elements. The uniformity of the properties of SCC in this element was investigated using non-destructive testing (NDT)-hammer testin some considering point of elements in this research. The specimens are full-scale of beam-column structural elements. It consists of three specimens made from SCC and three specimens made from conventional concrete as comparison (NC). To confirm the result of hammer test, the specimens were then loaded until failure. According the hammer test, there is only slight differences in rebound number between NC and those of SCC indicatingthere is a uniformity of structural elements. However, during structural testing, in higher reinforcement ratio, the SCC aren't able to reach the maximum load as NC due to early failure occurred in column indicating there was a problem during placement which cannot be detected during NDT. More than one NDT tool has to be utilized to evaluate the uniformity of structural elements.

Keywords: Self Compacting Concrete, Non-destructive Testing, Hammer testing, Beam-column, Properties Uniformity

1. Introduction

Self-compacting concrete is a type of concrete which doesn't need vibration during placing due to high flow ability properties. The ability of self-levelling nature of SCC offers many advantages; for instances enhancing construction properties, reducing overall cost, improving working environment (Zhu, 2001). Therefore, the use of SCC in construction practice has been increasingly since it was invented in the early of 1990s in Japan.

However, the hardened properties of SCC, that are very important in structural design have only been analysed solely to mechanical properties such as compressive strength and modulus elasticity. In fact, since SCC has the ability of self-compacting, inadequate homogeneity of hardened SCC due to either segregation or poor compaction need to be considered.

To ensure the uniformity distribution of SCC in a structure mainly in congestion place due to heavy reinforcement has still to be reviewed. Therefore, this research is aimed to investigate the homogeneity of SCC in full scale beam-column structure using non-destructive testing.

2. Related Works and Theory

An experimental and numerical research on mechanical properties, such as strength, elastic modulus, creep and shrinkage, of self-compacting concrete (SCC) and then the results were compared to the corresponding properties of normal compacting concrete (NC) has been investigated by Persson, (2001) and Domone (2007). It was observed that the properties on elastic modulus, creep and shrinkage of SCC were almost similar to the corresponding properties of NC.

Zhu et al., (2001), has studied on uniformity of in situ properties of SCC mixes in practical structural columns and beams. The properties were compared to those of well compacted conventional concrete (NC). The properties were investigated using testing cores, pull-out of pre-embedded inserts, and rebound hammer number for near-surface properties. The research found that there were not significant differences in uniformity of in situ properties between SCC and NC.

2. 1. Self-Compacting Concrete (SCC)

SCC is a modern concrete that does not need vibration duringplacement and compaction. It can flow under its own weight, completely filling formwork and achieving full compaction, even in the presence of congested reinforcement. The hardened concrete is able to be dense, homogeneous and has similarmechanical properties and durability toconventional vibrated concrete. SCC is usually produced with low water-cement ratio which can achieve high early strength, earlier de-moulding and faster use of elements and structures.

According to The European Standar for Self-Compacting Concrete, (2005), to examine the fresh properties of SCC, some testing should be conducted. Slump-flow value describes the flow ability of a fresh mix in unconfined conditions. It is a sensitive test that will normally be specified for all SCC, as the primary check that the fresh concrete consistence meets the specification. Passing ability describes the capacity of the fresh mix to flow through confined spaces and narrow openings such as areas of congested reinforcement without segregation, loss of uniformity or causing blocking.

Superplasticisers or high range water reducing chemical admixtures is the primary component of SCC. This admixture achieves the required water reduction and fluidity as well as maintains its dispersing effect during the time required for transport and application.

2. 2. Non-Destructive Testing (NDT)

It is often necessary to test concrete structures after the concrete has hardened to determine whether the structure is suitable for its designed use. Ideally such testing should be done without damaging the concrete. Non-destructive testing can be applied to both old and new structures. For new structures, the principal applications are likely to be for quality control or the resolution of doubts about the quality of materials or construction. The testing of existing structures is usually related to an assessment of structural integrity or adequacy.

One of the well-known NDT on concrete structures is The Schmidt rebound hammer. Hammer test is principally a surface hardness tester. It works on the principle that the rebound of an elastic mass depends on the hardness of the surface against which the mass impinges (Malhotra and Carino, 2004)

3. Experiment

3. 1. Materials and Mix Designs

Concrete aggregate consists of coarse aggregate made by crushed stone which has maximum diameter of 20 mm and fine aggregate which has 5 mm in maximum diameter. The specific gravity of of fine and coarse aggregate were 2.56 and 2.69 respectively. The grading curves of coarse and fine aggregate are illustrated in Figure 1. Cement type was Portland Cement Type 1. The water cement ratio is kept by 44% for whole mixture of SC and SCC. The flow ability was provided by high water reducing admixture, a brand from Sika, named Sika Viscocrete. The mixture proportion of SCC and NC is shown in Table 1.

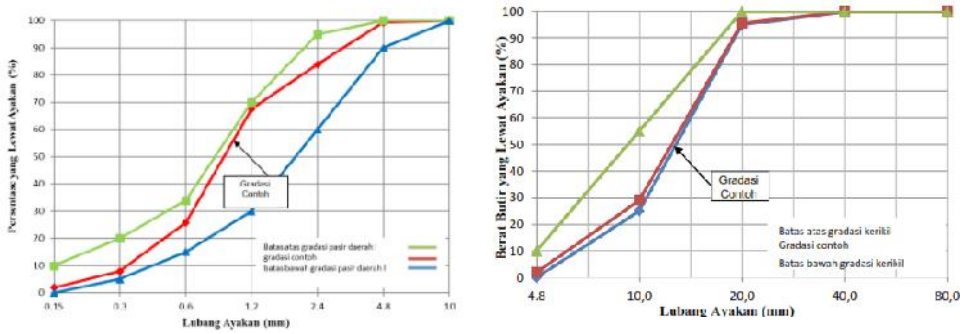


Figure 1. The grading curves of coarse and fine aggregate

Table 1. Concrete mixture proportion

Concrete Type	Mixture Proportion (kg/m^3)				
	Water	Cement	Fine Aggregate	Coarse Aggregate	Superplastisizer
NC	225	510	922	668	-
SCC	200	450	790	962	0.8% of cement weight

To check the properties of fresh concrete, some test were conducted both in SCC and NC to describe whether the mixture meet the specifications. The fresh properties of concrete are shown in Table 2.

Table 2. Fresh properties of concrete

Fresh Properties	NC	SCC	Required Value
Slump (cm)	13	-	7.5-15
Slump Flow Spread (cm)		68.2	65-80
J Ring Test (cm)		63.5	60-85

A set of three concrete cylinders of NC and SCC were prepared to examine the compressive strength. The sizes of cylinders were150 mm in diameter and 300 mm in height. Full scale beam-column structural elements of NC and SCC were casting according to mix design shown in Table 1. The detail of dimension and bar arrangement of full scale beam-column is shown in Figure 2. The steel reinforcement (Figure 2) were design in two ratio which were low and high reinforcement ratio to provide such an adequate spacing and constricted spacing respectively in concrete. All the materials and test procedures was based on Indonesian Standard.

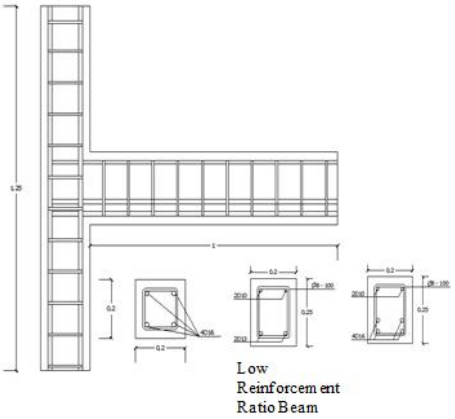
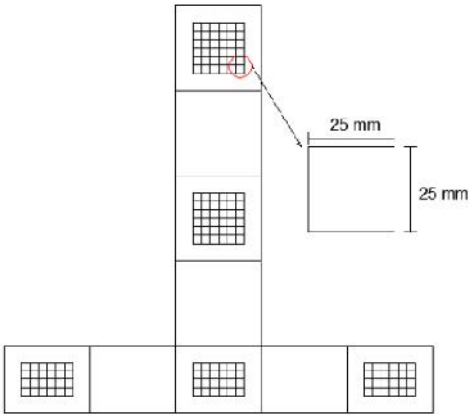


Figure 2. Beam column specimen and detail of reinforcement

3. 2. Methods

Testing was carried out at the age of 28 days of specimens. After rebound numbers reading were conducted, the destructive testing was applied on both cylinder concretes and structural elements. To prevent sway during hammering, the cylinder concrete was braced using compression testing machine. At least ten readings were taken in each location as shown in Figure 3.The beam column elements were loaded by static flexure load at beam end until failure. The setting up of structural testing is shown in Figure 4.



Hammer Testing Location on Beam-column Hammer Testing on Cylinder

Figure 3. Hammering location on beam-column and cylinder specimen

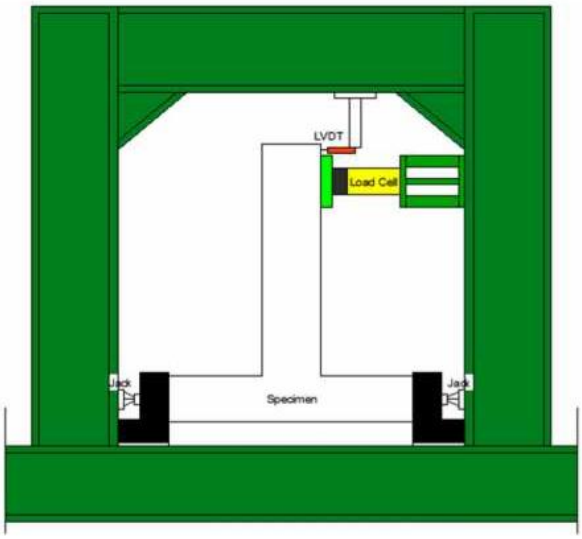


Figure 4. Beam-column testing set-up

4. Results and Discussion

4. 1. Concrete Cylinder Compressive Strength and Rebound Number

With the same target strength during mixture proportion design, NC has greater compressive strength and rebound number than those of SCC as shown in Table 3. During mix design, NC has greater cement content than SCC causes NC has greater compressive strength than those of SCC. Greater strength leads to produce higher rebound number during hammer test.

Table 3. Compressive strength and average of rebound number

Concrete Type	Compressive Strength(MPa)	Average of Rebound Number
NC1	38.4	30.7
NC2	39.0	30.6
NC3	38.7	30.7
Average	**38.7**	**30.6**
SCC1	31.0	29.2
SCC2	30.7	28.7
SCC3	30.1	29.7
Average	**30.6**	**29.2**

4. 2. Hammer Test on Beam-Column Structural Elements

There is only slight differences in rebound number between NC and those of SCC as shown in Figure 5. Moreover, in joint, SCC shows slight better rebound number, indicating that SCC has good placement performance even in such congestion places. According to the result of hammer test, there are no significant differences in uniformity on structures between SCC and NC.Homogeneity is found in SCC, since the different of RN in each hammering location are found not more than 5 (ASTM C805, 2013).

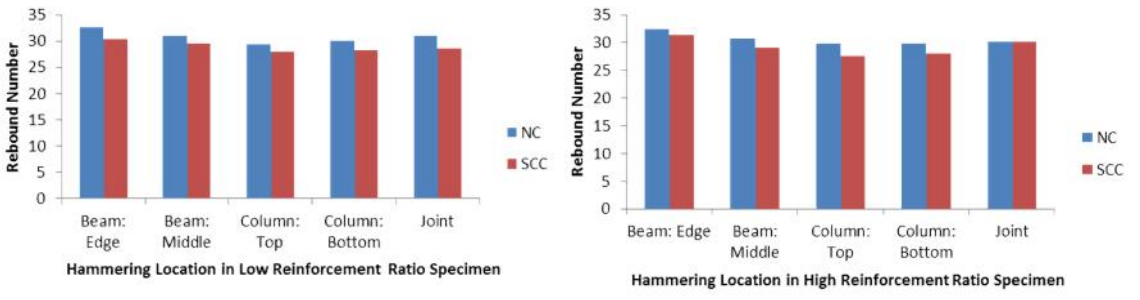


Figure 5. Rebound number in each location of beam column specimens

4. 3. NDT Result Confirmation Using Structural Testing

Maximum load of NC and SCC in lower reinforcement ratio are almost similar as shown in Table 4. It only differs 10% indicating there is uniformity present in SCC as expected similar to that in NC. However, according to the relationship load-displacement obtained from structural testing as shown in Figure 6, even both concrete have almost similar maximum load, but in the early of load level, NC shows more stiff that that of SCC. This is common due to greater compressive strength of NC.

Table 4. Maximum load

Reinforcement Ratio Type	Maximum Load (kN)		Maximum Load SCC/NC (kN)
	NC	SCC	
Low ratio	23.3	20.9	0.90
High Ratio	42.8	28.3	0.66

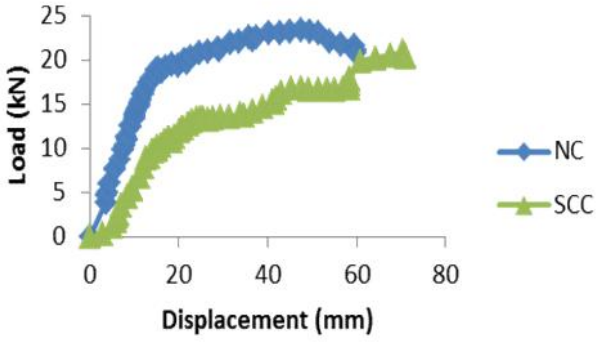


Figure 6. Load-displacement relationship of lower reinforcement ratio

Furthermore, in higher reinforcement ratio SCC only reaches 66% load of NC maximum load. SCC beam-column aren't able to reach the maximum load as NC due to early failure occurred in column. Early failure in column indicating there was a problem during placement due to non-homogeneity such as voids or honey combing. This performance has the opposite result to the rebound number. This problem isn't able to be detected by hammer test which only can evaluate surface hardness. Therefore, more than one NDT should be used to check the uniformity of SCC because hammer test is only able to detect the condition of material surface.

5. Conclusion

This research investigate the investigate the homogeneity of SCC in full scale beam-column structure using non-destructive testing (hammer test). According to NDT, there are no significant differences in uniformity on structures between SCC and NC. During structural testing, maximum load of NC and SCC in lower reinforcement ratio are almost similar, indicating good placement of SCC. In higher reinforcement ratio the SCC aren't able to reach the maximum load as NC due to early failure occurred in column showing non-homogeneity occurred in column which is not detected by hammer test, which only enables to detect the surface hardness.

Acknowledgement

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The Contribution of Soil Management Strategies to Plant and Soil Physical Health, and Soil Microbial Community

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Abstract

Soil-borne plant disease incidence in tropical (including subtropical) soils are caused by many factors, and often involve an environment conducive to an increase in pathogenic organisms. A case study was conducted on a field trial in the Bundaberg region of subtropical QLD, to take a snap-shot of the effect of soil management strategies on plant and soil physical health, and soil biological properties. Soils were collected from three different farming systems (conventional tillage; minimum tillage with crop residue; minimum tillage with crop residue and covered with white plastic mulch). The 797 capsicum plants were scored visually based on symptoms of pathogenic root rot disorder and were scored as 'healthy,' 'sick,' and 'dead'. The results show that the numbers of sick and dead plants and soil compaction level were significantly higher across all conventional tillage treatments. Conversely, higher numbers of healthy plants, lower level of soil compaction, as well as higher soil microbial community were found in minimum tillage treatments. The finding emphasis that soil disturbance resulted from frequent tillage practices was the key factor contributing to the incidence of soil-borne plant disease.

Keywords: Soil management strategies, plant and soil physical health, microbial community

1. Introduction

Frequent tillage operation has been recognized to impair soil health by accelerating decomposition of soil organic matter (SOM) and therefore degrade soil structure, increasing the risk of soil compaction (Roscoe & Buurman, 2003).Instead, a growing number of farmers in many parts of the world are implementing reduced tillage system. Minimum tillage practices which are also known as conservation tillage systems (Bailey & Lazarovits, 2003) refer to the soil management strategy that minimise the use of tillage operations whilst leaving at least 30% of the soil surface covered with a crop residue following planting operations (Bailey & Lazarovits, 2003; Hobbs, Sayre, & Gupta, 2008). The benefits of adopting these systems include conserving energy requirement for bed preparation; maintaining higher SOM and soil moisture; preventing soil erosion, due to stabilizing effects of plant residue in the top-soil layer; enhancing soil carbon sequestration; and an accompanying increase in microbial biomass and activity (Govaerts et al., 2008; Hobbs et al., 2008; Pankhurst, McDonald, Hawke, & Kirkby, 2002).

The use of minimum tillage in tropical and subtropical regions can, however, have adverse implications for soil health. According to Botta, Tolon-Becerra, Lastra-Bravo, and Tourn (2010), soil compaction can occur on planting beds with continuous no till or minimum tillage, which is associated with climatic factors. Higher temperature and heavy rainfall throughout the year can produce consecutive drying-wetting cycles in the soil, and thus affect soil physical conditions (Ogle, Breidt, & Paustian, 2005; Six et al., 2002). Six et al. (2002) pointed out that a rapid alternation of wetting and drying can disrupt soil structure and detach the aggregates into small particles.

Little attention has, however, been given to the effects of reduced tillage farming systems in subtropical and tropical regions on population dynamics of microorganisms involved in soil-borne diseases. Changes in soil compaction is likely to induce changes in microbial community structure and function. The present study, therefore,aimed at evaluating the impact of different farming systems on plant health and soil physical, and biological

characteristics. Assessing the changes in soil characteristics, and plant health status, in conventional tillage and minimal tillage systems under field conditions would provide valuable baseline information on which further studies examining soil health in subtropical conditions could be based.

2. Materials and Methods

A field trial established in September 2011 in a randomized block design with a factorial arrangement at the Queensland Department of Agriculture and Fisheries Research Station, Bundaberg, Queensland (24°51.171´S, 152°24.200´E), Australia, was used for data collection. Planting beds established in the trial had an area of 18.875 m^2 (11.25 m long x 1.5 m wide)and were subjected to two treatments in combination.The first treatment level was soil management strategy: conventional tillage (CON); minimum tillage blanketed with sorghum-soybean trash residue mulch (NMR); and minimum tillage blanketed with sorghum-soybean trash and covered with white plastic film mulch (NMP). The second treatment level was nematicide addition: with no Fenamiphos addition (N) and with Fenamiphos addition (Y). Each treatment combination had four replications. All beds were grown with capsicum in a first planting season (September 2011), and then followed by the same crop in the second planting season (February 2012).

Assessments were subjected to plant health condition; soil physical and soil microbialcharacteristics. Plant health condition was assessed by investigating plants in each plot (and treatment). The plantswere scored as 'healthy' (meaning visibly healthy), 'sick' (wilted/yellowed – indicating onset of root disturbance caused by fungal-wilt disorders) and 'dead' (wilted plants where vegetation was desiccated and plants could be broken with ease). The proportion of healthy, sick and dead plants within each plot or treatment were recorded.Soil physical characteristic was analyzed by measuring soil bulk density. Soil bulk density was determined using the core method (Blake 1965) after collecting soil samples using a metal corer with 8 cm diameter and 15 cm length. Soil samples were collected in between the rhizospheres of two plants per plot, per treatment, thus 18 samples were collected from the field trial and taken to the laboratory (three replicates per treatment, one per plot). Meanwhile, within each soil management treatment, 0-15 cm soil samples were collected from three points surrounding the rhizosphere of three capsicum plants for soil microbial assessment. All soil samples within a treatment and plots were bulked to form one composite sample for a healthy, sick and dead plant. A composite of the nine individual soil samples was collected from three points of the rhizospheres of three plants in each plot and bulked by treatment and plant health status.

Three sub-samples were taken from each for plate count. For plate count analysis, 10 grams of air dry soil from each treatment was suspended in a 100 mL of a sterile sodium (NaCl) solution (0.85%, w/v). The suspension was shaken using a rotary shaker at 200 rpm for 1 h at an ambient temperature of 25 ^{0}C and then settled for 11 h before diluting to 100- and 1000-fold to be used for inoculation.For plate inoculation by the bacterial community, a 0.1 mL of 1000-fold diluted solutions from each treatment was inoculated on the top of plate count agar (PCA) media and incubated in the dark at 30 ^{0}C for 72 h, whilst for fungi, sabouraud dextrose agar (SDA) media was used which had been added with 0.1 g streptomycin and 0.015 g tetracycline per litre agar media prior to inoculation process in order to inhibit bacterial growth. The fungal inoculated media were then incubated in the dark at 26 ^{0}C for 5 days. The number of bacteria and fungi appearing on the surface of each plate was counted for calculation of bacterial and fungal community. Bacterial and fungal colony was counted in CFU (coloni forming unit) per gram soil by multiplying the number of colony

grown on the media with soil weight, dilution inverse and 10 (CFU per gram soil = *Count x [ideal soil weight/actual soil weight] x dilution inverse x 10*).

The data collected were then statisticallyanalyzed. An Analysis of Variance (ANOVA) was used to assess differences in plant health in each treatment across all rows in the field trial; the effect of farming system on the bulk density of soil samples collected; as well as the effect of farming system and nematicide treatment on bacterial and fungal CFU.

3. Results and Discussion

This research was aimed at evaluating whether plant health condition, soil physicaland biological characteristics were affected by soil management treatments. Because nematodes can be both abundant and pathogenic in the capsicum growing region of Bundaberg, it wasnecessary to determine how soil attributes and plant health status differed when nematicide was applied.

3.1. Plant health condition as affected by soil management strategies

There were no significant differences in the number of healthy, sick or dead plants between nematicide treatments. Only the main effect of soil management strategies was significant (healthy: $F_{(2,23)} = 12.41$; $p = 0.0004$; sick: $F_{(2,23)} = 17.81$, $p = 0.0001$; dead: $F_{(2,23)} = 10.01$, $p = 0.0012$). A significantly lower mean number of healthy plants were found in the conventional tillage treatment (**Figure 1**). Further, significantly higher mean numbers of sick and dead plants were found in the conventional tillage treatment (almost a 50% increase on minimal-till systems). This study confirmed that nematicide treatment did not correspond with

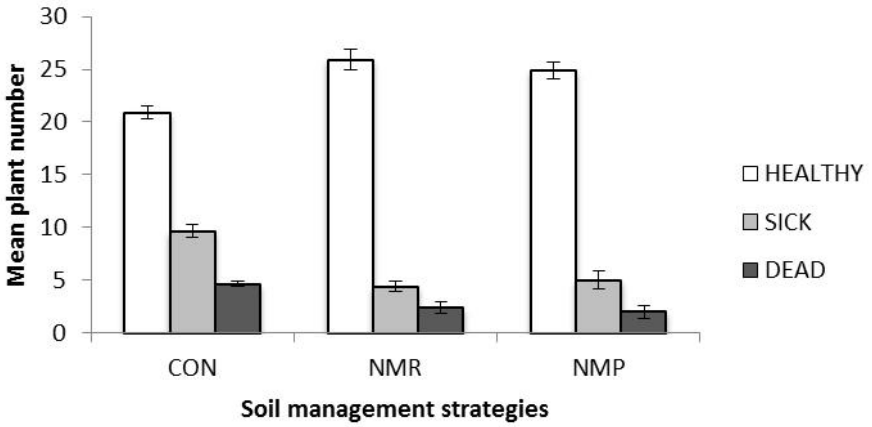

Figure 1. **Mean capsicum plant condition counts in three soil management strategies (CON = conventional permanent bed; NMR = minimal tillage with incorporated residue; NMP = minimal tillage with incorporated residue covered with white plastic). Values are means ± S.E. (n=4).**

symptoms of disease exhibited by plants - therefore the disease was probably caused by soil-borne bacteria or fungi.

The visual impacts of disease were evident where more sick plants were found in conventional tillage treatment (12% more) than in minimal tillage treatments. There were no significant differences among the number of sick plants that were detected between the two minimum tillage treatments with and without plastic mulch, indicating that conventional tillage was the factor that drove the pattern in the incidence of plant disease.

A higher incidence and severity of soil-borne fungal diseases in conventional tillage management systems often indicates that the farming system had promoted the activity of

soil-borne fungal pathogens (Liu, Tu, Hu, Gumpertz, & Ristaino, 2007; Pankhurst et al., 2002; Stirling, 2008). When assessing organic, sustainable and conventional farming systems' effects on the onset of Southern blight plant disease caused by *Sclerotiumrolfsii*, Liu et al. (2007) have found that the disease incidence was higher in conventional farming systems than in organic and sustainable farming systems. Similarly, Pankhurst et al. (2002) in determining the effects of different farming systems on cereal root rot diseases caused by *Gaeumannomycesgraminis* var. *tritici* (Ggt) and *Rhizoctoniasolani*, have found that higher disease incidence was in conventional farming systems with intensive tillage compared with farming system with direct-drilling prior to sowing and residue retention. They assume that high disease incidence under conventional management was related to the low soil organic carbon content and activity of soil microbial communities in the soil.

3.2. Soil physical characteristic as affected by soil management strategies

Bulk density responded significantly to different soil management strategies ($F_{(2,17)}$ = 26.46, p = 0.000, respectively). The bulk density of soil under conventional tillage was significantly higher at 1.22 g cm^{-3} than the soils in minimum tillage systems with or without plastic mulch (1.07 g cm^{-3} and 1.05 g cm^{-3}, respectively) (**Figure 2**). This indicates that a greater degree of 'compaction' was associated with conventional tillage management across the site.

Bulk density results obtained in this study indicate that conventional tillage management was associated with poorer soil physical health. Yet, the study clearly found that the level of compaction was significantly lower in minimum tillage management with and without plastic mulch than in conventional tillage management, six months after the trial was set up. It was presumably related to the intensive tillage used in conventional farming systems, which when adopted in tropical and subtropical regions that have high rainfall tend to enhance the vulnerability of soil structure to destruction (Six, Elliott, & Paustian, 1999) and extend soil erosion and runoff if applied on sloping lands (Govaerts et al., 2008).

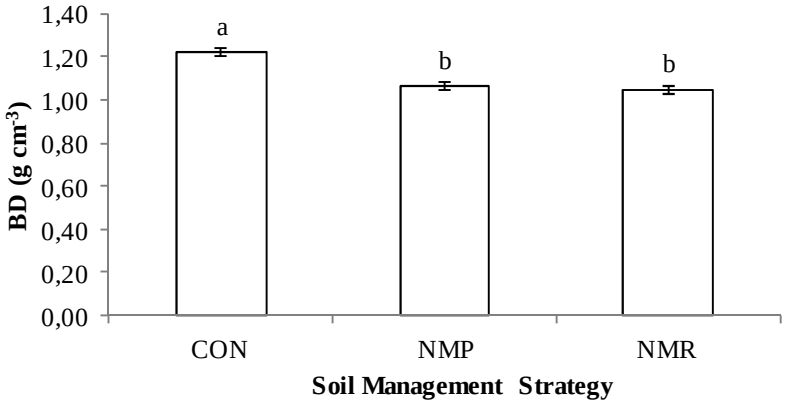

Figure 2. Soil bulk density (g cm^{-3}) under different soil management strategies (values are means ± S.E (n = 6)). CON = conventional tillage; NMP = minimum tillage with plastic mulch; NMP = minimum tillage with residue retention.

3.3. Soil microbial characteristics under different soil management strategies

This study revealed that bacterial sizewas significantly affected by the interaction between soil management treatment, nematicide treatment and plant health status respectively. It can be described from the data of plateablebacterial CFU presented in **Table 1** that higher

bacterial CFU were found in soils taken from dead plant rhizospheres where the soils were minimally tilled with residue cover and treated with nematicide. This notified that increased bacterial community size in soil was associated with the interaction between minimum tillage with residue cover treatment, nematicide application and dead plant condition. Meanwhile, lower bacterial CFU that were found in soils from dead plant rhizospheres treated conventionally and nematicide application, confirming that the decline in bacterial community size was associated with the interaction between the three factors.

Table 1. **Bacterial and fungal community mean size in soil under different soil management strategies (CON = conventional tillage; NMP = minimum tillage with plastic mulch; NMP = minimum tillage with residue retention), nematicide treatment (N= no nematicide treatment; Y= nematicide applied) and plant health status (Healthy; Sick; Dead). Different letters on the top right side of the numbers indicate significant differences (P<0.05) according to Tukey pairwise comparisons.**

Soil management strategies + Nematicide treatment	Plant health status	Community size (x 10^6 CFU g^{-1})		Bacterial : fungal ratios
		Bacteria	Fungi	
CON N	Healthy	1.9^{defg}	0.04^{ab}	87 : 1
	Sick	1.4^{fgh}	0.02^{ab}	64 : 1
	Dead	1.0^{gh}	0.04^{ab}	26 : 1
CON Y	Healthy	1.4^{fgh}	0.02^{ab}	107 : 1
	Sick	1.7^{efgh}	0.03^{ab}	65: 1
	Dead	0.9^{h}	0.02^{ab}	60 : 1
NMP N	Healthy	3.0^{abc}	0.05^{ab}	76 : 1
	Sick	3.1^{abc}	0.05^{ab}	74 : 1
	Dead	2.4^{cde}	0.01^{b}	198 : 1
NMP Y	Healthy	2.3^{cde}	0.05^{ab}	51 : 1
	Sick	2.8^{abcd}	0.05^{ab}	56 : 1
	Dead	2.3^{cdef}	0.01^{b}	229 : 1
NMR N	Healthy	2.5^{cde}	0.03^{ab}	131 : 1
	Sick	3.6^{ab}	0.04^{ab}	98 : 1
	Dead	2.3^{cdef}	0.02^{ab}	178 : 1
NMR Y	Healthy	2.7^{bcd}	0.03^{ab}	145 : 1
	Sick	2.6^{cde}	0.06^{a}	45 : 1
	Dead	3.7^{a}	0.03^{ab}	150 : 1

Plateable total fungal CFU was significantly affected by the interaction between soil management strategies and plant health status. This was seen in the higher mean size of total plateable fungi in soils from sick plant rhizosphere and the lower mean size of total plateable fungi in soils from dead plant rhizosphere in which both were found in minimum tillage treatment (**Table 1**). There was no significant effect of nematicide treatment, either as the main factor or in its interaction with soil management strategies and plant health condition, on the size of fungal community. Evidence can be seen in **Table 1** where total plateable fungal CFU were higher in soils from sick plant rhizospheres treated with minimal tillage and with nematicide application, but lower in soils from dead plant rhizospheres in minimum tillage treatment without the application of nematicide.

The present study found that different farming management systems in combination with nematicide application may trigger changes in the size of bacterial community and total fungalcommunity; as well as bacterial-fungal ratios, thereby having impact on plant health ondition. Interestingly, different responses were shown by bacterial communities which were higher in some tillage treatment in combination with nematicide application and lower in the treatment combination with no nematicide treatment. Unfortunately, this snap-shot study had only collected the data at harvesting time period, so that it is difficult to determine that the presence of nematicide did or did not harm bacterial community. It can only be noted from the present study that higher bacterial size occurred in minimum tillage treatment in combination with nematicide and lower in conventional tillage treatment without nematicide application indicating that nematicide application can probably be beneficial for bacterial communities only if it was in the combination with minimum tillage treatment. Meanwhile, without nematicide treatment under conventional tillage, bacterial communities were low confirming that tillage was the main factor for bacterial community changes.

The size of total detectable fungal community in soil may also shift as a consequence of different tillage practises in combination with plant health condition. In contrast to bacterial communities, total fungal communities were not significantly affected by the interaction between soil management strategies and nematicide. However, it does not mean that there were no changes in fungal CFU following changes of farming systems. According to Shannon, Sen, and Johnson (2002), differences in microbial community under different farming systems can be subtle rather than dramatic. Higher number of total fungal CFU under sick plants showed that there was a fungal disease killing the plant. Further, as plateable fungi are all that can be detected with plate counts, it might be possible that the causal fungal agents (if any) are not plateable using ubiquitous laboratory media.

4. Conclusion

The results of the study suggest that mechanical disturbance from conventional tillage management may have exposed soils in the conventional treatment to structural degradation in the form of higher soil compaction, and hence a greater onset of disease. In contrast, minimum tillage resulting in lack of disturbance appears to have helped conserve soil organic carbon and organic matter and therefore protected soil from compaction. An understanding of the relationships between compaction, soil organic matter and carbon, and microbial diversity and activity could, therefore, be important in improving understanding of compaction and disease relationships in subtropical and tropical cropping systems.

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Effectiveness of Goat Milk Yogurt Starter Against Various levels of HDL, LDL and Triglycerides in male white rats (*Rattus norvegicus Wistar strain*)

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Abstract

Natural ingredients that can lower cholesterol in the body is a yogurt drink. Yoghurt goat milk is goat's milk fermented with lactic acid bacteria, particularly *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. The study aims to determine the effectiveness of goat's milk yoghurt with different types of starters on levels of HDL, LDL and triglycerides in male white rats (*Rattus norvegicus Wistar strain*).
The design of this research is true experimental with using post test only control group. The method used a completely randomized design with four groups: placebo control group, the group with starter *Lactobacillus Bulgaricus*, *Streptoccocus thermophilus*, and Mixed (*Lactobacillus Bulgaricus* with *Streptoccocus thermophilus*). Giving yogurt ad-lib. The observed variables include the levels of HDL, LDL and triglyceride blood of male rats (*Rattus novergicus Wistar* strain). Analysis of data using one way ANOVA test and LSD test.
The results showed that levels of HDL, LDL and triglycerides were significantly different. Conclusion goat milk yogurt with mixed starter of *Lactobacillus bulgaricus* and *streptococcus thermopilus* more effective than yogurt with only once starter. Recomendation in order to maintain health can take advantage of goat milk yogurt as a healthy beverage.

Keywords: Goat's milk yogurt, levels of HDL, LDL and Triglycerides

1. Introduction

Major public health problem today due to change unhealthy lifestyle is characterized by a high prevalence of non-communicable diseases (NCDs) and this is not only in Indonesia but also globally. According to the Ministry of Health (2007) and the World Health Organization (WHO) (2009), non-communicable diseases (NCDs) become the main cause of death globally. One of the PTM is cardiovascular as a result of high cholesterol levels or abnormal lipid levels (Thomas and S, Singh, 2014). Various types of synthetic drugs used in medicine for example for lowering koleserol with drug gemfibrozi, fenofibrate and bezafibrat from the group of acid fibrates that are usually used in patients hiperlipoproteinemia type III and hypertriglyceridemia severe side effects gastrointestinal disturbances such as nausea, diarrhea, flatulence, and other - others. Class of drugs such as cholestyramine and colestipol resins commonly used in patients with hypercholesterolemia, also give side effects such as nausea, vomiting, and constipation

Therefore, it is necessary to find an alternative treatment, especially from natural sources that are safer, does not have efeksamping and effective for use in the treatment of hiperkolesetrolemia namely by using fermented goat milk (yogurt). Goat milk is processed fermented yoghurt made has advantages compared with fresh goat milk. Several hypotheses about the decreased levels of cholesterol by Lactobacillus bacteria, namely: 1) the cholesterol that is in kimus eaten by bacteria, so that cholesterol is absorbed by the gastrointestinal tract decreases. 2) cholesterol can be bound to the bacterial cell surface or incorporated into the bacterial cell membrane or in convection becomes coprostanol by cholesterol reductase produced by a strain of Lactobacillus. 3) inhibited the formation of micelles by probiotik.Bakteri Lactobacillus strains can produce ferulic acid (FA), which can inhibit HMG-CoA reductase and sterol secrete acid, so that blood cholesterol levels can be decreased. (Duchesneau, et al. 2014).

Yogurt is a probiotic product. capable of providing a beneficial effect on health when consumed in sufficient quantities (Muhammadshahi, et al, 2014). This makes

researchers are interested to know the effectiveness of goat's milk yoghurt starter against the various levels of uric acid, total cholesterol and blood glucose in male white rats (Rattus norvegicus Wistar strain).

2. Results and Discussion

2.1 The Concentration HDL Results

Mean HDL levels at observation day to 31 male rats (*Rattus norvegicus Wistar* strain) is presented in Table 1.

Table 1. Average of HDL levels

Treatment	Average concentration of HDL
Placebo group / water	8,29[a]
Group of goat's milk yoghurt with Lactobacillus bulgaricus starter	9,29[a]
Group of goat's milk yoghurt starter streptococcus thermophiles	9,79[b]
Group of goat milk yoghurt with Lactobacillus bulgaricus starter mix and Streptococus thermophiles	10,06[c]

Note: Different letters in one column show significant differences

The results of LSD test showed that the placebo group (water) was not significantly different from the treatment stater *Lactobacillus*, significantly different from *Streptococcus*, and the mixture (*Lactobacillus* and *Streptococcus*) .Group of placebo (water) have the lowest HDL compared to the treatment group, namely *Lactobacillus, Streptococcus* and mix (*Lactobacillus* and *Streptococcus*). The highest concentration of HDL obtained in Ussu goat yogurt treatment with a mixture of *Lactobacillus* and *Streptococcus* starters. The results of this study together with the results of research and Rustanti Sayekti (2013), as well as the results of research and Nuryanto and Naufalina (2015) is yogurt koro sword can also increase HDL cholesterol levels HDL.Increasing is due to saturated fatty acids in yogurt increases the secretion of apo A-1 from hepatocytes, increases the rate of transport of apo A-1, increasing the HDL particle size, and decrease the rate of catabolism fraction of apo A-1. Increasing the number and the rate of transport of HDL may be the mechanism of adaptation to the amount of cholesterol in darah.12,13 main fatty acid content increases HDL cholesterol levels are lauric acid, stearic, myristic, and palmitic and oleic unsaturated fatty acids.

2.2 The concentration of LDL Results

The mean levels of LDL in the observation of the day to 31 male rats (*Rattus norvegicus Wistar* strain) is presented in Table 2.

Table 2. Average of LDL Levels

Treatment	Average concentration of HDL
Placebo group / water	96,64[a]
Group of goat's milk yoghurt with *Lactobacillus bulgaricus* starter	63,99[b]
Group of goat's milk yoghurt starter *Streptococcus thermophiles*	65,76[b]
Group of goat milk yoghurt with *Lactobacillus bulgaricus* starter mix and *Streptococus thermophiles*	67,31[b]

Note: Different letters in one column show significant differences

The results of LSD test showed that the placebo group (water) was significantly different from the treatment stater Lactobacillus, significantly different from Streptococcus,

and the mixture (*Lactobacillus* and *Streptococcus*) .. The treatment of placebo (water) had LDL levels higher than those in other treatments, namely *Lactobacillus, Streptococcus* and mix (*Lactobacillus* and *Streptococcus*). Lowest LDL levels obtained in the treatment Ussu goat yogurt with Lactobacillus bulgaricus starter. The results of this study together with the results of research Towil and Pramod (2015), ie non-fat yogurt plus sinbiotik inulin from potato flour can lower LDL cholesterol significantly in mice with hypercholesterolemia. The decrease is due during the fermentation process koro sword with lactic acid bacteria helps prevent the increase in LDL cholesterol with β-glucosidase enzyme produced in large numbers. These enzymes hydrolyze into aglycone isoflavones and saponins. A compound free of aglycone isoflavones and saponins higher activity in preventing the increase in LDL cholesterol

3. Concentration Triglycerides Results

Mean triglycerides on the observation day to 31 male rats (*Rattus norvegicus Wistar* strain) is presented in Table 3.

Table 3. Average of Triglyceride Levels

Treatment	**Average concentration of Triglyceride**
Placebo group / water	96,83[a]
Group of goat's milk yoghurt with *Lactobacillus bulgaricus* starter	60,83[b]
Group of goat's milk yoghurt starter *Streptococcus thermophiles*	45,66[c]
Group of goat milk yoghurt with *Lactobacillus bulgaricus* starter mix and *Streptococus thermophiles*	41,66[c]

Note: Different letters in one column show significant differences

The results of LSD test showed that the placebo group (water) was significantly different from the treatment stater *Lactobacillus*, significantly different from *Streptococcus*, and the mixture (*Lactobacillus* and *Streptococcus*) .. Triglycerides treatment of placebo (water) had higher levels than those in other treatments, namely *Lactobacillus, Streptococcus* and mixture (*Lactobacillus* and *Streptococcus*). Triglyceride levels streptococcus thermophilus starter equal treatment by treatment with a mixed starter. The results of this study together with the results of Pramesti and Kartasurya (2015) that administration of red bean yoghurt 225 ml / day for 15 days lowered triglycerides pre-menopausal women with dislipidemia.This is caused by bacteria fermented probiotic caused short chain fatty acids such as propionic acid. Propionic acid can lower triglyceride levels by inhibiting the lipogenesis in the liver, it can cause a decrease in fatty acid synthesis. Fatty acids are the raw material for making triglycerides.

4. Conclusions and Recommendations

Based on the results and discussion of this study, it can be concluded as follows:

1. Yoghurt goat milk is effective in lowering the levels of LDL and triglycerides in male white rats (*Rattus norvegicus Wistar* strain).
2. Yogurt goat milk is effective in improving blood HDL levels in male white rats (*Rattus norvegicus Wistar* strain).
3. Overview of hematology there are significant differences between the three treatment groups with placebo

4. Goat milk yoghurt with starter mixture of *Lactobacillus bulgaricus* and*streptococcus thermopilus* more effective than a single starter yogurt.

The recommendation of the results of this study are:

1. In order to maintain health can take advantage of goat milk yogurt as a healthy beverage.
2. Making goat milk yogurt starter should use a combination of *Lactobacillus bulgaricus* with *streptococcus thermopilus* because it gives better effect on health.
3. Need to continue studies in humans with the same variable and expandable

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Adsorption of Free Fatty Acid from Crude Palm Oil on Natural Zeolite Activated with Sodium Hydroxide

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Abstract

Free fatty acid with high value can decrease the quality of crude palm oil, therefore the free fatty acid value should be reduced to increase its quality. The aim of this research is to investigate the performance of natural zeolite activated with sodium hydroxide in adsorption of free fatty acid from crude palm oil. Adsorption of free fatty acid on activated natural zeolite has been studied with various concentrations of sodium hydroxide (0, 0.25, 0.50, 0.75, 1.00, 1.25 and 1.50 M), zeolite sizes (150 and 200 µm), and adsorption temperatures (27, 50, 70 ˚C). Experimental results were analyzed using pseudo first order and pseudo second order kinetics models. The result showed optimum value of free fatty acid adsorbed was obtained by natural zeolite activated with sodium hydroxide 0.75 M and kinetics data fit the pseudo second order model for each zeolite size and adsorption temperature. The value of free fatty acid removal rises as the temperature increases and smallerzeolite size. The optimum value of free fatty acid removal is 57.79 % obtained from adsorption using natural zeolite size 150 µm, activated with sodium hydroxide 0.75 M, at 70 ˚C.

Keywords: Adsorption, Free fatty acids, Crude palm oil, Natural zeolite, Sodium hydroxide

1. Introduction

Crude Palm Oil (CPO) is obtained as a result of the extraction process of oil palm fruits mesokrap fibers. The reddish orange color in CPO emerges as the result of the high value carotenoid compounds in CPO. In addition, there are nutritional and macro nutrients that are beneficial to human health, subsequently CPO is widely used in food and pharmaceutical industries (Boonie and Choo, 2000; Joy et al., 2007).Not only contains useful components, but CPO also contains undesirable impurities such as free fatty acids (FFA). High value FFA can cause unpleasant odor, consequently it can't be used in food industry (Gunstone, 1997). The presence of high value FFA in CPO can cause disturbance in the application of CPO as a raw material for biodiesel production(Clowutimon et al., 2011).

There are many methods to reduce the value of FFA in vegetable oil, such as distillation, extraction, crystallization, neutralization, and adsorption. The neutralization method has a fairly high efficiency value but it may trigger the formation of soap, and it can reduce the oil recovery value (Young, 1981; Aryusuk et al., 2008; Goncalves et al ., 2016). Adsorption method becomes a fairly efficient and economical solution to decrease the value of FFA in vegetable oil(Maddikeri et al., 2012). Adsorption of FFA from vegetable oil has been done using various types of adsorbents, such as ion-exchange resins (Maddikeri et al., 2012), iron oxide nanoparticles (Cano et al., 2012), diatomaceous soils, activated carbon, silica, and magnesium silicate (Manuale et al., 2013; Clowutimon et al., 2011).

Natural zeolite is a crystalline alkaline aluminosilicate and crystalline alkaline earth with a tetrahedral framework of AlO4- and SiO4 three dimensions. The general formula of the zeolite molecule is $M_{n/2}O$ [(Al_2O_3) (SiO_2) x] yH_2O, where M is an alkali or alkali metal with valence n. Natural zeolites are widely used in industry and agriculture, such as animal feed supplements, soil improvers, ion exchange agents, adsorbents, catalysts and contaminated water purifiers (Gerrard et al., 2004; Rao et al., 2006). The impurities in the natural zeolite can inhibit the application of zeolites, subsequently zeolite requires activation treatment to remove its impurities, and increases the ability of natural zeolite as an adsorbent. Zeolite activation treatments may be carried out chemically using strong acid solutions such as HCl

(Ozkan and Ulku, 2005) or using strong base solutions such as NaOH (Jozefaciuk and Bowanko, 2002; Inglezakis et al., 2001).

In this study, adsorption of FFA from CPO was done by using zeolite activated with NaOH as an adsorbent. The effect of NaOH concentration for zeolite activation, the effect of zeolite size and adsorption process temperaturewere studied to determine the performance of zeolite as an adsorbent to adsorb FFA from CPO. This study used the first order pseudo kinetics model and second order pseudo to analyze the adsorption kinetics.

2. Materials and methods

2.1 Materials

Crude Palm Oil (CPO) is obtained from one of the palm oil processing companies in Rokan Hilir area, Riau, Indonesia (FFA content = 5.23%). Natural zeolite is obtained from Klaten, Central Java, Indonesia. Chemicals; ethanol and phenolphthalein were obtained from Merck.

2.2 Characterization methods

The zeolite surface area was determined by the Brunauer-Emmett-Teller (BET) method using the Quantachrome NovaWin instrument. Fourier transform infrared spectroscopy (FTIR) spectrum of natural zeolite before and after adsorption was analyzed at wave number (4000 - 400 cm^{-1}) with Shimadzu FTIR spectrometer FT-IR 8201.

2.3 Sample preparation, analysis and adsorption experiments

Natural zeolite was soaked in aquadest and stirred for 24 hours. The zeolite solid was separated from aquades containing impurities, and then dried with an oven at 100 ° C for 24 hours. Furthermore, the natural zeolite was crushed and sieved to obtain zeolites 150 µm and 200 µm. Uniformed natural zeolites were activated by immersing 200 grams of zeolite in 500 ml of NaOH solution with various concentrations (0, 0.25, 0.50, 0.75, 1.00, 1.25 and 1.50 M) and stirred for 24 hours at 100 rpm. Each activated natural zeolite was washed with aquadest to neutral (pH = 7), then dried with an oven at 100 ° C.

Determination of the effect of NaOH concentration in zeolite activation was done by mixing 25% ($w_{zeolite}/w_{mixture}$)of each 150 µm NaOH-activated zeolite with CPO in vial bottle at 25 ° C, and shook at 100 rpm for 24 hour. After adsorption, CPO and zeolite were separated by centrifugation. The residual FFA value in the CPO was analyzed by standard titration method (Pasias et al., 2006).

Determination of the effect of zeolite size and adsorption process temperature were done by mixing 25% ($w_{zeolite}/w_{mixture}$) of natural zeolite (150 µm) without activation and optimum concentration of NaOH-activated natural zeolite (150 µm or 200 µm) with CPO in a round bottom flask at various temperatures (25 ° C, 50 ° C, or 70 ° C) and stirred at 500 rpm using a temperature controlled magnetic stirrer for 3 hours. Several samples were taken every 15 minutes,afterwards the CPO and zeolite from the sample were separated by centrifugation. The residual FFA value in the CPO was analyzed by standard titration method (Pasias et al., 2006).

The residual FFA value in the CPO was determined by equation (1), and the FFA removal value from CPO was determined by equation (2):

$$C = \frac{V_{NaOH} \cdot [NaOH] \cdot MW_{PA}}{m_S} \quad (1)$$

FFA removal (%) = $\frac{(C_0 - C_t)}{C_0}$ x 100 (2)

where V_{NaOH} = NaOH consumption (mL); [NaOH] = concentration of NaOH solution (mol/L); MW_{PA} = molecular weight of palmitic acid (g/mol); m_s = sample weight (g); C_0 and C_t (mg/g) are free fatty acid concentration at initial and time t.

Two kinetics models, pseudo first order and pseudo second order were investigated in order to evaluate adsorption process.

3. Results and Discussion

3.1 Characterization Results

The BET surface area of natural zeolite without activation and after activation were determined to be 30.270 m^2/g and 60.323 m^2/g respectively.The FTIR spectrum (Figure 1) was obtained from zeolite before and after FFA adsorption from CPO to review the fatty acids adsorbed on zeolite. The absorption peaks of the zeolite were seen at wave numbers 1064.71 cm^{-1} (stretching asymmetric T-O), at 694.37 cm^{-1} and 794.67 cm^{-1} (stretching symmetric Si-O-Al and T-O-T), and at 455.20 cm^{-1}(T-O bend) (Flanigen et al., 1971). Zeolite that had adsorbed fatty acids showed new absorption peak, seen at wave numbers 1743.65 cm^{-1}indicating stretching C=O (Zhang et al., 2006; Diaz & Brito, 2014). The absorption peaks at wave numbers 2924.09 $cm^{-1}$and 2854.65 cm^{-1}showed asymmetric and symmetrical stretching of CH_2 (Ilgen & Dulger, 2016). The absorption peaks obtained were similar tothe study of Sadic et al.(2010), it adsorbed oleic acid using calcium, magnesium, barium, zinc, and aluminum silicate, where the absorption peaks at the wave number 2980-2850 cm-1 appeared in all silicates that had adsorbed oleic acid. In addition, the absorption peaks at wave numbers 1635.64 cm-1 and 1543.04 cm-1 indicated the occurrence of metal-fatty acidschemical bonds.

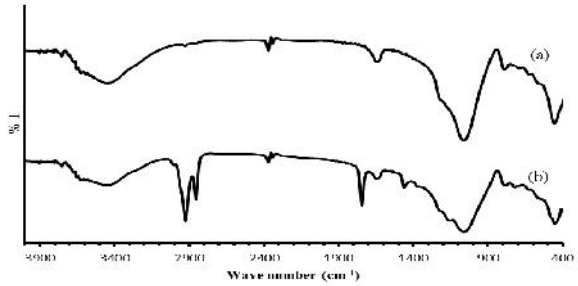

Figure 1.FTIR spectrum: (a) zeolite before adsorption, (b) zeolite after adsorption

3.2 The effect of NaOH concentration in zeolite activation

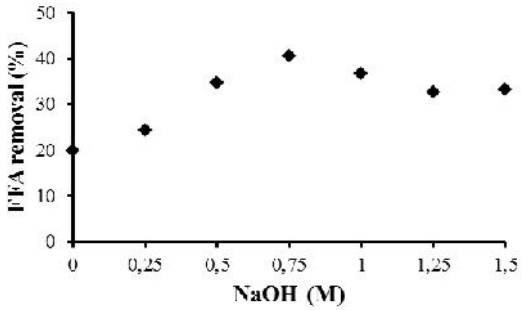

Figure 2.The effect of NaOH concentration in the zeolite activation towards FFA removal

Adsorption was carried out at room temperature for 24 hours to ensure the achievement of the adsorption equilibrium condition. From Figure 2, zeolite activated with NaOH0.75 M has the highest FFA adsorption capability. This may occur because inorganic impurities such as silica and aluminanon-framework that covering zeolite pores can be well-eliminated (Alfaro et al., 2007). Activation using NaOH with very high concentrations can damage the zeolite frame structure, because silica and alumina within the framework can be eliminated as well, it can disrupt the zeolite structure and decreasing its ability as an adsorbent (Jozefaciuk & Bowanko, 2002). Zeolite activated with NaOH 0.75 M was used to determine the effect of zeolite size and temperature in the adsorption process towards its ability to adsorb free fatty acid from CPO.

3.2 The effect of zeolite size and adsorption process temperature

Zeolite of 150 μm and 200 μm were selected to assume that the adsorption process is not affected by internal diffusion due to very small grain size, and to determine the differences in FFA removal value obtained from the various zeolite size. The conditionof 25 °C was chosen as the lowest temperature in this study to represent the adsorption capacity of FFA by zeolite at room temperature, the condition of 50 °C was chosen to represent the adsorption capacity of FFA by zeolite in industrial CPO storage, and the condition of 70° C was chosen as the highest temperature to avoid the possibility of desorption (Ilgen & Dulger, 2016).

From Figure 3, it can be seen that the ability of FFA adsorption by natural zeolite rises as the adsorption process temperature increases. This may occur because the increasing of the temperature can decrease the level of CPO viscosity, subsequently the zeolite iseasier to be dispersed and mixed evenly in the oil. The ability of the adsorbent to be evenly dispersed in the oil can increase its adsorption ability towards the oil impurities component (Sathievel & Prinyawiwatkul, 2004).

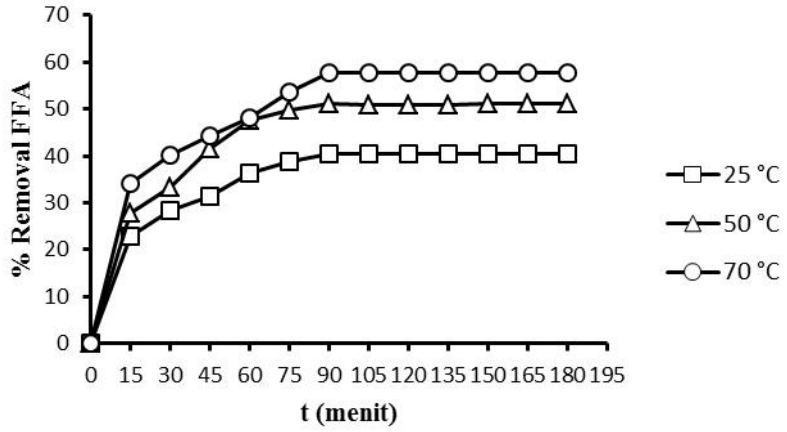

Figure 3.The effect of adsorption temperatures towards FFA removal

From Figure 4, it can be seen that activated zeolite (150 μm) has higher FFA adsorption ability compared to inactivated natural zeolites (150 μm). This occursbecause inactivated natural zeolite still contains more impurities compared to activated zeolite. Subsequently, activation treatment is important to be done in order to increase the zeolite adsorption ability. The adsorption ability of FFA by natural zeolite activated with NaOH of 150 μm and 200 μm does not show a great difference, but zeolite with smaller size has higher FFA removal values. As the adsorbent size becomes smaller, the surface area and dispersion

ability will be greater, subsequently adsorbate will be easier to interact with adsorbent. The maximum FFA removal achieved by each zeolite was, 28.63% for the inactivated zeolite (150 µm), 53.9% for zeolite activated with NaOH 0.75 M (200 µm) and 57.8% (150 µm) at 70 ° C.

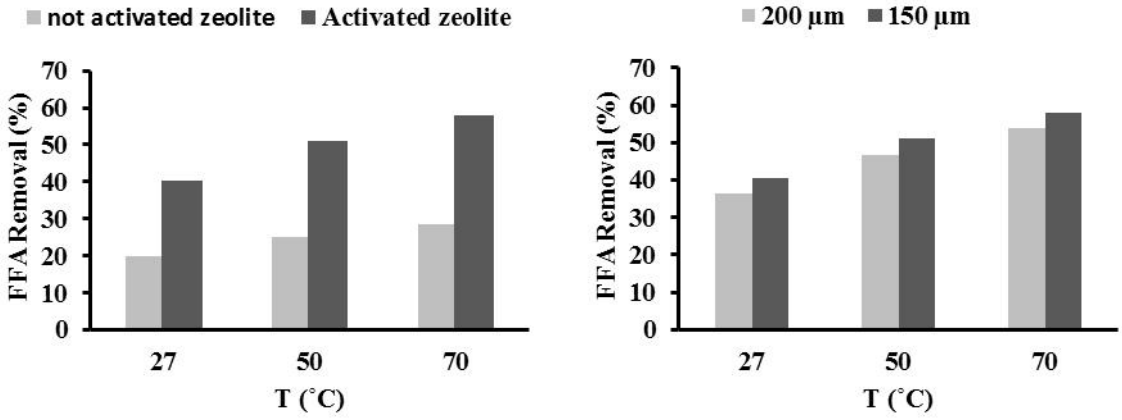

Figure 4.The Effect of the type and size of zeolite towards its ability to adsorb FFA

3.3 Adsorption kinetics

An analysis of adsorption kinetics data is performed using pseudo first and second order kinetic models. The linear equation of the pseudo first order model is expressed as follows (Lagergren, 1898):

$$\log (q_e - q_t) = \log q_e - \frac{k_1.t}{2.303} \quad (3)$$

where q_e (mg/g) and q_t(mg/g) are FFA adsorbed value at equilibrium and at t (min), k_1 (min^{-1}) is the pseudo first order model rate constant. The intercept and slope of the log ($q_e - q_t$) vs time respectively shows the values of q_e dan k_1.

The linear equation of the pseudo second order model is expressed as (Ho, 2006):

$$\frac{t}{q_t} = \frac{1}{k_2 . q_e^2} + \frac{t}{q_e} \quad (4)$$

where k_2 (g/mg.min) is the pseudo second order model rate constant.

Kinetic parameters such as q_e, k_1, and k_2 are presented in Table 1. The correlation coefficient (R^2) and q_e (cal.) values are used to test the validity of the kinetic model (Clowutimon et al., 2011; Maddikeri et al., 2012; Jamal et al., 2014; Ilgen & Dulger, 2016). The experimental results showed that the FFA adsorption process of CPO on each adsorbent follows the pseudo second order kinetic model for all temperature variations with the R^2 value close to 1. This means that the FFA adsorption process on zeolite starts rapidly and slows down as the time increases until it reaches the adsorption equilibrium condition (Ho, 2006).

Table 1. Kinetic parameters for adsorption free fatty acid on to natural zeolite

Natural Zeolite	Temp. (°C)	Pseudo-first order				Pseudo-second order		
		R^2	k_1 (min^{-1})	q_e-cal (mg/g)		R^2	k_2 (g/mg.min)	q_e-cal (mg/g)
Not activated	25	0.6564	0.0225	25.56		0.9468	0.0011	36.10
	50	0.7884	0.0225	37.63		0.9472	0.0008	46.29
	70	0.8197	0.0230	45.24		0.9203	0.0006	54.64
Activated (200 µm)	25	0.9074	0.0363	115.21		0.9488	0.0006	68.02
	50	0.8321	0.0479	255.97		0.9507	0.0005	84.03
	70	0.8373	0.0534	328.92		0.9747	0.0005	96.15
Activated (150 µm)	25	0.9424	0.0651	126.61		0.9945	0.0017	67.56
	50	0.9662	0.0683	168.07		0.9937	0.0013	85.47
	70	0.8917	00.0884	400.77		0.9932	0.0010	97.08

Several studies have observed the kinetics of the adsorption of fatty acids from different types of vegetable oil using various types of adsorbents, such as, Maddikeri et al. (2012) stated that the adsorption of oleic acid and stearate from sunflower oil on the resin followed the pseudo first order kinetics model. The results of Ilgen & Dulger (2016) showed that the adsorption of oleic acid in zeolite 13X followed the pseudo second order kinetics model with high temperature adsorption.

4. Conclusion

In this study, the ability of natural zeolite activated with NaOH to adsorb FFA from CPO has been investigated. Based on the results obtained, natural zeolite activation treatment with NaOH increases the ability of FFA adsorption. As the temperaturein the adsorption process rises, and the size of the adsorbent becomes smaller, the ability of FFA adsorption is also increasing. The results of the adsorption kinetics study showed that the FFA adsorption process in all zeolites used in this study followed the pseudo second order kinetics model. The optimum removal value of 57.8% was obtained from zeolite 150 µm activated with NaOH 0.75 M at adsorption temperature of 70 ° C.

Acknowledgement

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Hypoglycemic Effect of *Brucea javanica* (L) Merr Leaves and Seed Extract in Alloxan-induced Diabetic Rats

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Abstract

Brucea javanica (L) Merr is one of the local plants in Lombok Island that is traditionally used for diabetic medication. The purpose of this research was to evaluate the hypoglycemic effect of B. javanica (L) Merr leaves and seed extract in alloxan-induced diabetic rats. Diabetic condition was induced with an intravenal injection of 125 mg/kgBW alloxan monohydrate in the rats. After stable diabetic condition, the rats were treated with leaves methanol extract (LME) and seed methanol extract (SME) of B. javanica (L) Merr, with the dose of 50 mg/kgBW. Glibenclamide (0,25 mg/kgBW) was used as a reference drug. The treatments were performed daily for 15 days. Evaluation of hypoglycemic effect was conducted by estimating the fasting blood glucose level of the rats. The percentages of reducing blood glucose level of LME and SME were 13,19% and 84,31%, respectively, while Glibenclamide was 43,97%. Statistically, blood glucose reduction of LME and SME were not significantly different (P<0,05) comparing with positive control. SME with the dose of 50 mg/kgBW seems to be overdose in causing hypoglycemic to the rat. Histologycal studies indicated that LME improved the morphology of the islets of Langerhans and recovery β cells to secrete insulin.

Keywords: Hypoglycemic effect, Brucea javanica (L) Merr, alloxan, diabetic rats, histology pancreas

1. Introduction

Diabetes mellitus (DM) is a metabolism disorder that has become a global and serious disease with the death case of about 5.1 million people annually (Eid et al., 2014). According to the International Diabetes Federation (IDF), approximately 285 million people were suffer of DM in the world and it is estimated this number will increase to 438 million in 2030 (Chackrewarthy & Tahbrew, 2014). The treatments of DM are now still using synthetic drugs and insulin therapy, but it is relatively expensive and caused various side effects. Therefore, exploration of natural antidiabetic agents from plants is very important to be developed as alternative treatments that cheaper, more simple and less side effect (Osadebel et al, 2014).

About 400 plants and compounds are known to have antidiabetic activities in vivo or in vitro (Chang et al., 2013). One of the plants in Lombok Island that is known to have a high antidiabetic activity is *B. javanica* (L.) Merr. *B. javanica* (L.) Merr, locally called "*Makasar* or *Wali*", belongs to family Simaroubaceae and is known to have anticancer, antitumor, and antidiabetic activities (Ablat et al., 2014). Based on the empirical experience of the people at Sesaot Village (West Lombok, Indonesia), the seed of *B. javanica* (L.) Merr can significantly reduce the blood glucose level of the people who suffer of DM, while the leaves activities have not studied yet. This study was to evaluate the hypoglycaemic effect of *B. javanica* leaves and seed extract on alloxan-induced diabetic rats.

2. Materials and Methods

2. 1. Plants and animals

The plant materials were collected from the cultivated plants at Sesaot village, West Lombok, West Nusa Tenggara, Indonesia. The male rats Wistar strain (2-3 months) was purchased from Pharmacy Lab. of Udayana University, Bali, Indonesia.

2. 2. Preparation of Extract

B. javanica seed and leaves were air dried and extracted with methanol 96% for 3 x 24 hours. The extract was filtrated and evaporated with rotary evaporator. Crude extract of *B. javanica* seed [Seed methanol extract (SME)] and leaves [Leaves methanol extract (LME)] were then used for antidiabetic assay.

2. 3. Phytochemical Studies

The extracts were analyzed qualitatively for the following phytochemicals: alkaloid, flavonoid, terpenoid, steroid, tannin, and saponin according to the method describe by Harborne (1987).

2. 4. Antidiabetic Assay

A number of 30 tested animals were measured and randomly divided into five groups: Possitive control (K1), Negative control (K2), Normal control (K3), SME group (P1) and LME group (P2). K1, K2, P1, and P2 were induced by alloxan 125 mg/kgBW intravenal way, while K3 was uninduced. The diabetic animals of K1 were treated with glibenclamid 0,25 mg/kg BB; K2 was untreated; P1 was treated with SME 50 mg/kgBW daily; P2 was treated with LME 50 mg/kgBW daily. Blood glucose level of the fasting animals were measured every three days using GlucoDr^{TM} Test Meter (model: AGM-2100; Korea).

2. 5. Pancreas Hitologycal Observation

Pancreas histologycal observation was conducted at the end of the experimental period (day 15). Pancreas of the rats were isolated, fixed with 10% formalin, and stained with *Hematoxylin eosin* (HE) for observation of islet Langerhans morphology.

2. 6. Statistical Analysis

Statistically significant difference of hypoglycemic effect by ANOVA continued with LSD. Significance was set at $p<0.05$ for all tests.

3. Results and Discussion

3. 1. Phytochemical studies of *B. javanica*

The seed extract of *B. javanica* yield obtained from maceration process was 7,678%. Chemical constituents detected qualitatively in seed methanol extract (SME) and leaves methanol extract (LME) are shown in **Table 1**. Based on phytochemical screening, LME contains alkaloid, flavonoid, steroid, tannin and saponin with different intensity; while SME contains alkaloid, terpenoid, and tannin with a high intensity.

Ablat, *et al*., (2014) reported the same result that seed extract of *B. javanica* contains alkaloid, lignan, terpenoid, and quassinoid. Those compounds are responsible to the bioactivities of *B. javanica* seed extract as antidiabetes, antioxidant, and anticancer. The difference chemical compounds containing in LME and SME are terpenoid, steroid, and saponin. It may cause the different bioactivities of LME and SME.

Table 1. Chemical constituents of LME and SME

Chemical Constituent	Leaves Methanol Extract (LME)	Seed Methanol Extract (SME)
Alkaloid	++	+++
Flavonoid	+	-
Terpenoid	-	+++
Steroid	++	-
Tannin	+++	++
Saponin	++	-

(+): positive result
(-) : negative result
The number of "+" showed the intensity of the detected compound

3. 2. Hipoglycemic effect of *B. javanica*

The people who suffer of DM in West Lombok consume the seed of *B. javanica* directly without extraction as much as 8-10 seeds per day for DM treatments. The dose of SME and LME used in this study (50 mg/kg BW) is the result of conversion dose from human to rat (conversion factor = 0,018). The result of this study showed that treatments with LME and SME of *B. javanica* can reduce blood glucose level (BGL) of alloxan-induced rats. The fasting BGL of the rats every 3 days measurement is shown in **Table 2**, while the profile of reducing BGL in all treatments is shown in **Figure 1**. Day 1 is the starting point of BGL after 3 days induction by alloxan, as well as the first day of treatments.

LME reduce the BGL of diabetic rats from day 3 to 15 with a fluctuative pattern; the BGL reduce at day 3 to 6, rise at day 9 and down again at day 12. The total percentage of reducing BGL for 15 days by LME is 13,19%. The rat condition of LME group after 15 days treatment was good and still alive. This result indicated that LME of *B. javanica* is potential to develop as antidiabetic agent; and LME dose of 50 mg/kgBW is a safety dose for diabetic treatments.

Table 2. Effect of treatments LME and SME of *B. javanica* on blood glucose levels of alloxan-induced diabetic rats (mmol/L)

Treatment groups	Day-					
	1	**3**	**6**	**9**	**12**	**15**
Normal control	80.25	84.5	69	79	105.75	91
Negative control	455.2	234.75	259.25	384	494	397.75
Positive control	443.5	373.5	358.25	248.5	420.75	345.75
LME (50 mg/kg BW)	344.2	279	238.4	300.2	295	298.8
SME (50 mg/kg BW)	510	134	92	80	*	*

*no data observed

SME reduce the BGL of diabetic rats drastically to the normal BGL at day 3 with reducing percentage of 73,73%. The BGL was keep down at day 6 and 9. Unfortunately, we

found that all rat in SME group was dead at day 8 and 9, so that the observation was missed for day 12 and 15. This is probably because the dose was so high for diabetic rats or there are some toxic compounds in SME that is not work in the whole seed (treatment in human). Meanwhile, the effective dose and toxicity of SME needs further investigation. Brucein A and D are two compounds in *B. javanica* that found to significantly reduce blood glucose concentration in diabetic rats, beside in methanol extract some toxic components were identified such as bruceoside A and B and yadanzioside F (Okuyama et al., 1990; Noorshahida et al., 2009).

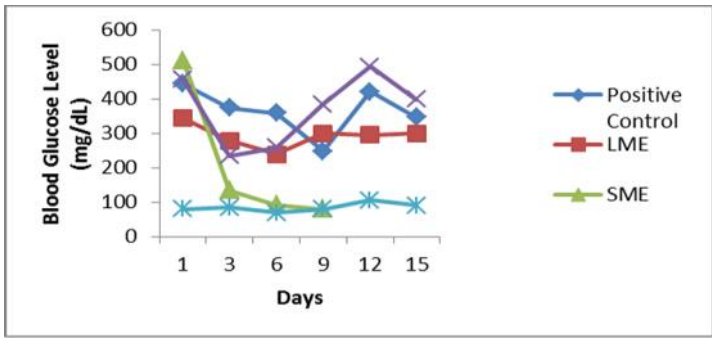

Figure 1. Profile of hypoglycemic effect of all treatments

Comparing with positive control (Glibenclamide), the reducing BGL was 43,97% and the BGL still in diabetes scale after 15 days treatment. This percentage of reduction is higher than LME but lower than SME. Statistical analysis showed that blood glucose reduction of LME and SME were not significantly different ($P<0,05$) comparing with positive control, indicating that LME and SME have the same significant hypoglicemic effect in diabetic rats.

3. 3. Histologycal Studies of Pancreas

Histologycal observation of rat pancreas was due to proposing the mechanism of SME and LME in reducing BGL of diabetic rats after 15 days treatments. In case of all rats in SME group was dead at day 15 of treatments, histologycal studies of SME could not be done. Here we reported histologycal observation after LME treatment that predicted to represent the mechanism of *B. javanica* in lowering BGL.

As shown in **Figure 2**, the islets of Langerhans in negative control (K2) were damaged observing by the present of edema and karyorhexis. It means that the pancreases were destructed after induction with alloxan. Alloxan works by destroying and reducing the pancreatic β-cell population via formation of reactive oxygen species like nitric oxide (Njogu et al., 2016). In positive control (K1), the damage of islets of Langerhans has been reduced but the damaging like pyknosis still found; while in LME treatments (P2), the islets of Langerhans are almost all recovered.

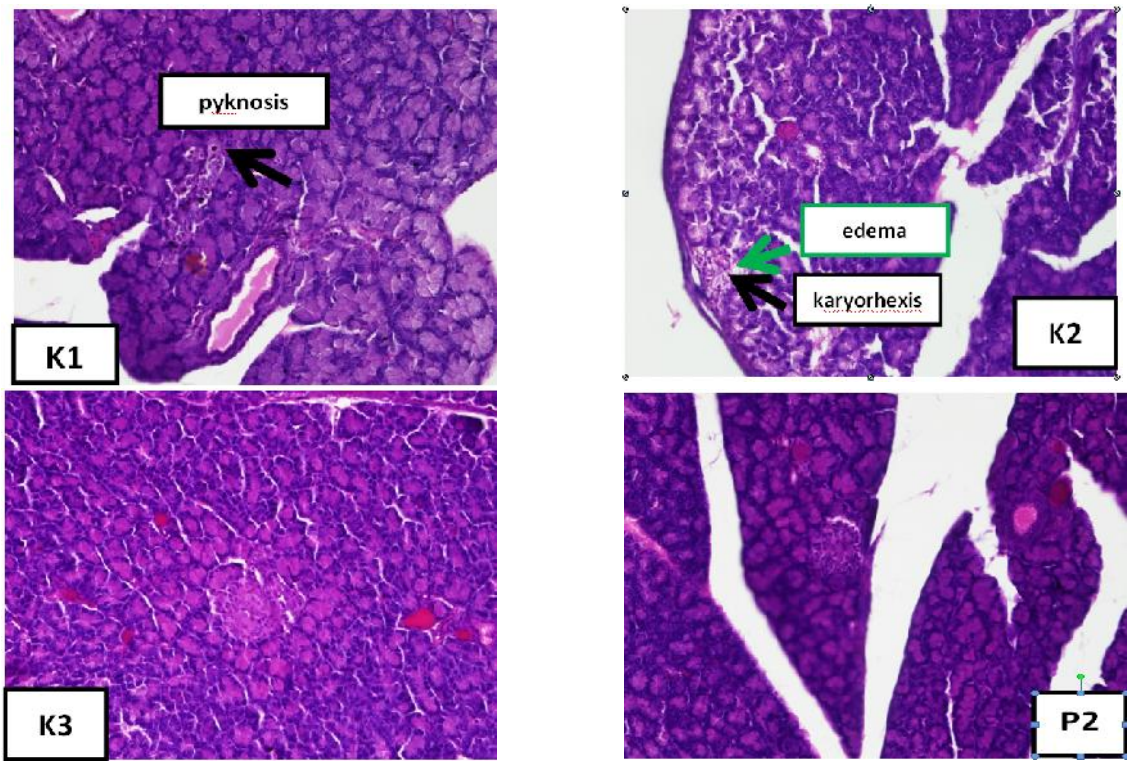

Figure 2. Histology pancreas stained with HE. K1: Positive control; K2: Negative control; K3: Normal control; P2: LME. The arrows show the damage of islets of Langerhans. Sample were observed under light microscope with 100x objective magnification.

Previous investigators suggested that the chemical constituents in *B. javanica* seed extract act as insulin secretagogue (Noorshahida et al., 2009). Histologycal pancreatic studies indicated that LME aid in the recovery of β cells to secrete insulin and improving the morphology of the islets of Langerhans; therefore, the blood glucose level was decreased after the treatment.

4. Conclusion

This study showed that LME and SME have a high hypoglycaemic effect in alloxan induced diabetic rats; but SME with the dose of 50 mg/kgBW seems to be overdose or toxic in causing hypoglycemic to the rat. Histologycal studies indicated that LME improved the morphology of the islets of Langerhans and recovery β cells to secrete insulin.

Acknowledgements

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Capability Analysis to Regional Innovation Development Based on the Locality Characteristics in Jawa Timur Province

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Abstract

The dynamics of the production system in Indonesia categorized as a developing country are strongly influenced by the industrially and technologically developed countries, in which these countries deploy the commercially realizable technological prescriptions undertaken by the institutional component of industrial systems for producing the commodities and services in the developing countries. This causes that the developing countries have the less ability for enhancing the competitiveness. To address this really, the the regional competitiveness system should be developed for improving the level of prosperity determined by the advances of science and technology development through the innovation capability. In autonomy era, the region represents a knowledge based economic model playing a role as an innovation driver and the social interaction of academic, business represented by micro, small and medium enterprise (MSME) and government could produce the hybrid organization containing the elements of *Deoxyribonucleic acid* ('DNA') that to be analogized as a genetic code of a large diversity of culture and resources to meet the sustainable competitiveness in the regions. In this study, Jawa Timur Province as a part of Indonesia is used as a locus for research through the mapping of locality characteristics as the innovation resources such as the uniqueness, culture, local potencies including the capacity of research and development institutions or agencies or universities. The locality characteristics have been analyzed to found the superior structure of 'DNA' in the regions for enhancing the capability of development on the science, technology and innovation to meet the sustainable competitiveness.

Keywords: Regional Innovation,Sustainable competitiveness, Locality Characteristics, Micro Small Medium Enterprise (MSME)

1. Introduction

Productivity systemsin the developing countries are very affected by the technology from developed countries, with a technology transaction, where technology prescription produced and delivered by the science and technology (S&T) developers agency of developed countries flows stronglyin the form of industrial technology into the developing countries including Indonesia. This is different from Taiwan, Korea and Singapore that seen as new industry countries in Asia that had a mechanism coordinated in conceptualization of technology prescription produced by S&T institutions to translate and transform to technologies that could be realized commercially and succeeded in providing welfare. Such transformation of S&T in the developed countries increases the competitiveness. Whereas, the system of regional or national productivity in the developing countriesis dictated by the current prescription technologies from the developed countries. (Saswinadi Sasmojo, 2014).

The efforts should be intended to cut the flow of technology prescription from developed countries in order to reduce the dependency of technology and provide a space for the development of industrial systems in strengthening of industrial technology to produce the industrial commodity of goods and services as well as an improvement of organization or productive processes. Strengthening of the technology prescription is designed on the base of innovation development in the area through the effort to the utilization of knowledge and utilization S&T exactly. The utilization is affected by force the knowledge that flows dynamically into the key actors and their interaction in forming a lot of fields to build core

competences. The dynamic is determined by legal instrument government as a catalyst, the potential of the regions and mechanisms to strengthenthe own industrial structure, and the capabilities of S&T and innovation development in accordance with the characteristics of region. In the process of transformation of a nation toward the knowledge based community or the knowledge based development, increasingof the sustainable competitiveness is the key success factor associated with the ability of an area to adapt, in the face of the uncertainty and the turbulence of business global environment.The process of the transformation is very muchdetermined by the progress of science and technology (S&T) utilized for improving the welfare and by the innovation ability which are affected by a structure or configuration all resources that is in a territorial and their network capabilities in developing the knowledge structure within the economic and social dimension. The region represents a knowledge based economic model playing a role as an innovation driver and the social interaction among the actors of government, academic and business community (Etzkowitz, H., 2008). The continuous interaction could produce the hybrid organisation containing the elements of Deoxyribonucleic acid ('DNA') that to be analogized as a genetic code of a large diversity of culture and resources to meet the sustainable competitiveness in the regions (Puspita, N.F. 2016). The MSMEs have been the backbone of the Indonesian economy and contributed 60.6 % to Indonesia's GDP (Sri Mulyani, 2016). However, the majority of MSMEs limits to the appropriation of stable capital, obtaining high quality materials and facilities, and acquiring modern technologies and innovation. In order to develop the own industrial structure, thebusiness community could be effectively represented by the micro, small and medium enterprises (MSMEs) (Kaufmann, A. and Todtling, F., 2002).

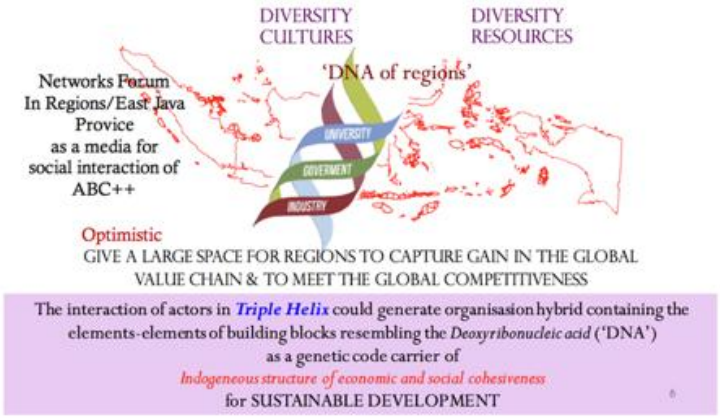

Figure 1.Locality Factor Analysis for RIS

To develop the industrial technologies appropriate to MSMEs, the S&T and innovation must be transformed with changes in technology created independently with superiority based to "DNA" of region with uniqueness of analyzed cultural variety and diversity local resources scattered throughout the country, as part of the efforts of the regional government and harmonization with provinces and the central government in encouraging innovation through implementation of the strengthening of regional innovation systems (RIS) as shown **Figure 1**.

In this study, Jawa Timur Province as a part of Indonesia is used as a locus for research through the mapping of locality characteristics as the innovation resources such as the uniqueness, culture, local economic potencies including the capacity of research and development institutions or agencies or universities. The locality characteristics should be analyzed to found the superior structure of 'DNA' in the regions for enhancing the capability of development on the S&T and innovation to meet the sustainable competitiveness.

The history of S&T that has been managed by the human race showed have much effect on the life patterns of the including ways to develop the quality of life and culture.Almost 100 years the era of industrialization indicating the existence of the dynamics of change, where social relationships between the community and the development S&T more and more quickly change. Consumptive behaviour especially in exploring and exploitation of non-renewable natural resources already been surpassed the boundary of the natural capacity to meet the needs of human life. So that in realizing sustainable development has happened the transformation of economic development based on industry headed toward the sustainable development based on information.The era of this information demonstrate the ability a country and its people in doing efficiency and using information to achieve welfare competition on the situation at the global cooperation as well as the dynamics of the developments based on the knowledge that be more complex.

In order to cut the prescriptive technology from the technologically developed countries. The superior "DNA" of the regions should be transformed into the local industrial structure to through the strengthening of RIS by development of learning ecosystems and innovation ecosystems. The learning ecosystem is the combination of technologies and support resources available to help individuals learn within an environment, where as the innovation ecosystems is used to describe the large number and diverse nature of participants and resources that are necessary for innovation that includes entrepreneurs, investors, researchers, university faculty, venture capitalists as well as business development and other technical service providers such as accountants, designers, contract manufacturers and providers of skills training and professional development. (EU Development Fund, 2012).

Figure 2. A Concept of Sustainable Competitiveness

Collaboration of University, industry and government as a catalyst to innovation learning process by increasing the capability to utilization of knowledge and social capital. Approach to the implementation of strengthening of RIS reflects for importance attached to the role of learning and milieu social to contribute inthe success ofthe social and economic global(Ponthieux, S., 2004).So that efforts to the innovation driven through the development of ecosystems intended to develop abilities and capabilities the innovation to reach sustainable competitiveness as shown in **Figure 2**.

The power of innovation learning depends very much on the order of intangible assets, in addition to the formal knowledge including the internal dynamics of the cultural, social and political assets, namely the informal knowledge flows between the parties producing the most of the externalities within a region. Each region has an opportunity for building and maintaining the competencies that differentiate including endogenous knowledge that already exists.

Learning innovation in technological development and changes of technology taking place in a region it is with the strengthening of RIS, where the region as a model knowledge base development is somewhere interaction between economic and innovation affected by the ability for strengthening of the social capitalconceptualized of any kind have considered as added value. In the relationship between the innovation actors, the social capital is being thrust on the social cohesion that can affect the ability to strengthen the institutions and make it more competitive.The diversity condition including the diversity of resources potential and also the diversity of culture across areas Indonesia provide the space for local efforts to come theinnovation learning.

2. Materials and Methods

Based on an analysis of innovation capability as shown in **Figure 3**, the S&T and innovation policy is intended to generate technical and organizational change in technology industry over an innovation cycle. Whereas a building of the capability of MSMEs from the top down and bottom up direction is intended to expand capacity, change its structure, raise its efficiency, increase its role in poverty reduction, make it greener. (Freeman, 2014)

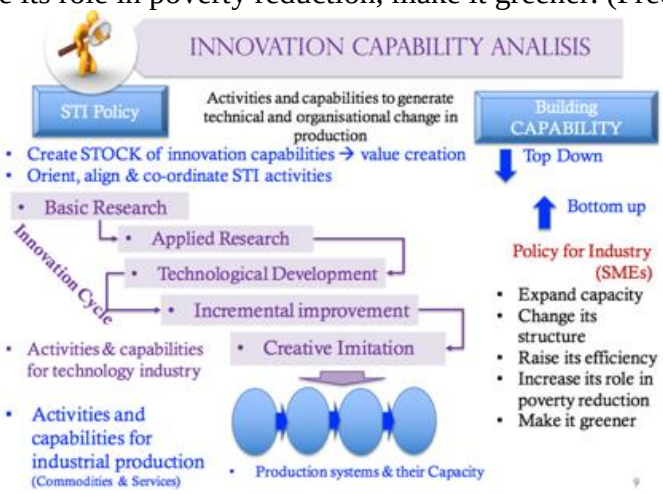

Figure 3. Innovation Capability Analysis

Regional resources and potencies of each region in Jawa Timur Province as locality characteristicare identified from the data base of statistics for Indonesia, Jawa Timur Province and Regions, as well as theregional research and development agencies, Indonesia higher education database (forlap.dikti.go.id), the exsisting MSMEs based on the nine leading sectors (agriculture, mining, manufacturing, energy, construction, trade, transportation, finance, and services) in the regions of Jawa Timur Province, and theextended innovation data from webomatrics, patents etc.The identified locality characteristics represent the social capability and economic performance as a candidate of superior structure of 'DNA' of region that could be developed into the RIS shown in **Figure 4**.

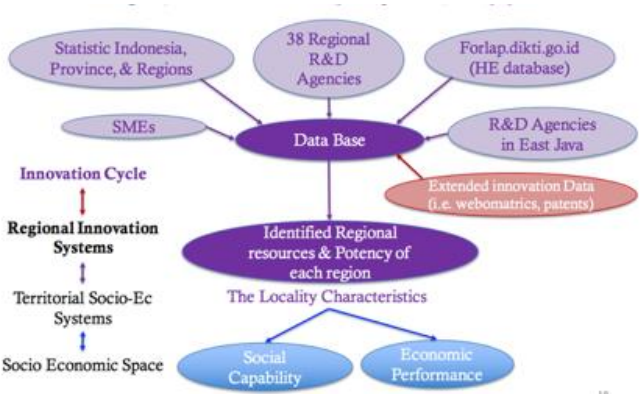

Figure 4. Mapping of the Locality Characteristics

3. Results and Discussion

The innovation capacity in the RIS is determined by a capability of MSMEs in adopting the technology and the potency of absorptive capacity. In the Jawa Timur Province, the micro enterprises dominate total MSMEs of 95.72% as shown in **Figure 5**. Based on the leading sectors of the MSMEs, the agriculture enterprises contributes 60,25%of the total as shown in **Figure 6**.

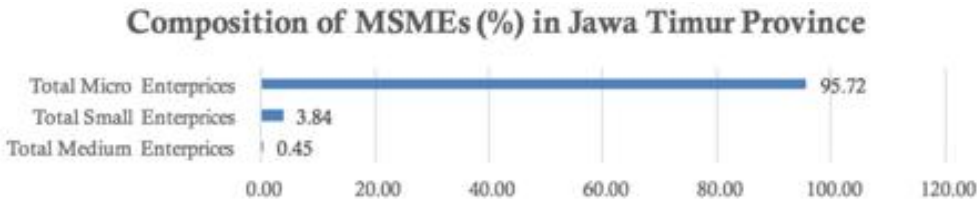

Figure 5. Compotition of MSMEs

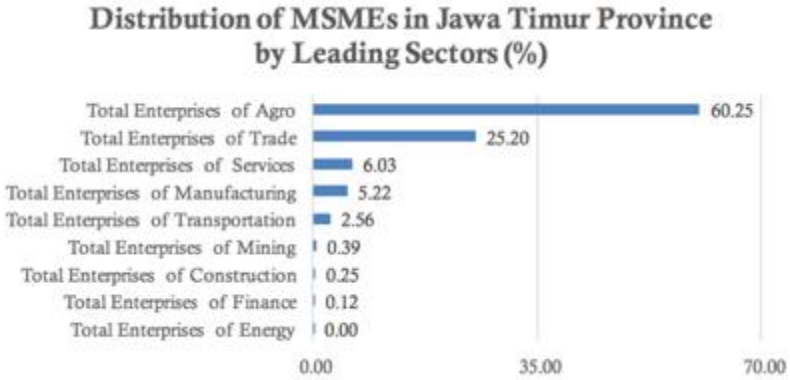

Figure 6. Percentage of MSMEs by Leading Sectors

The locality characteristics are represented by GDP/Capita by leading sectors, the potency of MSMEs, university and study programs distributed in the regions. **Figure 7** describes the highest potency for developing the regional innovation on the basis of agriculture leading sectors in the region of Jember, Malang and Banyuwangi. It is related with the highest contribution of GDP/capitainto Jawa Timur from the agricultureleading sector. The highest agriculture contribution of GDP comes from the Banyuwangi by 9,16%, Jember by 8.01% and Malang by 5,86%.

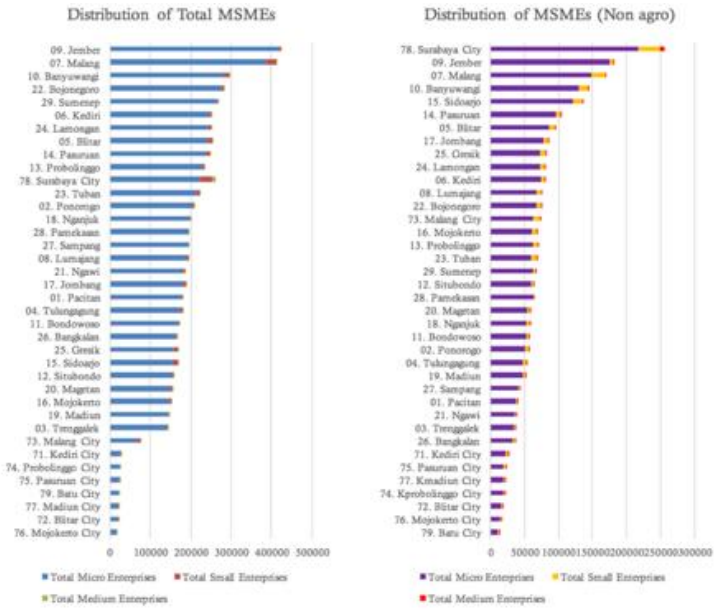

Figure 7. Distribution of Total MSMEs and MSMEs (Non-Agriculture) in Regencies/Cities.

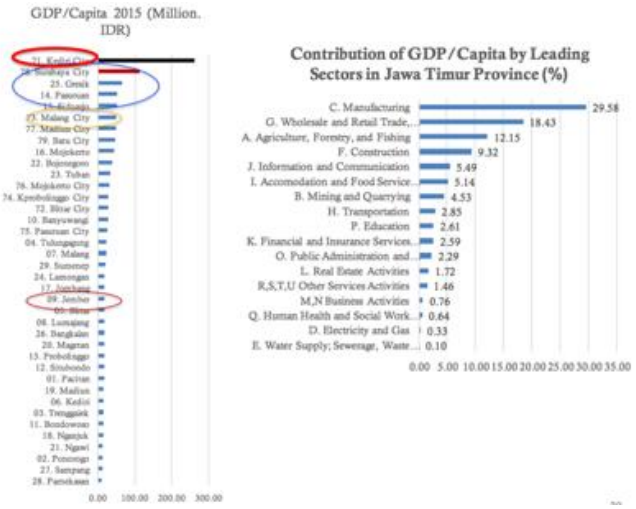

Figure 8. Distribution of GDP/Capitain Regencies/Cities and the Contribution into Jawa Timur Province

From the **Figure 8**and economic structure,Kediri city contributes the highest DGP/capita from the manufacturing leading sector of tobacco products. Whereas, Surabaya city contributes the majority of the leading sectors except for the agriculture and energy. Surabaya city has the highest potency for developing innovation in the non agriculture sectors, when correlated with the potency of higher education and study program as innovation resources distributed in Surabaya city, Malang and Jember as shown in **Figure 9**.

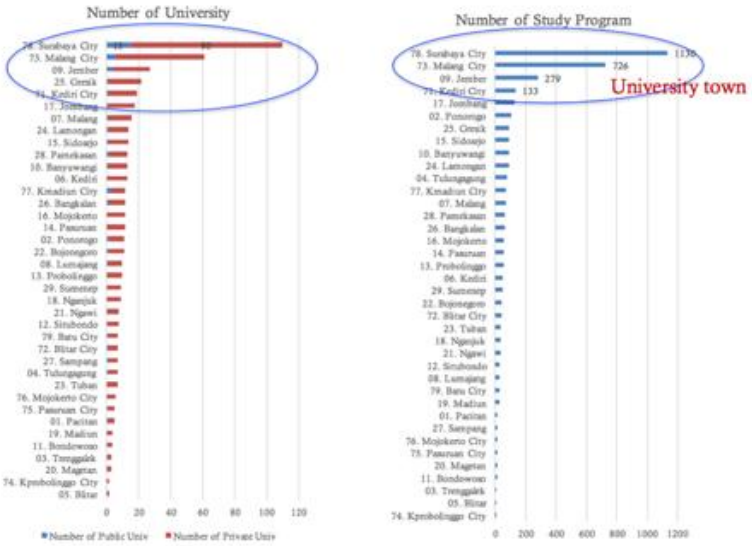

Figure 9. Distribution of University and Study Programe in East Jawa Province.

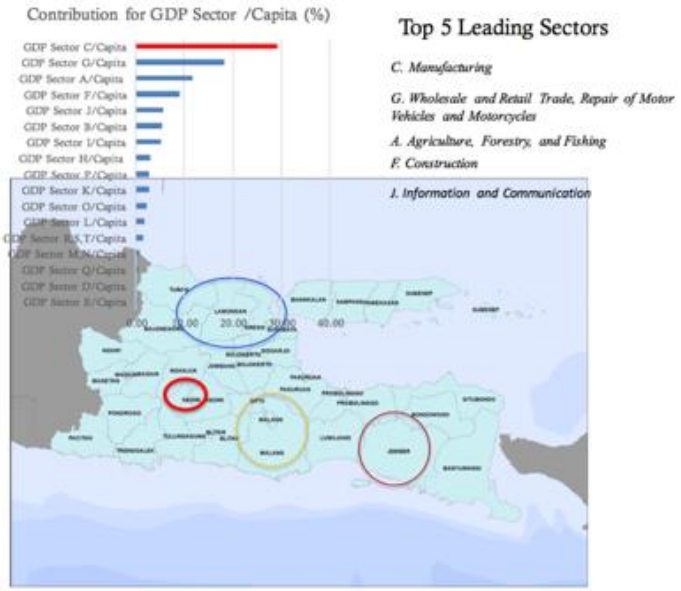

Figure 10. Mapping of Economic and the Resources of Innovation in Jawa Timur Province.

Mapping of high economic and innovation resources in Jawa Timur is shown in Figure 10 with top five leading sectors, i.e. manufacturing, trade, agriculture, construction and information & communication.

4. Conclusions

The conclusions are: 1) The locality characteristics have been analyzed to found the superior structure of 'DNA' in the regions for enhancing the capability of development on the science, technology and innovation to meet the sustainable competitiveness, 2) The data base generated could help significantly to analyze the innovation potency in Jawa Timur Province, but the effectiveness of data generation depends on the relationship of ITS (Institute of Technology of Sepuluh Nopember) and the local government and other universities to share the data, 3) The higher rank of universities in the three regions (Surabaya City, Malang City and Jember Regency) should have responsibility to share the academic activities into the other

universities in the lower rank to give an academic impact for improving the social capital, 4) The highest potency for clustering the SMEs is the cluster of manufacturing industry on the basis of agriculture.

Acknowledgement

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Aquaculture Waste as Ingredients For *Cyprinus carpio* Feed

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Abstract

Aim of experiment is to know the effect of utilization aquaculture waste as raw material in feed on growth performance of common carp (*Cyprinus carpio*).The experiment was designed in completely randomized design with five treatments and three replications. The treatments were feed which was made by combination between aquaculture waste meal and feed meal. Percentage of the waste inclusion in feed were 0% (without waste meal/control), 25%, 50%,75%, 100% (without feed meal). The feed was tested to the common carp for 45 days. The result showed that aquaculture waste utilization in feed affect weigh gaining (WG), feed consumption (FC), feed efficiency (FE), conversion rate(CR), protein retention (PR), and survival rate (SR). Control feed resulted WG, FC, FE, and CR which was significantly higher than waste based-feed, respectively 2.0±0.0 g, 3.8±0.1 g, 52.2%, 1.9. PR for feed using waste meal 75% and 25% were not differ significantly with control feed around 46.5% to 48.2%. SR was lowest in 75% and 100% waste meal utilization, respectively 93% and 80%. The experiment showed that the higher waste meal inclusion in feed, the lower measured parameter gained. However, protein combination from waste meal and feed meal showed could be used well by fish.

Keywords : *aquaculture waste based-feed, common carp, , growth performance*.

1. Introduction

Feed is the most determinant factor for successfull fish farming. Feed is main nutrition source in intensive farming. Sixty to seventy percent of operasional cost is filled by feed cost. Around 25 % of consumed feed are conversed as fish biomass and the rest of the consumed feed are wasted as waste (62 % as soluble matter, and 13 % as sediment matter)(Suryaningrumdan Maharani, 2014).

Unconsumed feed, fecal, and metabolic excretion enter to water then result toxic amoniac which will inhibit the growth in concentration of 0,18 mg/l (Afriansyah et al., 2016). Ekasari (2009) states that the presence of ammonia in the water is highly avoided because the toxicity on cultivated fish, even in low concentrations.

Aquaculture wastes consists of liquid and solid waste which are formed by fecal and unconsumed feed(Effendi dkk., 2015). Aquaculture wastes are problem due to its toxic material on environment, such as NH3, NO3, and NO2. But, in the same time, aquaculture waste contains N, P dan K which can be reused to produce biofloc.

Bioflochas potential to develope as raw material for fish feed due to its high nutrition content. Biofloc contain of 39 – 48 % protein, 12 – 24 % lipid, 3 – 4 % fibre, and 25 – 28 % ash (Widarnani, 2012). Naturally, biofloc is consumed by fish. Nuari et al. (2016) show that biofloc as feed supplement results high growth rate of walking catfish (*Clarias gariepinus*). Oktafianiet al. (2016), biofloc meal has imunostimulan effect on non specific immune and has a positif effect on survival rate of *C. Gariepinus*

Regarding the nutrition of biofloc which is formed by waste meal, the reseach was conducted to to know the effect of utilization of waste meal as a raw material in feed on growth performance of common carp (*Cyprinus carpio*).

2. Materials and Methods

The research was conducted at Aquaculture Laboratory of Mataram University. Completely Randomized Design with five treatments and three replications were applied in the research. The treatments were feed which were formulated using different combination of

feed meal and aquaculture waste (biofloc) meal. Percentages of the combination feed meal and biofloc meal for the treatments were 100:0 (control), 75:25, 50:50, 25:75, and 0:100.

2.1 Feed Preparation

The waste meal was collected from catfish (*Clarias* sp.) rearing facility with recirculation system. Water from fish tank was flowed continually trought the sedimentation channel and then the water back to the fish tank. Solid waste was settled in the channel. Settled waste collected by siphoning. Collected watery waste was aerated for 24 hours. The waste was filtered by using fine cloth to reduce the water and then drying under the sun. Dried waste was milled into flour and ready to mix with feed meal. Waste meal was analized to know proximate compositions (protein, lipid, ash, fibre, and water).

Feed meal was made by milling the comercial feed and then the meal was analized to know proximate composition. Commercial feed, which was used, was determined by considering the protein content of the feed in order to get tested feed which has close protein content with waste based feed. Waste and feed meal were mixed with particular composition based on the treatments. The dough of waste and feed meal were added with 40% of water and then the dough was molded by feed machine. The feed were dried under the sun for 2 days.

2.2 Fish rearing

Tested fish was *Cyprius carpio*with size 1,5$\pm$0,5 g per fish. Ten selected fishes were stocked for each 15 aquariums. The aquariums were arranged in recirculation system. The fishes were reared for 45 days with 2 times feeding frequency at 08.00 and 16.00 with at satiation methode. Water qualities were kept by doing water replacement every day as much as 10% of total water volume in recirculation system.

2.3 Collection and Analysis of Data

Initial weigh was get in the first and the fortyfifth day by weighin all the tested fish to get the average weigh. Before weighing, the fish was fasted for 24 hours. Consumed feed were recorded every day. Number of death fish was counted. Initial and final protein content of whole body fish were determined by taking five fish sample from every treatment. AOAC (1970) methode was applied to determine all of proximate analysis.

Weigh gain was determined by$W(g) = Wt - Wo$; Feed efisiensi (FE %)= (((Wt+D)-W_0)/f) x 100%; Feed conversion (FCR) = F/((Wt+D)-Wo); Protein Retention (PR %) = ((Pt-Po)/PC) x 100, and ; Survival Rate (SR %) = (Nt/No) x 100%. Wt = final weight ; Wo = final weight ; D weigh of dead fish; f = weight of consumed feed ; F = dry weigh of consumed feed; Pt = finial protein content of whole body fish; Po = initial protein content of whole body fish; PC = consumed protein of feed; Nt = final number of fish; No = initial number of fish.

All data were analyzedby one-way analysis of variance (ANOVA) followed by Least Significant Differ Test. Differences were considered significant at $p<0.05$.

3. Results and Discussion

The resulf of the experiment presents in Table 1.

Table. 1 Average of Initail Weigh (W_o), Final Weigh (W_t), Weigh Gain (WG), Feed Consumption (FC), Feed Efficiency (FE), Feed Convertion Ratio(FCR), Protein Retention (PR), Survival Rate (SR) of *Cyprinuscarpio* after 45 days rearing period.

Parameters	Treatments (% feed meal : % waste meal)				
	100 :0 (control)	75 : 25	50:50	25: 75	0:100
WG (gr)	$2,0 \pm 0,1^{(a)}$	$1,4 \pm 0,1^{(b)}$	$1,1 \pm 0,0^{(c)}$	$0,5 \pm 0,0^{(d)}$	$0,1 \pm 0,0^{(e)}$
FC (gr)	$3,8 \pm 0,9^{(a)}$	$3,2 \pm 0,2^{(b)}$	$2,8 \pm 0,1^{(c)}$	$1,8 \pm 0,1^{(d)}$	$1,2 \pm 0,1^{(e)}$
FE (%)	$52,2 \pm 0,8^{(a)}$	$45,6 \pm 1,4^{(b)}$	$39,0 \pm 0,1^{(c)}$	$27,3 \pm 0,1^{(d)}$	$11,4 \pm 2,7^{(e)}$
FCR	$1,9 \pm 0,0^{(a)}$	$2,2 \pm 0,1^{(b)}$	$2,6 \pm 0,1^{(b)}$	$3,7 \pm 0,1^{(c)}$	$9,8 \pm 2,0^{(d)}$
PR (%)	$46,5 \pm 0,7^{(a)}$	$47,8 \pm 1,3^{(a)}$	$34,\pm 1,6^{(b)}$	$48,2 \pm 0,8^{(a)}$	$21,6 \pm 2,9^{(c)}$
SR (%)	$100^{(a)}$	$100^{(a)}$	$100^{(a)}$	$93 \pm 3^{(b)}$	$80^{(c)}$

Mean values with different superscript along each row significantly differfrom each other ($p<0.05$); values after ± are standard error

Control feed consisting 100% feed meal resulted high performance than other feed which contained waste meal, while feed containing 100% waste meal resulted lowfor all measured parameters. The more high percentage of waste meal utilization, the more negatif effect on measured parameters will be gained. Based on analisis of variance, the utilization of waste meal can not result performance as same as control feed, except for protein retention, and survival rate. Feed containing waste which result the best performance was feed 75:25, in comparison with the other feed which containing waste meal, howevercontrol feed still result high in weigh gain, feed consumption, and feed efficiency.

Utilization of waste meal in feed success to result growth for fish, however in low rate. The growth of fish proof that waste based-feed can be consumed by fish for their growth and maintenance. The high growth for control feed may be caused by the high of feed consumption for control feed due to its palatability or its nutrition. Feed consumption for waste based-feed were decrease by incresing of waste meal level untilization. Inclusion waste meal in feed may reduce the palatability of the feed due to decreasing of fish meal in feed. Chun et al. (2016) shows that poor palatability is a limiting factor for fishmeal replacement with other protein source in feed.

Feed with high in fibre content will reduce the digestibility of feed and then made fully stomach. Fibre existing in feed will disturb nutrition absorption (Webster and Lim, 2002). As a result, the feed intake of fish is limited. Nutrition composition of feed presented in Table 2. Fibre content of tested feed around 14,1 to 24,9 %. NRC (1983) that feed should contain fibre around 3 % to 5 % which is derived from plant ingredients. The more high waste meal in feed, the more high fibre content of feed.

Table 2. Moisture, Ash, Lipid, Crude Fibre, and Crude Protein Content of Feed.

Nutrition (%)	Treatments (% feed meal : % waste meal)				
	100 :0 (control)	75 : 25	50:50	25: 75	0:100
Moisture	9,91	9,73	9,54	9,37	9,19
Ash	16,41	15,7	14,98	14,27	13,56
Crude lipid	2,99	4,06	5,12	6,2	7,27
Crude fibre	14,13	16,83	19,.51	22,21	24,91
Crude protein	18,41	21,62	24,82	28,03	31,24

Meyer and Fracalossi (2004) state that feed consumption was affected by the ingredients of feed. High fibre content in waste based feed was caused by waste itself.

Aquaculture waste consist fecal, where fecal consist of indigestible component from the feed. Fibre in feed can not be digested by fish. High fibre content in feed will produce fecal with high fibre content. Fecal, which associate with bacteria and other microorganisme to form biofloc, can reduce fibre content and increase the protein content, but it depend on the treatments. Time rearing period and molase addition could effect the composition of biofloc including the nutrition of biofloc (2012). Waste meal in these experiment was the biofloc which rear for 24 hour without any special treatment.

Fibre in feed not only affect feed consumption but also affect the eficiency and conversion rate. Waste basedfeed containing high fibre of 24,91% had worse feed efficiency, conversion rate, and protein retention. The fibre content in the waste was high compare to another experiment with only 7,65 % (Nauri et al., 2016) and 19,07 % Pasha (2015). Feed containing fiber more than 10% will reduce the digesibility and absorbsion rate (Watanabe, 1996). Feed efficiency for feed which was made by 100% waste meal were 11,4 %. It was lower than standar feed efficency for feed. Zulkifli (2004) stated that good feed efficiency was more than 25 %. It means that nutrition in waste meal can not be used optimally by fish. The lower feed efficiency, the higher value of feed conversion rate.

Protein retention is number of consumed protein which can be used to build biomass of fish. Protein content of waste based feed were higher than the control feed. Protein content of fish increase about 3,9 to 10,1 % (Tabl3 3).The increasing of protein in tested fish was a proof that protein in waste meal can be used by fish, however protein content of control and feed containing up 50 of waste meal are lower than the standar protein for *Cyrinus carpion* at 25 to 30 % (SNI, 2006). (Table 3)

Table 3. Protein Content of Whole Body Fish at Inital and Final Rearing Periode

Protein content of Whole body of Fish	Treatments (% feed meal : % waste meal)				
	100:0 (control)	75 : 25	50:50	25: 75	0:100
Inial Protein	7,27				
Final Protein	12,32	14,35	13,16	17,42	11,26

Combination feed meal and waste meal result better protein retention, except for combination 25 : 75, than sole feed meal or waste meal. Waste meal as sole an ingredient for feed may produce worse amino acid composition than feed which was made with the both combination. Usman at al. (2014) shows that milkfish which was feed by biofloc meal result low rate of protein utilization than feed with biofloc meal with amino acid addition. Protein retention rate of feed was determined by protein source, amino acid composition and amino acid requirements of fish.

Waste meal in high inclusion more than 50% in feed has a negatif effect on survival rate of Cyprinus carpio. Fish may die due to the lack of nutrition regarding to the low feed consumption.

4. Conclusion

Waste meal utilizationas feed ingredient has low performance on growth, feed consumption, feed efficiency and conversion rate, but protein in waste meal can be utilize well if combine with protein of feed meal.

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Yield and Growth Mungbean (*Phaseolus radiates* L.) with additional Organic Fertilizer under Intercropping System

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Abstract

Mungbean (Phaseolus radiates L.) is a potential plant for intercropping that is commonly found in conventional cultivation system. The use of compost to improve soil quality migh able to improve mungbean production. The study was conducted to compare the growth and yield of mungbean with and without compost grown under intercropping with cassava and long bean. The study was conducted KP. Narmada, West Lombok West Nusa Tenggara on January - April 2016. Experiment designed on split plot with six replications, the main plots were: 1) monoculture and 2) intercropping, were the subplots 1) without compost and 2) compost. Vegetatitive parameters were plant height and number of leaves, weight of pod, seed weigh / pod, number of pod / plant, weight of pod / plant and seed weight / plant. The results show that vegetative growth of mungbean is affected by croping system and compost application. Without competition with other plants, vegetative, mungeban grown under monoculture system with compost significatly grow higher vegetative (91.82 cm) and better leaf number (21.50) at 35 days after planting. Highest yield production mungbean (seed yield / plot - 1,1 kg) was obtained on intercropping system with compost and highest dry weight biomass (25.60 kg) on monoculture system with compos.

Keywords: intercropping, organic fertilizer, mungbean, vegetatif, yield

1. Introduction

Green beans (Phaseolus radiates L.) is one of the plant food sources of carbohydrates and vegetable protein. Carbohydrate content reached 14.46 gr, 5.42 gr protein, 0.4 gr fat, with total calories 81 in every 100 grams of green beans (Fatsecret, n.d). Stover green beans can be used as animal feed with a potential of 2.14 tons Dry weight / ha / harvested area (Anonimous, 1982). Every year the demand of green beans is quite large as a strategic commodity, in 2014 the average consumption per capita of green beans in Indonesia reaches 0.143 kg / capita / year (Pusdatin, 2014). Green beans have the advantage of short-lived, tolerant to drought because it is deep rooted so it can grow in suboptimal land of poor nutrients, cheap cultivation, little pest and disease and relatively stable selling price (Kasno, 2007).

Development of green beans in Indonesia encountered several obstacles such as low productivity and limited cultivation area. BPS (2016) data shows that the production of green beans in West Nusa Tenggara (NTB) in 2014 was 18,218 tons with a harvest area of 16,395 ha and productivity of 11.11 kw/ha while production in 2013 was 22,079 tons with harvested area of 19,374 ha and productivity 11.40 kw/ha. The data indicate a decline in production caused by decreasing crop area and declining productivity of green beans. Reduced area of green bean harvest in 2014 caused by the amount of land of green bean crops that are cultivated with other commodities whereas less intensive cultivation leads to low productivity of plants. Intercropping cultivation system and suboptimal land use is an alternative that can be used to increase green bean production in limited condition of production land. The use of organic materials is expected to improve the quality of land so as to increase crop productivity.

Intercropping system is done to improve the efficiency of time, space and resources available so that the production of farming and income farmers can be improved. Short-lived green beans (55-60 days) require little water, and N-binding ability is an advantage that is suitable for alternative cropping on intercropping cropping systems. In general, green bean

cultivation is still done conventionally, without fertilization because it uses residual fertilization from previous crop cultivation, and cultivated in the dry season with mamanfaatkan moisture content of the soil in previous seasons. The ability of green beans as one of the leguminous crops to bind N from air causes the expansion of green bean plants can be done by utilizing suboptimal land. The study of Holidi., et al, (2016) shows that Kutilang, Murai and Vima-1 green beans are able to model on peat and mineral soils.

Increased productivity can be done by improving the cultivation technology component of plants on suboptimal land. The use of organic materials such as compost is one of the alternatives used to improve suboptimal soil conditions. Plants need nutrients as one of the growth support that can meet with good fertilizer inorganic or organic fertilizer combined or combination. The use of compost is one of the additional forms of organic matter in the soil because the composting of manure can improve the physical, chemical and biological properties of the soil (Rosmarkam and Yuwono, 2003) by increasing air-binding air resistance so as to increase the amount of water available for the needs of the crops (Jumin, 2002).

Provision of nutrients with organic materials can improve the yield of higher green beans and better quality compared to chemical fertilizers. (Fernandes et al., 2003). Applications of organic materials can improve soil structure, increase air holding capacity and improve soil biological life (Dinesh, et al., 2010). Syafrina (2009) reported the use of manure and compost have a positive impact on the growth and yield of green beans. However, according to Yassi (2010) the increase in green bean yield is not available on the 1.0 t/ha compost award that is grown on rainfed lowland. The purpose of this research is to know the diversity of growth and yield of green bean plants on various planting systems and the use of compost.

2. Materials and Methods

The study was conducted on inceptisols with sandy clay texture in KP. Narmada, West Lombok West Nusa Tenggara (NTB) in January to April 2017 (MH, 2016) using local green beans Sumbawa, Sampeong. Experimental review uses a plot with six replications. The main plot is planting system, namely 1) monoculture and 2) intercropping, compost plot of compost is 1) without compost and 2) with compost. The tools used are raffia straps, rulers, analytical scales and stationery.

Table 1. Quantitative parameter description of Sampeong varieties, 2009

SAMPEONG		
Released	:	Februari 14, 2003
SK Mentan	:	135/Kpts/TP.240/2/2003
Strain number	:	MLG 1029
Origin	:	Local Sumbawa
Yield potensial	:	1,80 t/ha
Average yield	:	1,0 t/ha
Number of pod/tree	:	11–16
Number of seed/pod	:	12–14
Length of the pod	:	10–20 cm
Flowering stage	:	34–36 days
Harvest stage	:	70–75 days
Plant hight	:	60–80 cm
Weight of 100 seed	:	2,5–3,0 g

Source: Balitkabi, 2009

Green bean planting is done with a simple soil system (minimum preparation). Beds made with size 15x1.5 m. Compost equivalent of 2 tons/ha (5 sacks @ 9 kg/beds) is given at

planting on the bed that got the application of compost both with monoculture and intercropping system. Seeds planted with spacing 40x20 cm with the number of seeds 2 seeds / hole. Planting distance 1.5 m cassava planted in the middle of the bed and spacing of long beans 20 x 70 cm grown on the left and right side of the bed. Fertilization done at age 7 HST using NPK 15:15:15 with a dose of 200 kg/ha, plant directly at a distance of 5-10 cm from the plant. Weeding was manually and routinely at 21 HST and 41 HST. Harvested when the pods were black, and hardened. The first harvest of March 12, 2016; the second harvest was March 31, 2016 and the last harvest was April 14, 2016.

Observation plot made with the size of 2.5x1.5 m. Measurement of vegetative parameters on plants and number of leaves was done once every 7 days on 15 sample plants/observation plots. The generative observation parameters were made at harvest on 5 sample plants/observation plots. The generative parameters observed were pod length, number of pod seeds, pod weight, seed weight/pod, number of pod/plant, weight of pod/plant and seed/plant weight. The observed data were analyzed by vocabulary (Anova) using SAS application version 9.1. The average difference test using Duncan's multiple-range test (DMRT) at a 95% confidence level.

3. Results and Discussion

3.1. Effect of planting system and use of compost on vegetative growth of green bean plants

Analysis of variance (Table 1) shows the real effect of cropping systems and the use of compost on the growth and yield of green bean plants either independently or on interactions. The effect of planting system interaction and compost usage is more dominant than the effect of planting system and the use of compost independently. Independently, monoculture and intercropping systems only affect plant height and leaf number when green bean plants enter the generative phase (flowering) and weight of pod/tree. The use of compost independently affects only green bean plants in the generative phase (35 HST) and does not affect all the components of green beans.

This condition indicates that monoculture and intercropping system in green bean plants will increase plant height and number of leaves especially during generative phase (flowering) and weight of pod/tree. Monoculture planting of green beans increases the height of the plant and the number of leaves while the green bean planting tumpangsari increase the weight of pod/plant. Differences in planting systems cause differences in plant growth expression, the rate of plant growth in monoculture planting system will be different from the plants in intercropping cropping system. In the vegetative phase, the increase of the height and number of plant leaves on the intercropping system will be lower than the plants in the monoculture planting system. In the intercropping system, competition becomes the limiting factor for vegetative growth of both nutrients, water and light. Increased plant growth causes the root and plant canopy area to be wide and wide, the need for water plants, nutrients and more light but limited availability both in soil and above so the competition between plants is getting bigger.

Table 2. Effect of planting system and compost use on growth and yield of green beans of Sampeong varieties on inceptisol, Narmada, MH 2016

Variable	Planting system	Compost utilizing	Interaction
Plant High 14 DAP (cm)	tn	tn	tn
Number of leaf 14 DAP (leaf)	tn	tn	*

Plant High 35 DAP (cm)	*	*	*
Number of Leaf 35 DAP (leaf)	*	tn	*
Number of pod/tree	tn	tn	*
Weight of pod/tree (g)	*	tn	*
Weight 1 pod (g)	tn	tn	tn
Pod lenght (cm)	tn	tn	tn
Number of seed/pod	tn	tn	tn
Weight of seed/pod (gr)	tn	tn	tn
Weight of seed/tree (gr)	tn	tn	*

Description: The number in the same column followed by the same letter is not significantly different in the DMRT test error level of 5%; *: there is interaction, tn: not real

The effect of using compost independently only affects vegetative stage especially in plant height during flowering (35 HST). This indicates that composting on green bean cultivation spurs more vegetative growth compared to yield. Compost has the characteristics of low nutrient content, the availability of nutrients slow and provide limited amount of nutrients, the supply of nutrients by organic fertilizer takes a relatively long time because the process of decomposition of the content in organic materials is influenced by the role of microorganism activity so that nutrients become available and can be absorbed by plants.

The activity of microorganisms during the decomposition of organic materials in compost helps to improve the physical, chemical and biological properties of the soil. This process is not found in the use of inorganic fertilizers because inorganic fertilizers contain nutrients that are ready to be absorbed by planting so as to spur plant growth faster but not positively affect the soil.

One measure of the plant that is often used as an indicator of growth is the height of the plant. Further test results (Table 3) showed that the height of green bean plants in early vegetative growth (14 DAP) in intercropping system intercropping systems showed the highest measure compared to other treatments. At flowering, the interaction between composting monoculture systems provides the highest and tangible plant size compared to other treatments.

Table 3. Effect of plant system interaction and compost use on green bean varieties of Sampeong on inceptisol, Narmada, MH 2016

Planting System	Use of Compost		Use of Compost	
	Without Compost	With Compost	Without Compost	With Compost
Plant hight 14 DAP			Number of leaf 14 DAP	
Monoculture	29.13a	27.38a	13.17ab	13.50ab
Intercopping	26.98a	30.42a	12.67b	14.17a
Plant hight 35 DAP			Number of leaf 35 DAP	
Monoculture	85.85ab	91.82a	21.00ab	21.50a
Intercopping	70.60c	78.53b	19.50b	20.00ab

Description: The number in the same column followed by the same letter is not significantly different in the DMRT test error level 5%

In early vegetative growth, environmental conditions grow on monoculture and intercropping systems both without compost or compost. Early vegetative growth, rooting of green bean plants is still not perfect, shallow and the number of leaves is small. The cassava plant begins the growth of adventoius root on the base of the cuttings, the formation of new leaves and all the buds begin to sprout. Long bean plants are growing upward canopy and rooting has not developed. Different initial growth rate conditions among plants in intercropping systems cause competition to obtain nutrients, water and light have not occurred so that the rate of increase in plant height is almost the same (not significant).

The high growth of green bean plants showed significant when flowering plant (35 DAP), plant size on monoculture plant system was higher than in intercropping. This condition is allegedly related to the competition that began to occur between plants that ditumpangsarikan. The growth rate of cassava began to aggressive, at the age of 35 DAP, the leaves of cassava plants began to enlarge and began to actively conduct photosynthesis in order to obtain food reserves as much as possible for the formation of prospective tubers. Long bean plants enter the phase of flowering and require nutrients in large quantities, so competition between green beans, cassava and long beans to get water and nutrients is very possible.

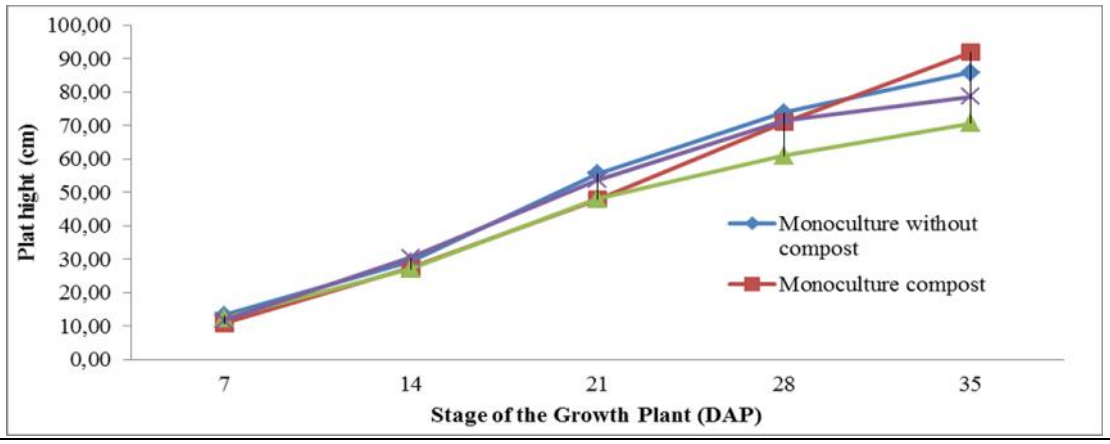

Figure 1. The high growth rate of green bean plants in various planting systems and composting, Narmada, MH 2016

The rate of increase of plant height in monoculture planting system of compost is supported by the content of organic material in the given compost. Provision of organic materials in the form of compost can improve soil CEC so the soil is able to hold the nutrients to dissolve in the soil, the higher the soil CEC so the soil more fertile so it can affect the growth of plants. Compost is also able to increase soil moisture so as to increase the capacity of the field because it enlarges the ability of the soil to hold water (Sutanto, 2002), able to provide macro and micro nutrients and able to improve the soil structure. Research on the use of organic materials on green beans has been done by Husna, 2016 that the giving of organic material 20 t / ha has implications on increasing the height of green bean plants.

The height of green bean plants in composted monoculture treatment was 85.85 cm and the tumpangsari without compost reached 70.60 cm in accordance with the description of the high potency of Sampeong green bean plant which reached 60-80 cm. This condition indicates that the dominant plant height is influenced by genetic factors. The interaction between genetic and environmental support in the form of soil nutrients in the soil, water and available light causes the green bean plants to grow and reach normal size despite competition (intercropping) or without competition (monoculture). Provision of organic materials is preferred to improve soil quality.

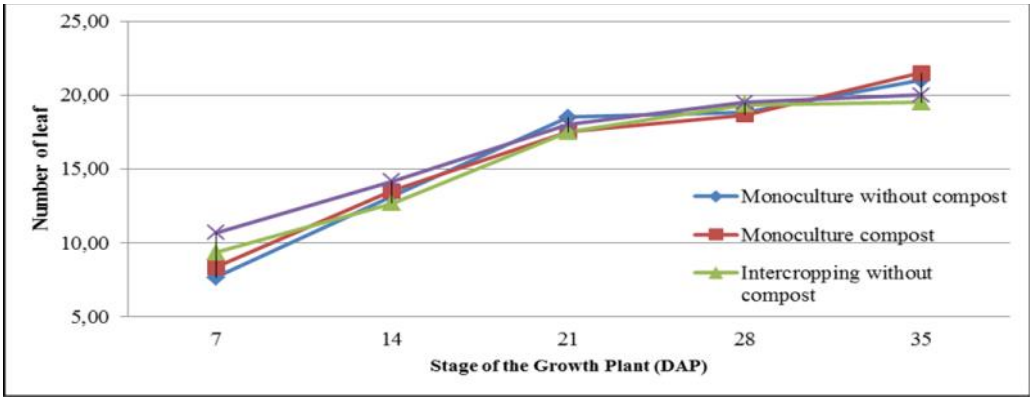

Figure 2. The growth rate of green leaf number on various planting systems and composting, Narmada, MH 2016

Root activity and nodule roots go early at a rapid rate (Indradewa et al., 2004) so that the photosynthate translocation takes precedence over root and root nods, causing N content in tissue and leaves to decrease in initial growth. As the growth of plants grows, the formation of new roots will increase the formation of root nodules, thus increasing the process of nitrogenase and leaf nutrient uptake. Increased nutrient uptake improves the process of photosynthesis thereby increasing the size of the plant.

Competition is a major cause affecting vegetative growth of crops, especially above ground competition. The above ground competition in the planting system is related to the amount of light that can be received by the leaves and can be utilized in photosynthesis process according to Andrews and Newman, 1970 that the above ground competition more influence the optimum population density than the effect of the soil during soil and water fertility level is sufficient .

2. Effect of planting system and use of compost on green bean crops

Variation analysis on yield compoents showed that the number of pods per tree, the weight of pods per tree and the weight of the seeds per tree was influenced by the interaction between planting system and the application of compost on green bean crops. The number of pods contributed positively to the weight of pods per tree and the weight of the seeds per tree in all treatments, the largest number of pods obtained in the non-composted intercropping treatment followed by compost monoculture, intercropping and uncomposted monoculture. The intercropping pattern leads to competition between intercropping plants, but it is suspected that the influence of competition on the development of generative organs can be suppressed by organic compost content that is able to maintain the availability of water and nutrients so that it is available for the growth and development of pods and seeds.

Table 4. Effect of cropping system and compost use on the growth of green beans of Sampeong varieties on inceptisol, Narmada, MH 2016

Planting System	Use of Compost	
	Without Compost	Without Compost
Number of pod/tree		
Monoculture	8.17b	10.67ab
Intercopping	13.83a	8.67b
Pod weight/tree		
Monoculture	6.29b	7.40b

Intercopping	11.46a	6.88b
Seed weight/tree		
Monoculture	4.61b	5.42b
Intercopping	8.56a	4.89b

Description: The number in the same column followed by the same letter is not significantly different in the DMRT test error level 5%

The number of pods per plant in the non-composted intercropping treatment of 13.83 indicates that the growth of green bean plants is able to produce quality pods in accordance with the potential of local Sampeong green beans. Sampeong green beans have a potential number of pods per plant 11-16 pieces. Pods are one component of crop production especially in bean crops. Parameters of pods have not provided a description of the potential for crop production because the weight of pods consists of skin and fill weight but pod production per plot indicates relationship with seed production per plot and weight of 100 seeds, Plants with high pod production per plot yielded seed production per plot and weight of 100 seeds tall one. The highest peak per hectare production in intercropping of compost (1.8 kg, seed production/plot = 1.1 kg) was followed by compost monoculture (1.75 kg, seed production/plot = 1.00 kg), intercropping (1.35 kg; seed production/plot = 0.85 kg) and uncomposted monoculture (1 kg, seed production/plot = 0.6 kg).

The production of green bean plants is largely determined by the weight of the seeds rather than the weight of the pods. In green beans, pods are one of the places of fotosintat accumulation, the filling of potosintat in pods can be maximized if water and nutrients are sufficiently available during the photosynthesis process. The content of organic matter in the compost provided to maintain the moisture content of the soil. The activity of microorganisms in the process of decomposition of organic materials is able to provide nutrients available to plants during the process of photosynthesis so that competition in intercropping systems does not cause plants to deficiency of water, light and nutrients and able to produce good pod quality.

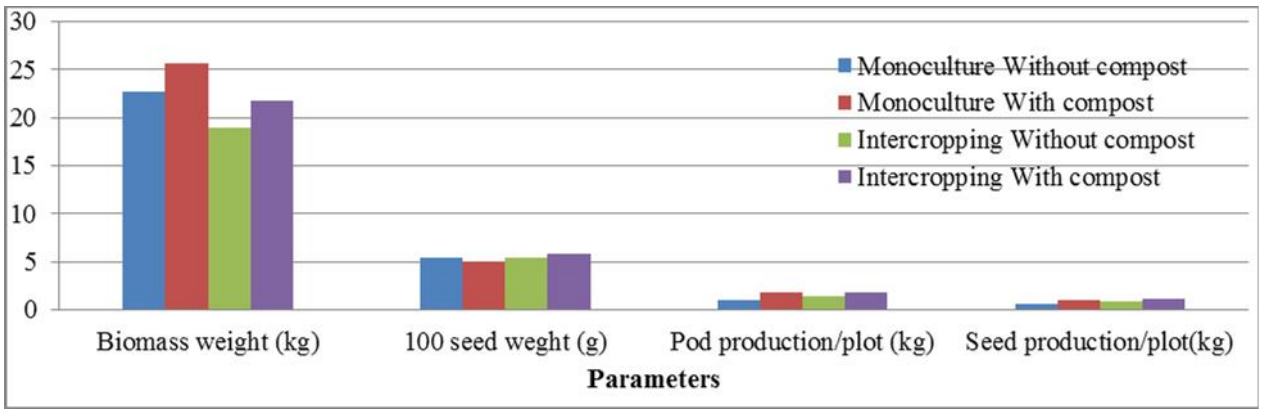

Figure 3. Grain/plot production, seed/plot production, 100 seed weight and weight of local Sampeong green beans on various treatments in Inceptisol soil, Narmada, MH. 2016

Quality pods are related to seed quality, good pods will produce good seeds. Food reserves of carbohydrates as a result of fotosintat will accumulate in the form of pods, food reserves in the form of carbohydrates will then be translocated to seed form so as to increase the weight of the seeds. In the filling phase of the seeds, all the resulting photosynthate is used to increase the weight of the seed. The amount of fotosintat accumulation in the seeds will be reflected on the weight of 100 seeds, photosynthate stored in the seeds of complex

compounds in the form of organic materials, fats, proteins and oxygen. The weight of 100 seeds in composted intercropping (5.80 g) and monoculture without compost (5.47 g) was higher than other treatments. The weight of 100 seeds of green bean plants obtained> 5 g, much higher than the potenai weight of 100 seeds of green beans Sampeong which only ranges from 2.5 to 3.0 g. This indicates that water, nutrients and light are available enough for the plant, the process of photosynthesis takes place optimally and produces a lot of photosynthesis. Stockpile of food reserves in the seeds takes place and produce a heavy seed.

The quality and quantity of crop components is closely related to the presence of available nutrients and can be absorbed by plants. The response of plants to fertilizer also indicates soil nutrient content and soil conditions associated with the ability of soil production to produce crop production. If a plant without composting can produce a component of production that is not significantly different and higher in some components than composted plants means that the actual land used has high production capacity.

The weight of the plant stalk showed that the highest weight was obtained at compost monoculture (25.60 kg) followed by uncomputed monoculture (22.65 kg), intercropping (21.73 kg) and uncompiled (18.9 kg) intercropping. The weight of dry plant stubs is closely related to the vegetative growth of the plant. Plant height and the number of leaves will affect the weight of the plant so that the higher the number of plants and the number of leaves the weight of the stove will be greater. The highest weight gain was obtained in monoculture planting system which also had high plant size and more leaf number compared with intercropping cropping system. Plant height and number of leaves are another form of measurable and observable fotosintat accumulation.

The fresh weight of the stover is related to the amount of photosynth and water content in the plant organ. The dry weight of the stalk is related to the accumulation of photosynthesis in plant organs so that plants with high growth rates will have a high dry weight. According to Junita, et. al., 2012 that the form of photosynth piles in the form of new plant parts that grow is the result of cooperation of leaves and other organs so that the growth rate relative relative to the ability of plants to add dry matter from any organs produced in a certain period.

Table 5. Regression analysis of growth factor influence (plant height & number of leaves) on weight of stover

BS=36,09 + 0.59 Plant Height – 3,04 Leaf Number				
	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	36.08962685	38.81751666	0.929725	0.523174
Plant Height	0.593394379	0.308310774	1.924663	0.305057
Leaf Number	-3.041460859	3.100912455	-0.98083	0.506162
S= 0,71	R^2= 98%	R^2(adjust) = 93%		

The result of regression analysis showed that each one unit of planting height increased the weight of the plant stalks by 0.59 otherwise the addition of one unit of leaf number could decrease the weight of stover by 3.04. The weight of plant stover is strongly influenced by plant height compared to the number of leaves. Leaves act more as organ source and plant height is one form of fotosintat accumulation that appears as measurable growth parameters. Plant height and number of leaves affect the weight of stover by 98% while the rest is influenced by other factors such as pods and seeds.

3. Correlation between parameters on various planting systems and use of compost

Interaction analysis was conducted to see the relation of growth parameters to crop yield components on various planting systems and compost usage. Result of correlation analysis (table 6) plant height correlated positively and significantly with leaf number (r = 0,792 *),

but negative correlation with all generative parameters of plant. The number of leaves was only positively correlated and not significant with the weight parameter of 1 pod (r = 0.01) and the weight of seed / pod (r = 0.056) but negatively correlated with all other generative parameters, in accordance with Ghulamahdi et al. 2009 that the number of leaves is beneficial in increasing pod production. This indicates that the higher the size of the plant is likely to cause the plant has a lot of leaves as one of the properties of superior plants.

Superior crops generally have high plant sizes in accordance with Sumarno and Manshuri (2007) that superior varieties are deliberately high-sized in hopes of obtaining high yields because, according to Noggle and Fritz (1983) that plant height, width and width dry weight of plants is a form of growth that can be seen and measured. The number of leaves many at the time of the generative phase of the plant causes the possibility of leaf to overlap (overlapping) the greater, so the leaf area that receives the light decreases. Limited light causes the leaves can not process photosynthesis to the maximum so that the number of photosynthate is not optimal (Sutoro and Setyowati, 2008). The small number of photosynthesis received by the sink organ causes the quality of the resulting organ such as pods and seeds to be low.

Table 6. Phenotypic correlation coefficient between varieties of local Sampeong green beans

Character	Plant Height	Leaf Number	Pod Lenght	Number of seeds/pod	Weight 1 pod	Weight of seed/pod	Number of pods/ trees	Weight of pod/trees
Leaf Number	0.792							
	0.000							
Pod Length	-0.134	-0.081						
	0.531	0.707						
Number of seeds/pod	-0.120	-0.01	0.776					
	0.576	0.964	0.000					
Weight 1 pod	-0.068	0.01	0.750	0.784				
	0.752	0.963	0.000	0.000				
Weight of seed/pod	-0.022	0.056	0.586	0.690	0.953			
	0.919	0.795	0.003	0.000	0.000			
Number of pods/trees	-0.294	-0.126	-0.134	-0.046	-0.076	0.046		
	0.163	0.559	0.531	0.831	0.724	0.829		
Weight of pod/trees	-0.425	-0.186	0.038	0.132	0.144	0.265	0.947	
	0.038	0.383	0.860	0.539	0.502	0.210	0.000	
Weight of seed/trees	-0.407	-0.170	0.021	0.128	0.151	0.285	0.944	0.998
	0.048	0.427	0.923	0.551	0.481	0.178	0.000	0.000

Description: *: significantly different at the 0.05 opportunity limit based on Pearson correlation

The number of pods per tree showed a positive and very significant correlation with the weight of pods per tree (r = 0.947) and seed weight per tree (r = 0.944). This indicates that the more pods formed in one plant will cause the weight of the pods per tree and the higher the seed weight of the trees, but show a negative correlation and not significant with the pod length (r = -0.134), the number of seeds / 0.046) and weight of 1 pod (r = -0.076). The number of pods that form will affect the quality of pods and seeds produced. The pods formed will be filled by photosynthat that will then form the seeds so that the availability of photosynthesis affects the quality of pods and seeds. The large number of pods that make up the

photosyntheses required more and more and should be redistributed to all the organ sinks evenly. Distribution of photosynthesis that does not go well will produce short and light pods and low seed quality. During the process of filling the seeds, most of the resulting photosynthate is used to increase seed weight.

The length of the pods showed a positive and significant correlation with the number of seeds per pod (r = 0.776), the weight of pods (r = 0.750) and the weight of the seeds per pod (r = 0.586), means that the longer pods tend to pick up the number of seeds resulting in heavy pods and high seed weight per pod. The pod is one of the organ sinks in which the foliage accumulates, the amount of photosynthate received will affect the quality of the pod. The more fotosintat the pods receive, the longer they grow, with the ability to form a high seed to produce the weight of pods and the weight of the seeds per pod.

4. Conclusion

Green bean plants grown with monoculture cropping system and use of compost at flowering (35 HST) has the highest plant height (91.82) and leaf number (21.50). The second is the highest grain yield (1.1 kg) was obtained from green bean plants grown on intercropping systems with compost use. Third, the highest dry weight of green bean plant (25,60 kg) was obtained on monoculture plant system with compost usage.

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Desaining And Developing Rechargeable Aluminium-Ion Battery Based On Corncob As Activated Charcoal

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Abstract

This study aims to know the technique of making rechargeable aluminum-ion battery based on activated charcoal of corncob waste and to know the best composition of materials to produce optimum potential (V) and current (mA). The research titled designing and manufacturing of rechargeable aluminum battery based on activated charcoal of corncob waste using electrochemical process to produce potential (V) and electric current (mA). There are two electrodes used in which aluminum as anode undergoes oxidation reaction and graphite or carbon rods as cathode undergoes reduction reaction. Type of this study is research and development which is a series of processes or steps in order to develop a new product or refine an existing product. The optimum ratio in the production of aluminum-ion rechargeable batteries based on activated charcoal of corncobs is 75% activated corncobs, 25% polypyrol catalyst (MnO2), and KOH 4.5%. This ratio produce 66,50 mA at the first hour as optimum current capacity the first hour of 66, 50 mA because the remaining wet condition of electrolyte at this point allows the electrons to move easily. For the value of the optimum voltage in the first two hours is a discharge voltage of 2.45 Volts and superfast charging time requires merely one minute.

Keywords: Rechargeable aluminum-ion battery, activated charcoal of corncob, KOH, polypyrol catalyst (MnO2)

1. Introduction

The availability of sustainable energy is one of the most important issues in every country including Indonesia. This is not inseparable because almost all sectors of economic development depend on the availability of sufficient energy (Secretariat of Energy Resources Technical Committee, 2006).

Thefore, it is wise step to look for more approriate alternative energy supply system. Utilization of the potency of primary energy and alternative energy depends on the condition of the area where the energy is located. The determination of the type of energy generator must meet the criteria of development and energy management namely reliability, security and economics (Agung, 2013).

One of the efforts to find alternative energy sources is developing battery. The main reason for the battery to be alternative energy because it is simple, lightweight, durable and rechargeable energy (Minami et al., 2005). The battery is an electrochemical cell that produces a constant current of the electrochemical reaction. This product is an electronic equipment that converts chemical energy into electrical energy. It has two electrodes in which the chemical reaction will take place by generating an electron. Both anode and cathode electrodes are connected to a solution called an electrolyte which the ion can move through the medium. The movement of these electrons will produce an electric current that can be used as a source of energy for electronic equipments (Sagir & Mohd, 2011)

The renowned form of batteries in the environment are generally solid cylinders or solid boxes. This is mainly because there are various metals and fluids or electrolyte pastes that are used to produce a battery. The ingredients sometimes are toxic to humans so they should always be wrapped in 'cans' or boxes to prevent the occurrence of leaking of such hazardous chemicals.

One more thing that becoming our binding concern is the habit of populace in recycling batteries especially disposable batteries irresponsibly. Some people throw the batteries into the trash so they mix together with other rubbish, some throw them in the river, some even throw away any roadside or in the field. Many people are less aware of the dangers and impacts of primary battery waste on the surrounding environment.

One solution in overcoming the above problems is to develop aluminum batteries with the basic ingredients of activated charcoal waste corncobs. Corncob is agricultural waste that so far has not been widely utilized into products that have additional value. The aluminum-based battery of activated charcoal of corncobs can also be recharged. This battery is also very safe, and no need to concern about the content of materials that are harmful to the environment.

On an aluminum-based battery, the anode is one of the most important components. Theoritically, the voltage values generated by each type of battery will differ according to the type of metal used as the anode. This difference is based on the standard potential energy value of each metal (Vincenzo & Benedetko, 2014). Aluminum metal acts as an anode on this battery, so this battery is named as an aluminum ion battery. The aluminum metal in this battery system will experience an oxidizing reaction by generating $Al_2Cl_7^-$ and electron. This electron will then move towards the cathode. The movement of electrons to the cathode will produce electrical energy (Modesto & Julie, 2007). The aluminum battery is described as a battery that has a high enough potential. This battery can be applied in various fields of application including in the military field. This is because aluminum batteries have a pretty good advantage such as lightweight and rechargeable power (Rao et al., 1992).

One type of cathode used in aluminum-based batteries is graphite or three-dimensional graphite foam. This three-dimensional graphite foam is made from Nickel (Ni) foam, used as a 3D scaffold for the growth of graphite foam CVD (Meng-Chang Lin et al., 2015). In addition, other types of cathodes used in aluminum-based battery systems consist of three main components: porous carbon, catalyst and binder polymer (Jang et al., 2011).

The porous carbon on the activated carbon based on the structure pattern is an amorphous carbon material composed mostly of free carbon and has an inner surface, thus having a high absorptive capacity (Alfathoni G., 2002). Activated carbon has a good absorption capacity to the solution as well as gas, activated carbon is one of the most frequently used adsorbents in the adsorption process. This is because the activated carbon has better absorption and surface area than other adsorbents (Walas, 1990). The nature of the activated carbon may be used as an electrode or as a gas absorbent medium to perform electrochemical processes on aluminum-based batteries (Yugang, 2013).

2. Materials and Methods

2.1 Materials

Material is used in this research is aluminum foil, graphite, Activated charcoal from corncob, polypyrrole catalyst (MnO2), KOH, aquadest, LED light, cable, electric switch, tissu, box acrylic.

The research titled design and manufacture of rechargeable aluminum-ion battery based on activated charcoal of corncob waste using electrochemical process to produce potential (V) and electric current (mA), used two electrodes include aluminum as cathode experiencing oxidation and graphite or carbon rod as Cathode witnissing a reduction reaction.

2.2 Methods

Type of research used is research and development. Research and development is a series of processes or steps in order to develop a new product or refine an existing product

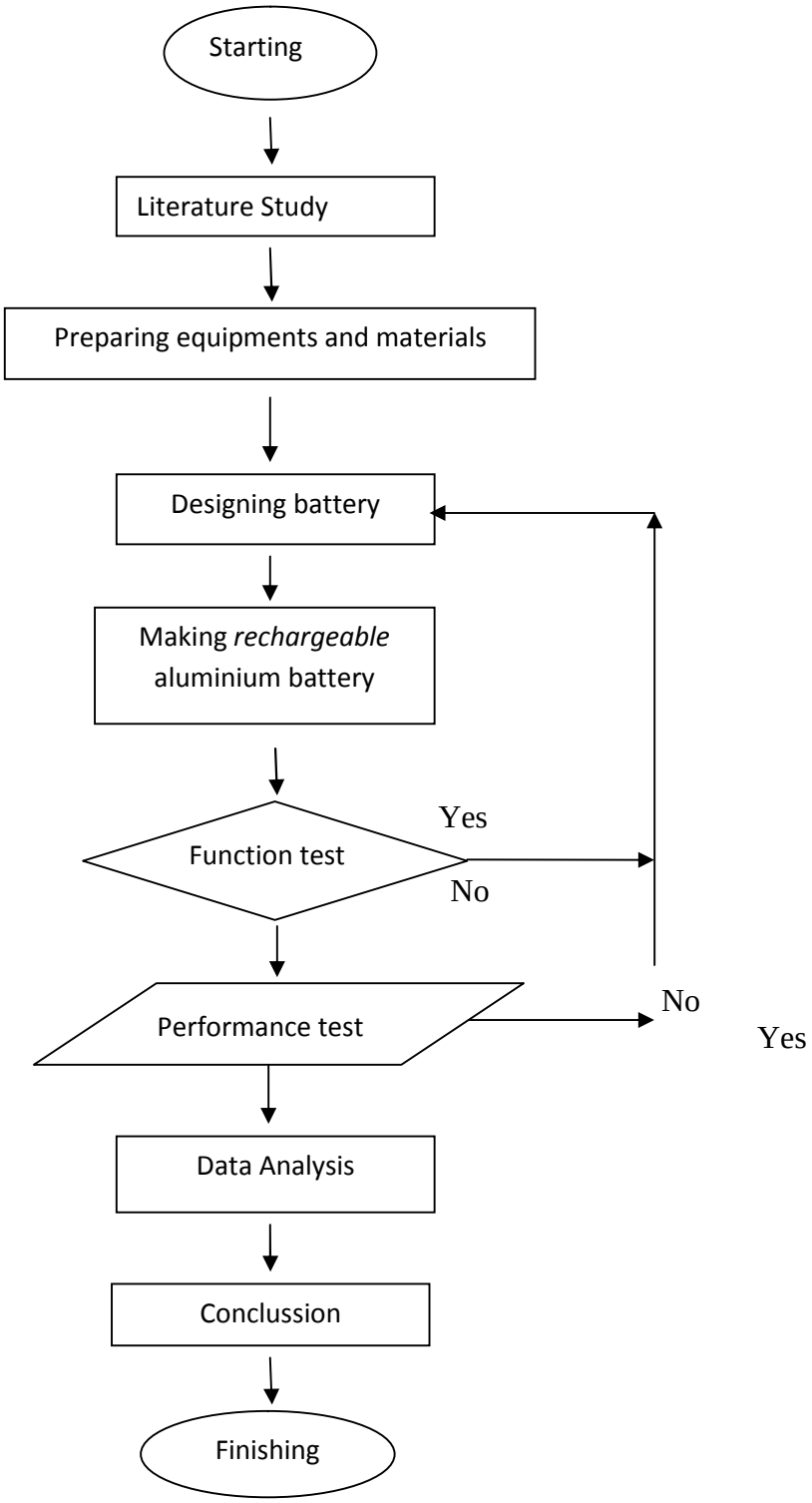

Figure 1. Flow Chart of Research

2.2.1 Designing Battery

This step contains all procedures in making rechargeable aluminum battery based on activated charcoal of corncob waste which are as follow:

1. Preparing all equipments and materials which will be used in this study.
2. Making KOH with composition 2,5 grams, 3,5 grams and 4,5 gram in 0,1 L aquadest, then they are dissolved to form 2,5 %, 3,5 % and 4,5 % of KOH

3. Making electrolyte for battery use activated charcoal from corncob waste with composition:
   a. 75 % activated charcoal form corncob, 25 % polypyrrole catalyst (MnO2), and KOH with concentration 2,5 %
   b. 75 % activated charcoal form corncob, 25 % polypyrrole catalyst (MnO2), and KOH with concentration 3,5 %
   c. 75 % activated charcoal form corncob, 25 % polypyrrole catalyst (MnO2), and KOH with concentration 4,5 %
4. Each composition of the above electrolyte mixture is then mixed becoming homogeneous to a concentration of 25%.
5. After all tools and materials have been prepared, the next step is designing rechargarbe aluminium batteries in which aluminium foil as anode and graphite as cathode with tissue as separator of both electrodes

2.2.2 Making *Rechargeable* Aluminium Battery

Figure 1. Making the electolyte of battery

Figure 2. Put electrolyte and positive electrode (graphite) on separator (tissue)

Figure 3. Rolled up to form cylinder

Figure 4. Aluminum foil coating

Figure 5. Measuring potential (V) and current (mA)

Figure 6. Perform test of battery

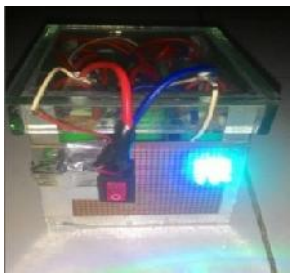

Figure 7. Final product of battery applying for LED light

Figure 8. Final product of battery Appalying for mobile charging

3 Results and Discussion

3.1 Initial Data Result of Aluminum-ion Battery Testing

In this study three electrolyte samples were used where the first electrolyte consisted of a mixture of 75% activated charcoal corncobs, 25% polypyrrole catalyst (MnO2), and 2.5% KOH . The second electrolyte comprises a mixture of 75% activated charcoal corncobs, 25% polypyrrole catalyst (MnO2), and a 3.5% KOH concentration. The third electrolyte contains a mixture of 75% activated charcoal of corncobs, 25% polypyrrole catalyst (MnO2), and a KOH concentration of 4.5%

From the results of aluminum-ion battery testing, the optimum composition was obtained in the third electrolyte sample that comprises 75% activated corncobs, 25% polypyrol catalyst (MnO2), and 4.5% KOH concentration as shown in Table 2. In the composition, the optimum current value reaches 62.21 mA with a voltage potential of 2.37 Volts.

Table 1. The average value for potential and current at rechargable aluminium battery

Electrolyte	Potential (V)	Current (mA)	Optimum Value	
			V	mA
I	2,18 V	44,86	2,37	62,21
II	2,33 V	59,86		
III	2,37 V	62,21		

The main requirement of the battery to be able to generate voltage is there any a potential difference of both electrode and electric current. The potential difference occurs because of the difference in the number of electrons in production of the electrochemical process. While the electric current is the amount of charge caused by moving of electrons. In this study, the maximum value of electric current is 62.21 mA in the composition of 75% activated corncobs, 25% polypyrol catalyst (MnO2), and KOH concentration 4.5%.

3.2 The testing of Electrical Energy from Rechargeable Aluminum-ion Battery Against Time

The testing results of designing and manufacturing the battery were obtained shown in table 2.

Table 2. Characterstics of potential and electric current from aluminium-ion battery against time

Electrolyte	Potential (V)				
	1st hour	2nd hour	3rd hour	4th hour	5th hour
I	1,85	2,12	2,18	2,23	2,38
II	2,09	2,25	2,32	2,34	2,38
III	2,20	2,40	2,45	2,45	2,45
Electrolyte	Current (mA)				
	1st hour	2nd hour	3rd hour	4th hour	5th hour
I	50,67	48,97	43,00	41,00	40,67
II	64,66	63,65	60,56	50,60	50,00
III	66,50	65,38	62,76	60,66	55,78

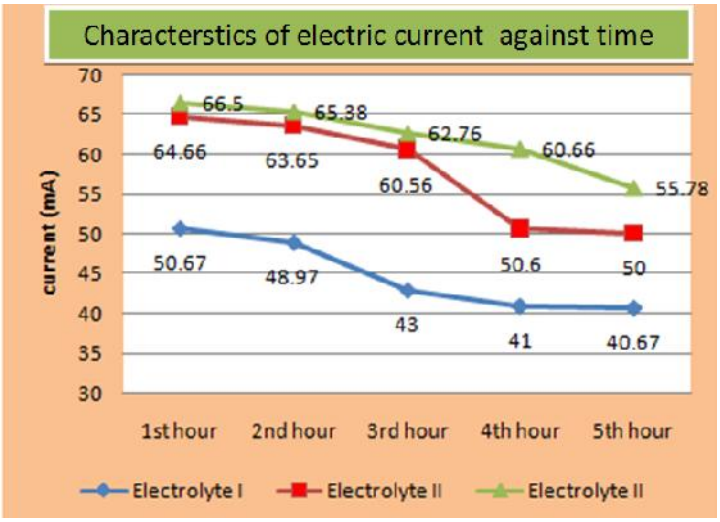

Figure 3. The characteristic of electrical potential in each electrolyte against time

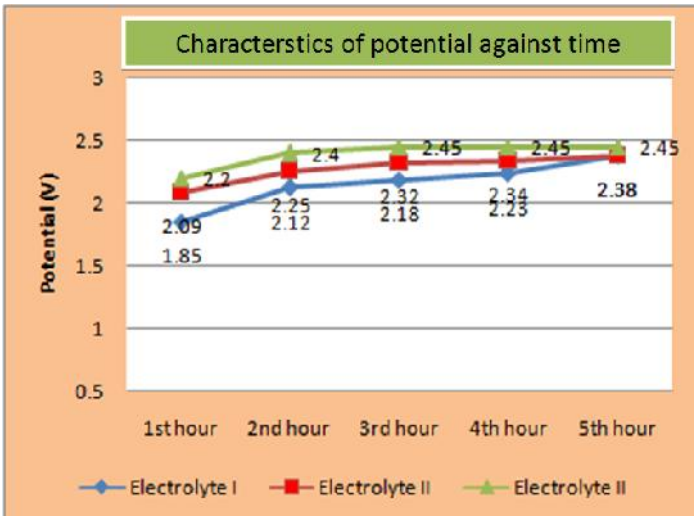

Figure 4. The characteristic of electrical current in each electrolyte against time

From the results of electrochemical testing on rechargeable aluminum-ion batteries (see figure 3 and figure 4) it is found that the optimum average voltage is in the first two hours, while the optimum average current in the first hour of the thirt electrolyte sample with composition 75% activated charcoal corncobs, 25% polypyrol catalyst (MnO2), and 4.5% KOH concentration. In general, it is observed that the voltage occurs every hour tends to rise, but the resulting current value tend to decrease, because to produce a stable voltage takes time for electrochemical equilibrium to run properly. While the causes of current value tend to decrease is the corrosion on the anode with electrolyte, so the production of ions to produce electrons is reduced every hour. Another problem is the reduction of the amount of liquid electrolyte used because it is consumed to produce current at the beginning of the running electrochemical process.

In the system of aluminum-based battery there are two major issues affecting its performace. First issue, aluminum metal is highly susceptible to corrosion in open-circuit potential conditions and when subjected to discs caused by reactions that occur between the water and the anode. The second issue is the formation of a passive hydroxide layer on the aluminum surface, thus inhibiting the dissolution of aluminum metal and causing the change of potential energy of aluminum metal. (Egan et al, 2013). In addition, another problem that

arises is the resulting of H_2 gas by the reaction between metal and electrolyte which will make the system from the battery break (Vincenzo et al, 2014).

According to (Mohammad, 2008, Gelman et al., 2015, Vincenzo et al., 2014) anode metal is corroded by reaction between the electrolyte and the surface of the aluminum battery, and will also form a metal hydroxide coating. This causes the process of migration of metal ions to the cathode will be inhibited and this causes decreased energy density and battery life to be short.

To solve the above problem can use pure aluminum (99.99%) as anode material with a combination of metal Mg, Sn, In and Ga. This metal can prevent corrosion and can also break the passive hydroxide layer on aluminum. However, considering that pure aluminum is relatively expensive then the alternative that can be used is to add inhibitor or direct additive to the electrolyte. It can also use gel electrolytes or alternative solvents such as alcohol and ionic liquids (Egan et al, 2013).

According to (Marliyana et al., 2015, Othman et al., 2001, Mohammad, 2008), another method developed to overcome this problem is by using a hydrogel polymer membrane. This membrane has the ability to bind water sufficiently good and has a high permeabiality, so the process of ion migration is maintained. This product will make the conductivity of the battery stay high. Therefore, this makes the hydrogel polymer membrane to be one of the potential ways to inhibit the corrosion process on the anode surface of an aluminum ion battery.

According to Jang et al., (2011), if the size of the activated charcoal particle is too large, it will form larger pores that its application will cause the aluminum battery's energy density decreases. This phenomenon occurs because the speed of electrochemical reactions that occur more quickly, so the process of formation of precipitation and corrosion on the surface will also take place quickly.

4 Conclusion

Based on the result of the research and the description of the discussion that have been presented, it can be concluded that the optimum ratio in the manufacture of aluminum-ion rechargeable batteries based on activated charcoal of corncobs waste is 75% activated corncobs, 25% polypyrrole catalyst (MnO2), and KOH 4,5% with the optimum current capacity in the first hour of 66.50 mA. This is mainly because at this point the electrolyte is still wet which allows the electrons to move. While the value of the optimum voltage in the first two hours with a discharge voltage is 2.45 Volts, and superfast charging time is only a minute.

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Urea Recovery from Industrial Wastewater by Adsorption using Porous Carbon and Its Utilization as Fertilizer

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Abstract

Wastewater discharged by urea manufacture usually contains urea in a high concentration. As the predominant constituent, concentration of urea in the wastewater is in the range of 2000-4000 ppm. In this high level discharge, urea disposal to environment may lead to eutrophication in aquatic ecosystem and decrease dissolved oxygen needed by aquatic organism. For this reason, decreasing amount of urea from wastewater is urgently required to meet an environmentally safe condition. In fact, urea is an important nitrogen source for plant which is produced from ammonia and carbon dioxide and the price is relatively high. Urea uptake from industrial waste water and utilizing it for fertilizer is of high interest. The purpose of this study is to uptake urea from fertilizer manufacture wastewater by adsorption using porous carbon and to use it as fertilizer. The porous carbon as adsorbent was made from coconut shell. Modification of carbon surface was performed by oxidation using sulfuric acid (50%) at 90^{o}C temperature. The adsorption study was conducted at room temperature with variation of urea concentration in the range of 500-20000 ppm. Results reveal that the adsorption of urea follows a multilayer adsorption system. A high amount of urea can be recovered from wastewater with 10% uptake capacity. Furthermore, the adsorbed urea in porous carbon shows efficacy when used as fertilizer. Therefore, the study shows the promising method of urea recovery from industrial wastewater and its application for fertilizer.

Keywords: adsorption, porous carbon, fertilizer, urea

1. Introduction

Indonesian government aims to improve national food production especially the staple food, rice As an agricultural country with tropical climate and fertile land, to date Indonesia is still struggling to be self-provided food country. However, the secure of national food production needs improvement on crops yields which dependent to the role of fertilizer. Urea is one of important fertilizer required for cultivation of paddy, staple food crops for Indonesian. Due to demand, Indonesia produces a high amount of urea. However, it results problem that wastewater of this fertilizer manufacture contains high concentration of urea and ammonia. Concentration of urea in wastewater range from 1500 to 10000 mg/L while ammonia range from 400 to 3000 mg/L (Swaminathan et al., 2005). Based on regulation, concentration of urea and ammonia released to environment should not exceed 200 mg/L and 50 mg/L, respectively. High concentration urea which freely disposed to aquatic environment can promote eutrophication or blooming algae (Hassani et al., 2012). Algae will not only consume nutrient provided for aquatic organism but also make sunlight difficult to penetrate as it covers the surface of water. Moreover, algae form a toxic substance which harm aquatic organism (Marhaini et al., 2013). Ammonia also toxic for aquatic organism, absorb oxygen in water, corrosive and cause eutrophication (Bitton, 2005).

Common treatment method for wastewater in urea manufacture is hydrolysis-stripping method where urea is hydrolyzed into ammonia gas (NH_3), CO_2, and water (H_2O). Ammonia is then stripped by air. Air containing ammonia gas finally released to atmosphere. This method is quite effective, but it needs high pressure and temperature. Ammonia released also produces emission to ambient air. While on the other hand, adsorption has been developed and accepted universally as one effective process to remove pollutant with less cost, easier operation, less reagent, and higher capability to regenerate treated component by

desorption or adsorbent regeneration (Dada et al., 2012). According to Rashed (2013), adsorption is widely used to treat industrial wastewater from uranic pollutant.

This work describes adsorption of urea using porous carbon as potential adsorbent. Porous carbon is modified by sulphonic group and the performance is studied. After adsorption process, urea release from adsorbent system is investigated, hence identifying the discharge performance of urea. The method proposed will give two advantages: i) treating pollutant in wastewater without causing new pollutant or emission, ii) providing nutrient source and or nutrient holder for crops by using adsorbate/adsorbent as fertilizer.

2. Material and Methods

2.1. Material

Materials used in this research are commercial porous carbon (PT. Home System Indonesia, Surabaya), concentrated sulphuric acid (H_2SO_4 98%), ammonium hydroxide (NH_4OH 25 wt.%), urea pro analysis, methanol pro analysis, deionized water, and paradimethyl amino benzaldehyde (PDAB, Merck). The porous properties of carbon with and without treatment of sulphuric acid are shown in **Table 1**.

Table 1. Carbon properties

Carbon	BET surface area (m^2/g)	Pore volume (cm^3/g)	Average pore diameter (Å)
Untreated	919	0.37	8.003
Treated	886	0.39	8.818

2.2. Methods

Carbon was firstly washed with deionized water. About 15 ml deionized water was used for each gram of carbon. Carbon was then heated at water boiling point for approximately 2 hours. Carbon was filtered and dried by oven with temperature of 110 ^oC. Modification process using sulphuric acid was carried by soaking 50 gram carbon in sulphuric acid solution (55%). The ratio of sulphuric acid/carbon was 5 mL/g carbon. The mixture was then heated using reflux condenser at temperature of 90^oC for approximately 2 hours. Carbon was then filtered, washed using aquadest and dried at temperature of 60^oC. Adsorption was conducted by adding an amount of porous carbon into synthetic wastewater, made by dissolving urea and urea-ammonia with varied concentration. The contact between treated carbon and solution were carried out in shaker waterbath for approximately 24 hours at room temperature with speed of 180 rpm. Ratio between treated carbon and solution was 0.5 gram carbon for 50 ml solution. Desorption process was conducted with several steps i.e. adsorption, adsorbent separation, and desorption process in 50 ml aquadest.

Mole of adsorbate adsorbed at equilibrium state ($C_{«}$, mmol/g) can be determined with this following equation:

$$C_{«} = \frac{V(C_o - C_e)}{1000 \times m} \quad (1)$$

V = volume of solution (mL), m = mass of adsorbent (g), C_o = initial concentration (mg/L), C_e = concentration at equilibrium (mg/L).

Freundlich and Linear isotherm model are employed as shown in Equation (2) and (3).

$$C_{«} = K \cdot C_e^{1/n} \quad (2)$$

model equation is

$$C_{«} = H \cdot C_e \quad (3)$$

Urea desorption from carbon follows the mass transfer correlation that neglects convection or diffusional mass transfer. The equations are as follows.

$$N_{Ax} = -D_e \frac{dC_A}{dx} \quad (4)$$

$$N_{Af} = k_c\left(C_{Af}^{*} - C_{Af}\right) \quad (5)$$

$$C_A = H \cdot C_{Af}^{*} \quad (6)$$

From mass balance on volume increment of adsorbent, the following equation is obtained:

$$\frac{\partial^2 C_A}{\partial r^2} + \frac{2}{r}\frac{\partial C_A}{\partial r} = \frac{1}{D_e}\frac{\partial C_A}{\partial t} \quad (7)$$

With boundary conditions:

$$C_A(r,0) = C_{A0} \quad (8)$$

$$-D_e \left.\frac{\partial C_A}{\partial r}\right|_{(R,t)} = k_c\left(C_{Af}^{*} - C_{Af}\right) = k_c\left(\frac{1}{H}C_A(R,t) - C_{Af}\right) \quad (9)$$

$$\left.\frac{\partial C_A}{\partial r}\right|_{(0,t)} = 0 \text{ (solute concentration at the increment center is maximum)} \quad (10)$$

The value of effective diffusivity (D_e), mass transfer coefficient (k_c) and Henry equilibrium constant (H) are evaluated using data of urea concentration (C_{Af}) at each time (t).

3. Results and Discussion

3.1. Carbon properties

Sulfuric acid modification on porous carbon has probability to create sulfonic functional group R−S(=O)$_2$−OH, where R is an organic alkyl. This was characterized using Fourier Transform Infrared Spectroscopy. Urea or aryl group and the S(=O)$_2$−OH group a sulfonyl hydroxide are showed by the peak in the range of 1200 – 1100 cm^{-1} (Coates, 2000). FTIR spectra results for treated carbon showed its peaks on 1100 cm^{-1} that confirmed sulfonic groups on carbon surface (see **Figure 1** and **2**).

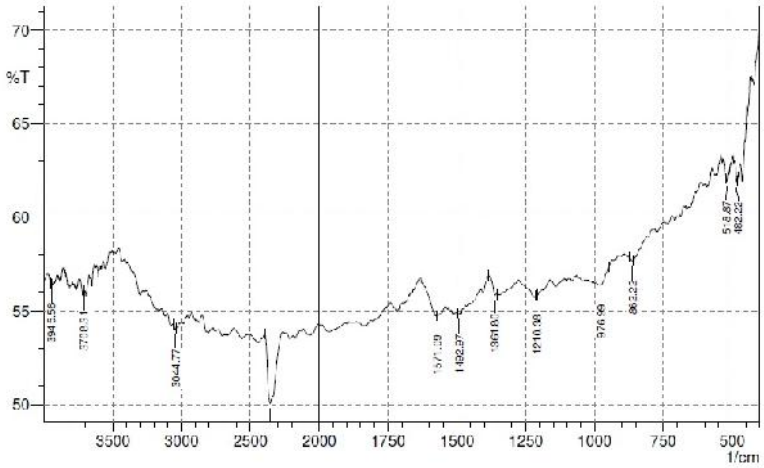

Figure 1. FTIR spectra for untreated carbon

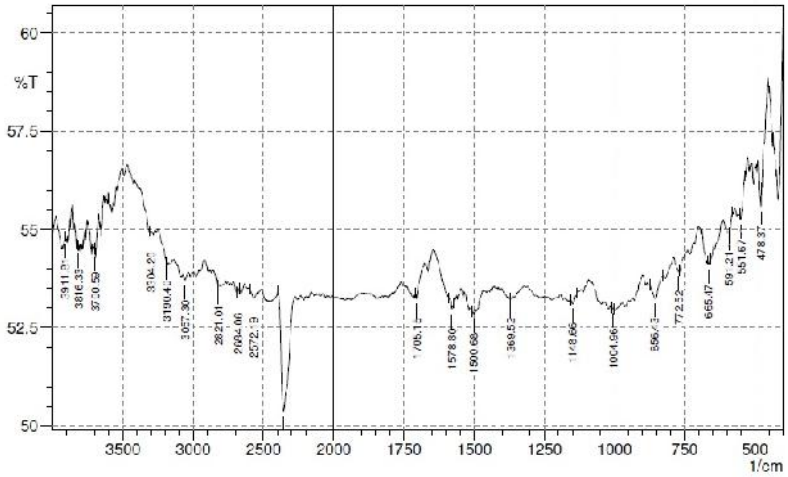

Figure 2. FTIR spectra for carbon impregnated with sulphuric acid (treated)

The uptake comparison of porous carbon with and without treatment was then studied for urea uptake. The results are shown in **Figure 3**. Treated carbon showed a better performance in adsorption compared to untreated carbon. An average urea uptake enhancement in the range of 6.37-10 % results. This is in agreement with Gao et al. (2017) experiment on influence of surface modification by sulfuric acid on coking coal's adsorption of coking wastewater.

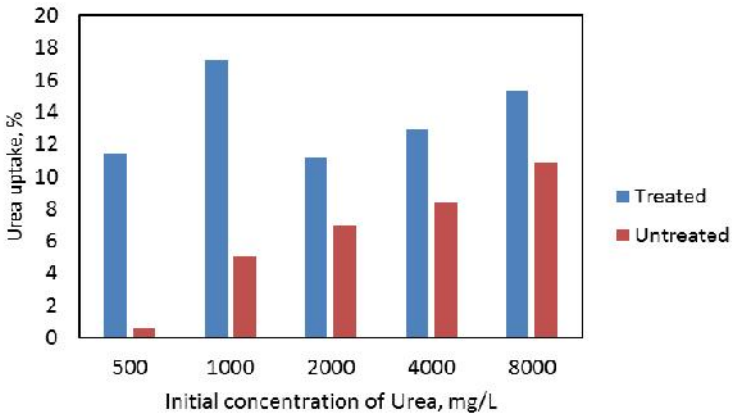

Figure 3. Comparison of urea uptake from treated and untreated carbon

3.2. Adsorption characteristic of urea on treated carbon

Figure 4 displays urea adsorption isotherm in treated carbon. The adsorption capacity increases linearly when a higher concentration of urea/ammonia in the solution presents. This indicate that urea isotherm adsorption on carbon modified with sulphuric acid is a multilayer isotherm. Freundlich and Linear isotherm model approach give R^2 value 0.995 and 0.999, respectively. It is noted that a $R^2 > 0.9$ exhibiting a good fitting between model and experimental data. In case of scientific purpose, Freundlich model are being selected.

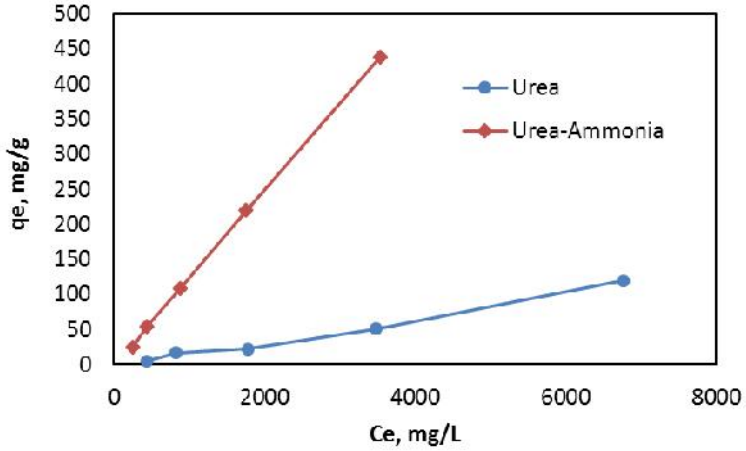

Figure 4. Adsorption isotherm curve of treated carbon with urea and urea-ammonia adsorbate

Adsorption performance of treated carbon was taken into account with two variant adsorbate i.e. urea and urea-ammonia. **Figure 5** shows the urea uptake at different initial concentration of solution. In urea-ammonia adsorbate solution, urea uptake is as high as 54%. This is almost constant when using different initial concentration. This indicates a significant adsorption of urea in treated carbon, which is a multilayer adsorption behavior. When using only urea, the adsorption capacity is lower than in case of using urea-ammonia which can be caused on different pH solution.

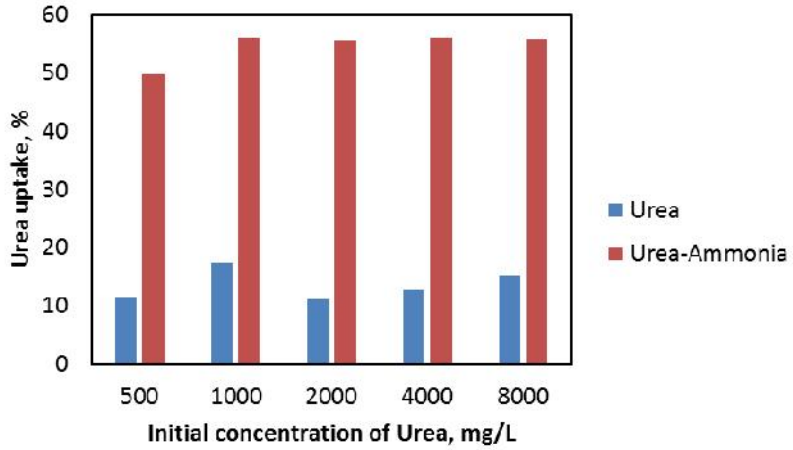

Figure 5. Urea uptake of treated carbon with urea and urea-ammonia adsorbate

3.3. Desorption of urea from urea/carbon

Freundlich model was used to obtain desorption parameter i.e. diffusivity coefficient (De) and mass transfer coefficient (kc) when simulating desorption data. The values of parameters are summarized in Table 2. Diffusivity coefficient value of urea on porous carbon is in order

10E-9 indicating that release of urea is likely follow diffusion rate of solid rather than liquid (Cussler, 1997).

Table 2. Equilibrium constant, diffusivity, and mass transfer coefficient for urea desorption using Freundlich model

Initial concentration of Urea, mg/L	H	De (cm^2/s)	kc (cm/s)	K	n
1000	0.0104	8.5948E-10	0.0134	0.0272	0.6569
2000	0.0104	2.2625E-09	0.0082	0.1380	0.5995
4000	0.0104	2.9964E-09	0.0087	0.1143	0.6137

3.4. Impregnated urea on carbon *vs.* pure urea in release test

Pure urea (prill) releases into water with more rapid rate compare to urea-treated carbon system (see **Figure 6**). At an instant time, prilled urea has released about 95 % of its total urea while urea-treated carbon discharges less than 40 % of its total urea. This result indicates that a relatively slowed release of fertilizer can be obtained when using system of urea/porous carbon.

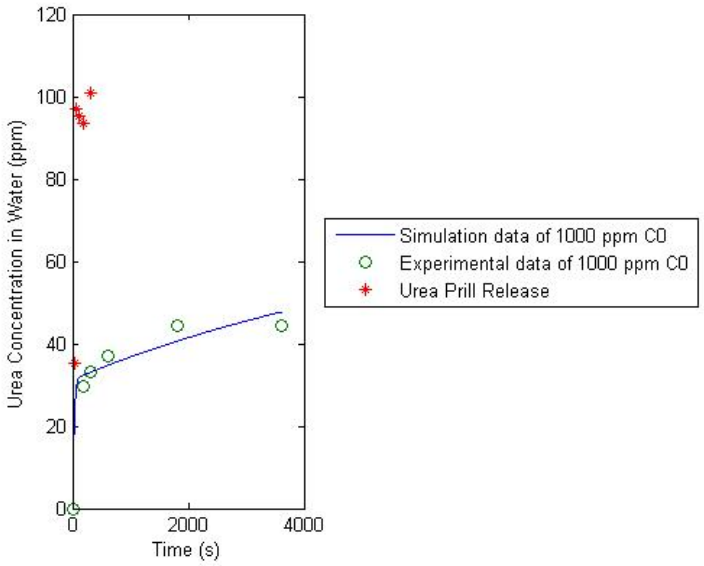

Figure 6. Comparison of urea desorption curve/release from treated carbon and urea prill

4. Conclusion

Porous carbon can be successfully employed to uptake urea from wastewater model. The study showed that treating carbon with sulphuric acid significantly enhances the adsorptive capacity of urea. The adsorption of urea on treated carbon displays a multilayer adsorption behavior and the uptake capacity up to 54% is obtained when using urea-ammonia system. Desorption study displays that urea discharge from urea/carbon is slow enough, hence promising as controlled release fertilizer.

Acknowledgements

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Imagined Regional Communities: Language Issue in a Decentralisation Policy in Indonesia

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Abstract

Since the former of Indonesian President BJ Habibie ratified the law of regional autonomy in 1999, a wave of making new regional autonomy in Indonesia seems to be difficult to avoid. Until 2014, as recorded, more than 500 numbers of new autonomous regions have emerged from the spirit of decentralisation. At the time, the effort to build new autonomous regions is still ongoing in the most of the regions in Indonesia. Apart from some advantages and a great deal of hope from this low (Erb, 2005), this phenomenon has shown that a sign of social disintegration is facing a new challenge after Indonesia's independence was proclaimed in 1945. In a plenary session of Indonesian House of Representative held on May 2014, there was an agreement to establish 11 numbers of new regional autonomy in Indonesia – as widely covered by media – comprising two provinces and nine regencies. As the way of accelerating equality of development in each region in Indonesia, regional autonomy policy seems to be eye catching and promising idea; however, on the other hand, building new autonomous regions driven by some elites in some regions is sometimes more likely kind of introducing identity as a different community with others. From that reason, forming new autonomous regions might threaten national bond, and hence neglecting it might result in social or national disintegration. Therefore, this paper will shed a light on the relationship between the issues of decentralisation, language, and social disintegration in Indonesia, particularly in the case of West Nusa Tenggara Province.

Keywords: *regional autonomy, decentralisation, language*

1. Introduction

Since the former of Indonesian President BJ Habibie ratified the law of regional autonomy in 1999, a wave of making new regional autonomy in Indonesia seems to be difficult to avoid. Until 2014, as recorded, more than 500 numbers of new regional autonomy have emerged from the spirit of decentralisation (Republika, 2014). At the time, the effort to build new regional autonomy is still ongoing in the most of regions in Indonesia. Apart from some advantages and a great deal of hope from this low (Erb, 2005), this phenomenon has shown that a sign of social disintegration is facing a new challenge after Indonesia's independent day was proclaimed in 1945. In a plenary session of Indonesian House of Representative held on May 2014, there was an agreement to establish 11 numbers of new autonomous regions in Indonesia – as widely covered by media – comprising two provinces and nine regencies.

In spite of widening a gap between group of people, the path of autonomy could strengthen differences of identity within the societies. A vivid example can be seen in the case of an effort of building Banyumas province in Central Java. As noted by (Nothofer, 2012), Banyumas people strove to secede from the Central Java province in order to create a new province, Banyumas province. In this case, elites deemed that group of people located in Central Java province was different from a group of people living in Banyumas. One of the reasons utilized to mobilize people in forming new autonomous region in Banyumas was a linguistic difference. As explained by Nothofer, elites of Banyumas argued that language used in Banyumas was different with the language used in Central Java, mainly in Solo and Yogyakarta. They regarded that dialectal variant of Java language in Solo and Yogyakarta owned by a noble society that was not appropriate to Banyumas people.

From that reason, it is a vivid role of language as a means of driving people to achieve a political agenda. Thus, in this paper I will shed a light on the issue—the relationship between the issues decentralisation, language, and social disintegration in Indonesia, particularly in the case of West Nusa Tenggara Province.

2. Materials and Methods

There is a strong correlation between language, identity, and space (Anderson, 2006; Bucken-Knapp, 2012; Blommaert, 2013; Goebel, 2015). This is cannot be separated from the fact that a practice of speech asserted by one community expresses their mind and view about the world. In this sense, referring to Pasis's framework of building regions regarding 'knowing-that' and 'knowing-how', 'regions are result of making in the course of narrativization by elites using their administrative power to construct reality though speech'. (Azizov, 2017; see also Daniels, 2005; Errington, 2008; Matsuzato, 2010; Golosov, 2012; Makarychev, 2012; Korostelina, 2013; Svarin 2016). In case of making autonomous regions in West Nusa Tenggara, I employ a literature review to collect data. Those are then analyzed based on a qualitative method.

3. Results and Discusion

West Nusa Tenggara province is located in the central part of Indonesia. It encompasses 8 regencies (West Lombok, East Lombok, North Lombok, Central Lombok, West Sumbawa, Sumbawa Besar, Bima, Dompu) and 2 cites (Mataram and Bima). Situated between 115 ° 46 '- 119 ° 5' East Longitude and 8 ° 10 '- 9 ° g 5' South Latitude, it covers area of 20.153,15 square kilometers. Most of its inhabitants live in Lombok Isaland. Of 10 regencies, two of those emerge later resulted from the spirit of decentralization, namely West Sumbawa emerging in 2003 and North Lombok emerging in 2011. Interestingly, forming a geographical area of the two newest regions shows a similar linguistic feature. Based on Mahsun (2006a), there are four dialects of Sasak language used by Sasak tribe in Lombok Island, namely Bayan, Selaparang, Aiq Bukaq, and Pejanggik. As we can see in the figure (1) and (2), Bayan dialect is mainly used in northen area of Lombok. When North Lombok emerged in 20011, the border of area between North Lombok and West Lombok depicts an identical border with the boarder of geographical dialect of Bayan and Pejanggik. This means that there has been a linguistic role used by elites in order to drive people in forming North Lombok regency.

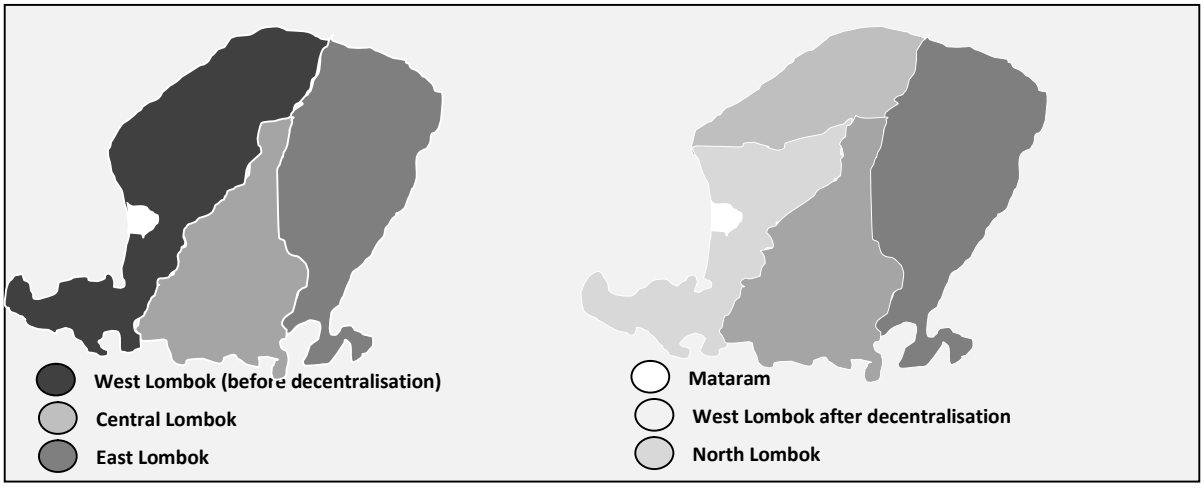

Figure (1): Map of Lombok regency before and after emergence of North Lombok

Figure 2. Comparison between map of Lombok regency and map of Geographical dialect of Lombok (the map the geographical dialect is adopted from Mahsun, 2006a)

Furthermore, the same depiction can be observed in Sumbawa island where one of the new autonomous regency was erected in 2003, called West Sumbawa regency (KSB). From the figure (3) and (4), it can be seen that the border of West Sumbawa regency (a new regional autonomy) and Sumbawa Besar regency is separated by an isogloss line (line separating areas based on their distinctive feature between dialects or languages). In the meantime, area of a dialectal variant of Sumbawa language used in West Sumbawa Regency is mainly populated by linguistic community using variant of Taliwang dialect. Conversely, people living in Alas (a part of West Sumbawa Besar Regency) use Sumbawa Besar dialectal variant in daily communication, even though its geographical area is closer to West Sumbawa Regency. This means that instead of merging to West Sumbawa regency, the Alas population prefer to stay in Sumbawa Besar regency thanks to linguistic reason. This portrait is sustained by the fact that the area of the new regency (KSB) just takes roughly a fifth of Sumbawa Besar regency instead of a half area.

Along with this, there has also been a long endeavour to make Sumbawa Island Province. In this case, the problem is not only caused by language difference between people living in Lombok and Sumbawa Island but also because of a difference of tribe and geographical area. Politically, a path to build Sumbawa Island province might appear to be easy task owing to those factors. However, when some elites face Mbojo tribe occupying eastern part of Sumbawa Island, the problem becomes more complicated, mainly with regard to locating province's capital. This is because the Mbojo tribe community tends to prefer to establish a capital city of the 'seed' of Sumbawa Island Province (KPS) in the eastern area of Sumbawa Island, meanwhile Samawa tribe community tend to choose a central area of Sumbawa island as the place of the capital city. In this case, some elites frequently employ a linguistic reason as means of mobilizing people to promote the effort of making the new province.

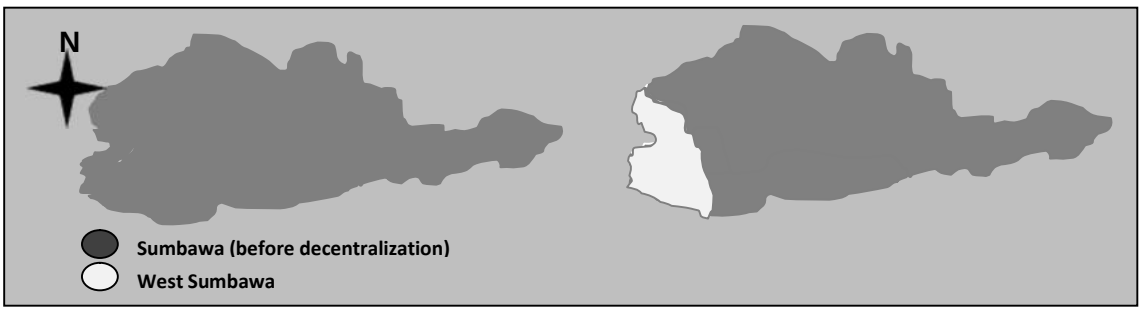

Figure 3. Map of Sumbawa regency before and after emergence of West Lombok

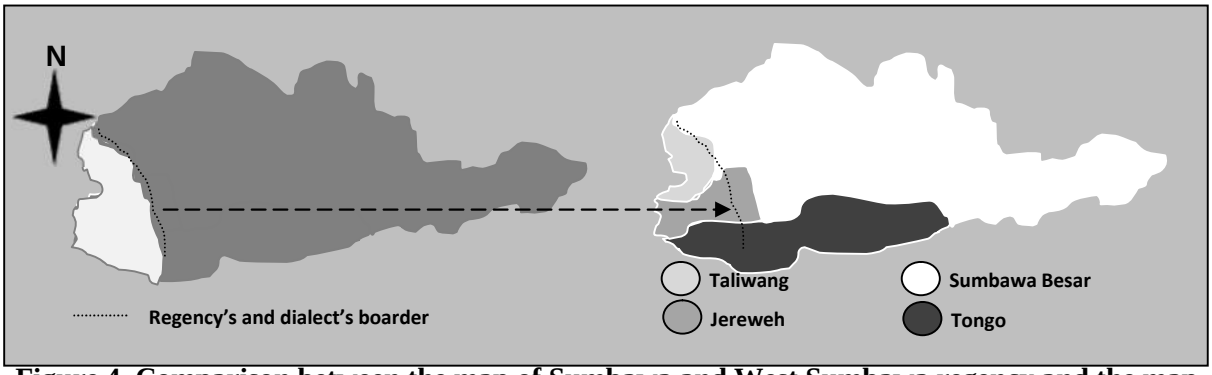

Figure 4. Comparison between the map of Sumbawa and West Sumbawa regency and the map of geographical dialect of Sumbawa language (the map of the geographical dialect is adopted from Mahsun, 2006b)

4. Conclusion

As the way of accelerating equality of development and prosperity in each region in Indonesia, regional autonomy policy seems to be an eye catching and promising idea; however, on the other hand, building new autonomous regions driven by some elites in some regions, including in West Nusa Tenggara, brings some drawbacks. In spite of widening a gap between group of people, the path of autonomy could strengthen differences of identity within the societies. Therefore, it is imperative to take into account linguistics aspects of erecting new autonomous regions in order to prevent a social or national disintegration.

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Magnetotelluric Data Processing Based on Hilbert – Huang Transform

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Abstract

Magnetotelluric (MT) is one of the most common methods used for mapping conductivity strucuture of subsurface. The main problem of MT is itoftencontaminated by noise from natural processes or local objects surrounding the measuring site. Such phenomenon will make the MT data becomes a non-stationary random and can lead the estimated transfer function to be biased, therefore it required a special method to process it. Processing of MT data is performed using a method of Hilbert - Huang transform (HHT) with the aim of obtaining apparent resistivity and phase curve. Stages of MT data processing are conducted by decomposing the MT signal into several IMF components. Furthermore, analysis and elimination of baseline drift noise was conducted before the calculation of instantaneous spectrum (IS) values. HHT's method test is performed on two synthetic data, free noise data and noisy data of 10%, to evaluate the effectiveness of this method. The results of test in these data indicate that the estimated MT transfer function obtained by the HHT method is more stable than the most common used method of Fourier transform. The HHT method is able to overcome the problem of non – stationary characteristic of MT data.

Keywords : Empirical mode decomposition, Estimation of MT transfer function, Instantaneous spectrum and MT data

1. Introduction

Magnetotelluric is a passive method that utilizes the Earth's natural electromagnetic (EM) field as an energy source to map the conductivity structure of subsurface. To obtain an overview of the distribution of subsurface's conductivity structures, the MT data acquired by measuring variations of electric and magnetic fields need to be processed first. The estimation of tensor impedance as a function of frequency from spectral ratio of horizontal components time-varying electric and magnetic fields is crucial part in the processing step in order to determine the conductivity structure. Most present method of analysis use Fourier transform as basic method to determine the spectra and impedance and therefore need to assume that the MT data are stationary over the record length. The main problem in this case is that in practice, MT data may contain signal components which break the assumption made in MT processing. The electromagnetic signals measured on the earth's surface may be contaminated by noise originating from a localized cultural sources, such as powerlines, electrical fences, mining areas, television transmitters and other industrial sources (Junge, 1996; Szarka, 1987; Trad and Travassos, 2000). Superposition between MT main signal and noise makethe MT data to be non-stationary random (Chant and Hastie, 1992) and can lead to impedance tensor estimation results to be biased.

This study describes the approach of one of the methods of non-stationary and nonlinear signal analysis, Hilbert-Huang transform (HHT) (Huang *et al*., 1998, 2003), that can be used to process MT data.As a signal processing method, it has been widely applied primarily to reduce the effect of noise on the signal (Tang et al., 2007; Zhang et al., 2010; Calif et al., 2013). Particularly in the geophysical field, it has been applied to reflection seismic data for improvingthe quality of the data (Battista et al., 2007). In addition, the application of HHT method to MT data can also be used to suppress the noise contained in the data, such as baseline drift, high frequency noise and powerline noise (Cai et al., 2009; Cai, 2014). In this paper we use synthetic MT data as media to know whether HHT method can be used to process MT data. In addition, evaluation is also conducted by comparing the estimated transfer function between the HHT method and the most commonly used method of Fourier transform.

2. Hilbert – Huang Transform

Hilbert - Huang transform (HHT) is an adaptive method used to analyze nonlinear and non-stationary signals (Huang *et al*., 1998). The HHT method emphasizes on two main aspects,empirical mode decomposition (EMD) and instantaneous spectral analysis (ISA). EMD is used to decompose complex signals into monocomponent zero mean signals or better known as intrinsic mode function (IMF),while ISA is used to get instantaneous spectrum.

2.1 Empirical Mode Decomposition (EMD)

Long *at al*. (1995) in Huang *et al*. (1998) states that a signal, at a given time interval, can have more than one oscillation mode so that Hilbert transform can notprovide a complete description of the frequency content present in the signal. To obtain time-frequency representation of a non-stationary signal, it is necessary to decompose the signal into IMF components, where it satisfies the following two criteria (Huang *et al.*, 1998):

- In each IMF, the number of extrema (maxima and minima) and the number of zero crossings must either equal or differ at most by one, and
- The mean value of the envelopes determined from the local maxima and local minima of each IMF, at any time, must be equal to zero.

2.2 Instantaneous Spectral Analysis (ISA)

To obtain an instantaneous spectrum (IS) of the signal, the first step that needs to be done is to perform Hilbert transform on each component of the IMF(Huang *et al.*, 1998). By performing Hilbert transform on each component of the IMF $C_j(t)$, ISof every j^{th} IMF can be expressed in the form :

$$IS_j(\omega,t) = Re\left[a_j(t)exp\left(i\int \omega_j(t)dt\right)\right] \quad (1)$$

3. Data and Method

Basically, the HHT method consists of two parts, empirical mode decomposition (EMD) and Hilbert transform. The EMD method was used to decompose the MT data into low to high order of IMF components which represent the high to low frequency contents of the signal and Hilbert transform was used to calculate the instantaneous spectra. In this study, firstly, we made the script of EMD matlab codes based on standard algorithm (Huang *et al*., 1998, 2003; Wu and Huang, 2004) and spectral analysis (ISA) matlab codes based on (Huang *et al*., 2009, 2011). Those codes then verified based on the publication results of Huang *et al*. (1998) before being applied on the MT data. The flow diagram of the process of decomposition and instantaneous spectra estimation is highlighted in Fig. 1.

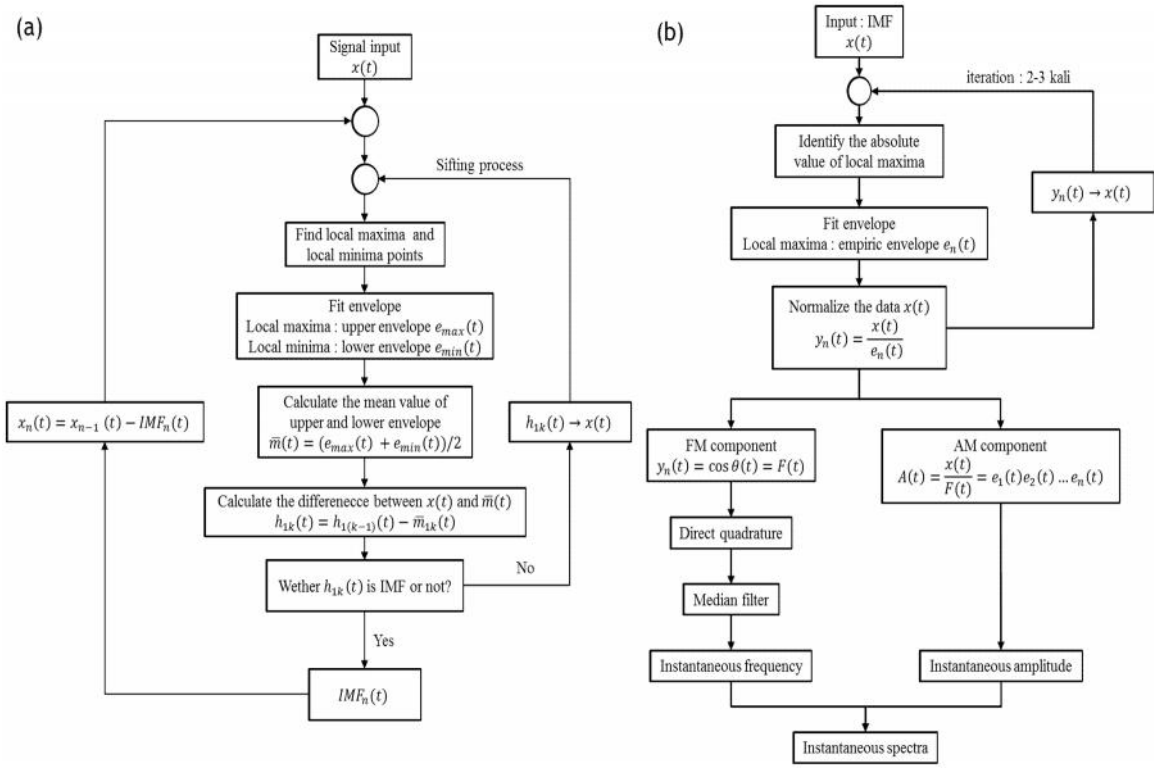

Figure 1.(a) Decomposition process of the signal and (b) estimation process of instantaneous spectra

In order to verify the correctness of the HHT method, we applied the method to synthetic MT data with a known impedance, Z. The procedure performed to generate it was divided into two stages. First, we used four 1D layered Earth models (see Fig. 2a) to obtain impedances, apparent resistivities and phases through 1D MT forward modelling process based on the recursive equation connecting the impedance at two successive layers (Grandis, 1999). Second, we selected the magnetic field components ($H_x$and H_y) of one site of field MT data (KAP106) to construct synthetic electric field data (E_x and E_y) based on the correlation between impedance (Z) and horizontal components of electric (E) and magnetic (H) field. The MT data used in this study was taken from Southern African Magnetotelluric Experiment (SAMTEX) Project, the largest regional-scale MT experiment which comprises MT data from over 730 distinct locations in an area of over one million square kilometres(Jones *et al.*, 2009). The KAP106 was recorded at latitude –31.67 and longitude 20.92 over one month, start from 2nd October 2004 until 2nd November 2004, and in this study, only 8192 data points was used with a sampling frequency 0.2 Hz . The flow diagram of the process to generate synthetic data is highlighted in Fig. 2b.

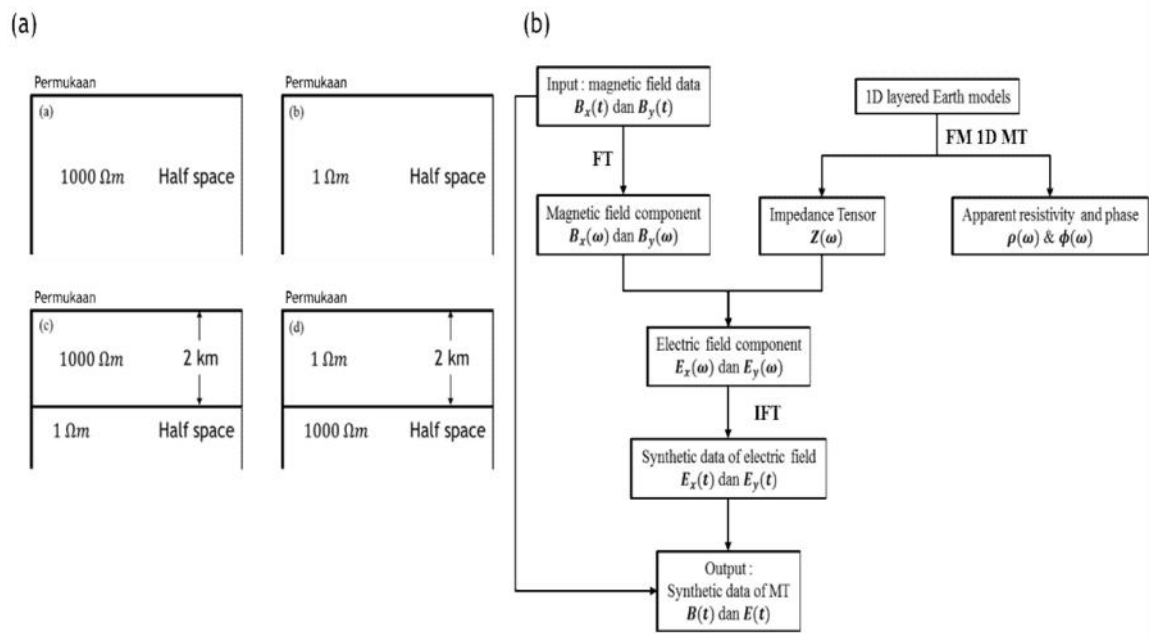

Figure 2.(a) The horizontally layered Earth models used to create synthetic MT data and (b) the process of generating synthetic data

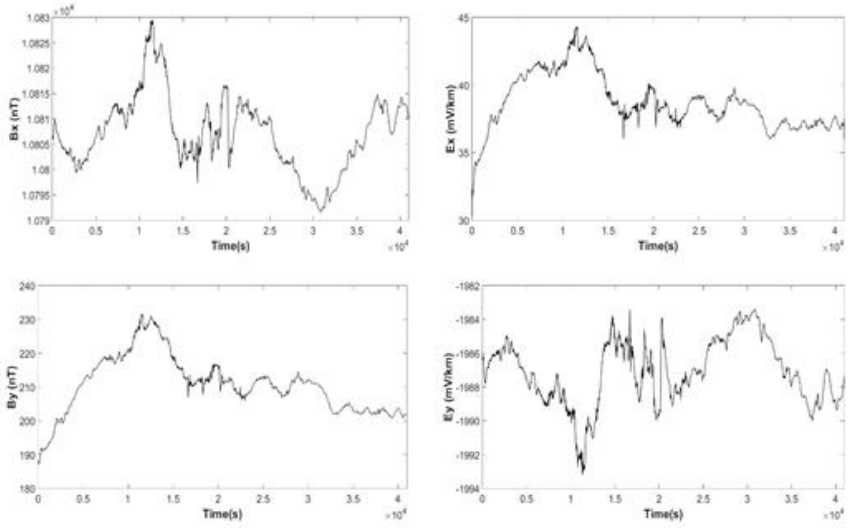

Figure 3.Example of the synthetic data (B_x, E_y, E_x and E_y components) generated from fourth earth model.

In order to determine the MT impedance tensor, MT data was firstly decomposed into IMF components. The decomposition process was stopped after *n* iterations when the residue becomes a monotonic function r_n, which cannot be decomposed further. The final signal can be expressed as accumulation of all IMFs and residual :

$$X(t) = \sum_{j=1}^{n} IMF_j(t) + R_n(t) \quad (2)$$

In this context, the number of iteration processes was determined a priori of 15 times and the number of IMFs close to $log2(N)$, where N is the number of samples. After getting IMF component using EMD, we calculated the instantaneous amplitude $a_j(t)$ and frequency $\omega_j(t)$. This calculation enables us to represent the amplitude and frequency contents of the MT signals as a functions of time. The amplitude density distribution in time- frequency space (Fig. 3) is called the instantaneous spectrum.From the instantaneous spectrum, we then calculated the impedance using formula proposed by Berdichevsky (1973).

$$Z_{xy} = \frac{\sum_{n=0}^{N} NY^* \sum_{n=0}^{N} XX^* - \sum_{n=0}^{N} NX^* \sum_{n=0}^{N} XY^*}{\sum_{n=0}^{N} XX^* \sum_{n=0}^{N} YY^* - \sum_{n=0}^{N} XY^* \sum_{n=0}^{N} YX^*} \quad (3)$$

$$Z_{yx} = \frac{\sum_{n=0}^{N} EX^* \sum_{n=0}^{N} YY^* - \sum_{n=0}^{N} EY^* \sum_{n=0}^{N} YX^*}{\sum_{n=0}^{N} XX^* \sum_{n=0}^{N} YY^* - \sum_{n=0}^{N} XY^* \sum_{n=0}^{N} YX^*} \quad (4)$$

where $X = B_{xf}(t_n)$, $Y = B_{yf}(t_n)$, $N = E_{xf}(t_n)$ and $E = E_{yf}(t_n)$ are the complex signals corresponding to the frequency ω_0. To be able to use the formula of berdichevsky (1973) and make it applicable we changed the amplitude density distribution in time-frequency space with the complex signal density distribution and we then divided the frequency axis of the instantaneous spectrum into 18 frequency windows (see Fig. 4) and used the centre frequencies of each window as the evaluation frequency (ω_0), for which the impedance should be calculated. For each time, we sampled and summed up the complex signals of the IMFs that were located within the same window and then assigned to the associated evaluation frequency. The values are used in the calculation of impedance only if a value in the frequency window is present for all field components simultaneously.

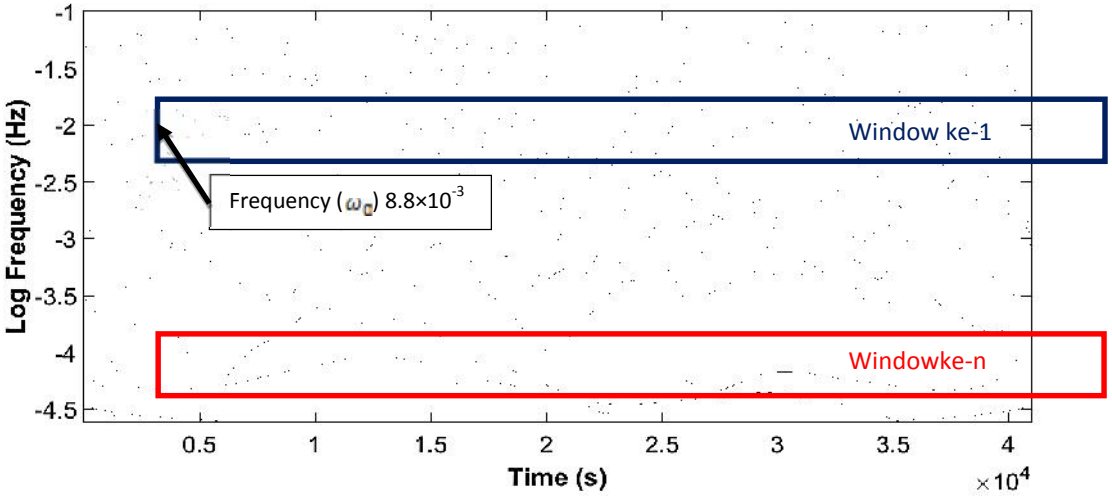

Figure 4. Example of the instantaneous spectra and illustration of how to estimate impedance from this spectra using Berdichevsky's formula

In this context of study, the bandwidth of the evaluation frequency used was varies. At higher frequencies, more observation data was merged into the same evaluation frequency in

order to meet requirement that the evaluation frequencies were equally spaced on a logarithmic scale. It also could be stated that, at short periods, we have more independent observation per period of resulting transfer function.

4. Results and Discussion

In order to verify that the HHT method is advance to estimate the response function of MT,four simulated data without noise and four noise-simulated data of 10% are analyzed and compared with the most commonly used method of Fourier transform. The results ofthe data simulation without noise are shown in the Fig.5.From all models used, those can be seen that, obviously, the curve shape of both methods are quite similar and the estimation results, qualitatively, are in good agreement compared to the model curve used as validator. All trends of both HHT and FT derived apparent resistivities show that the values fit similarly well to the model curve for higher frequencies, however, for lower frequencies the values deviate from this model curve. Regarding on this case, it can be interpreted as an error caused by the number of independent observation used for estimating transfer function of MT. In addition, it also can be caused by the presence of wind drift noise or baseline noise on MT signals. In this case, through the HHT method, the noise can be removed so as not to affect the estimation result, while the estimation curve obtained by the FT method is still influenced by the noise.Based on the calculation of misfit error that is shown in Table. 1, quantitatively, we can state that HHT method give more stable apparent resistivities and slightly worse phases estimation compared to standard FT method.

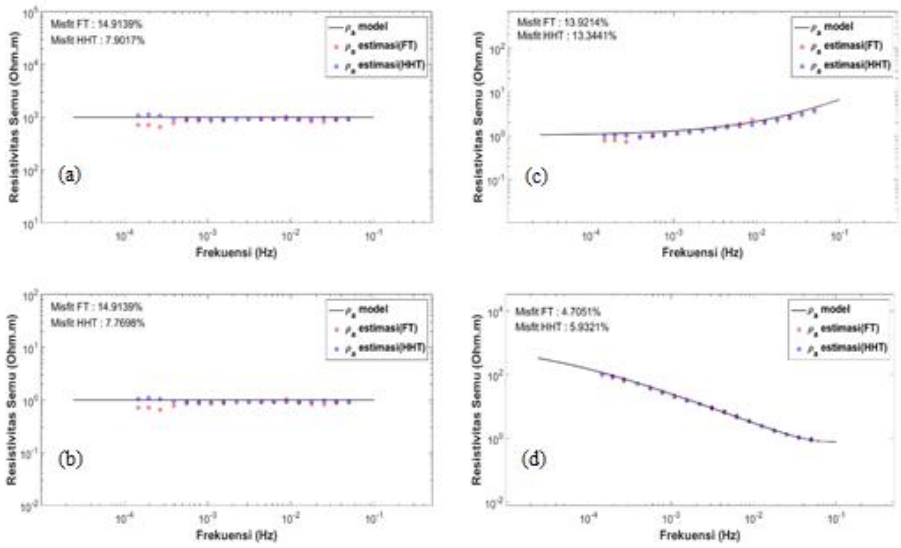

Figure 5. The estimated curve of apparent resistivities from both HHT and FT method. (a) apparent resistivity curve of first earth model, (b) apparent resistivity curve of second earth model, (c) apparent resistivity curve of third earth model and (d) apparent resistivity curve of fourth earth model.

Tabel 1. Misfit error (%) of estimated apparent resistivities and phases for both HHT and FT method for the case of noise-free simulated data

Parameter	FT method	HHT method	Earth Model
Rho app	14.9	7.9	I
Phase	0.8	3.7	
Rho app	14.9	7.8	II
Phase	0.8	3.4	
Rho app	13.9	13.3	III
Phase	1.7	3.9	
Rho app	4.7	5.9	IV
Phase	12.9	10.3	

The estimation results of noise-simulated data are shown in Fig. 6. Based on the results obtained, the estimated apparent resistivity from both methods, HHT and FT, are equally affected by noise. Those can be seen from the apparent resistivity that is shiftedupward or downward from the last position. In the case of noise-free simulated data, the calculation of auto-cross correlation term,eq. (3) and (4), between electric and magnetic field components are not affected by noise. While in the case of noise-simulated data, the auto-cross correlation termare very influenced by the amount of noise component,thus it will multiply the results of the calculation.Misfit error of FT's derived apparent resistivity are 16.2 % for first earth model, 23.4 % for second earth model, 10.1 % for third earth model and 38 % for fourth earth model. The same parameter calculated using HHT method are 8.9 % for first earth model, 15.4 % for the second earth model, 3.4 % for third earth model and 36.4 % for fourth earth model. These results show that HHT give smaller amount of error than FT give andit can be stated that HHT can treat noise better than standard method of FT can handle.Incontrast to the resistivity curve that changes due to the influence of noise, the phase curve does not change (see Fig. 7).

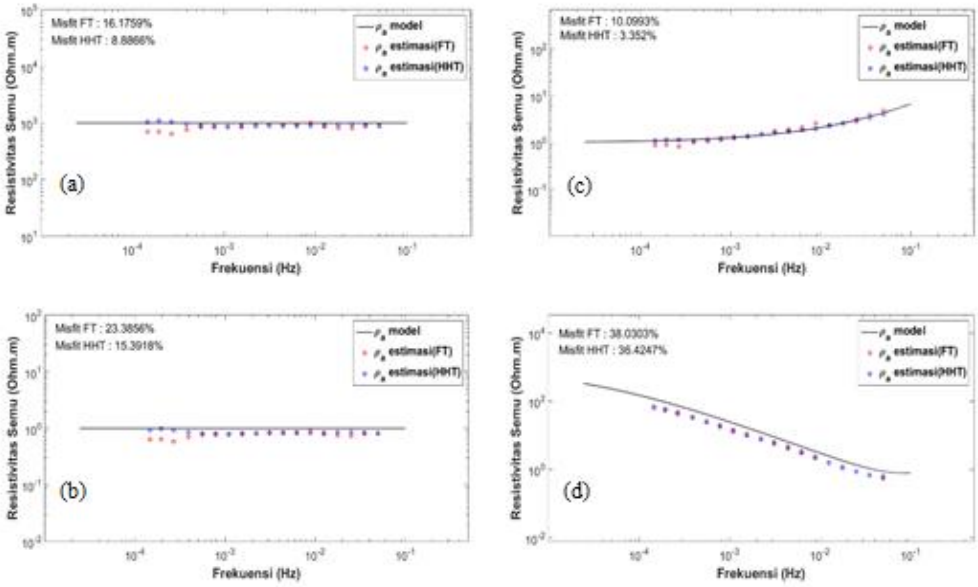

Figure 6. The estimated curve of apparent resistivities from both HHT and FT method for the case of noise-simulated data. (a) apparent resistivity curve of first earth model, (b) apparent resistivity curve of second earth model, (c) apparent resistivity curve of third earth model and (d) apparent resistivity curve of fourth earth model.

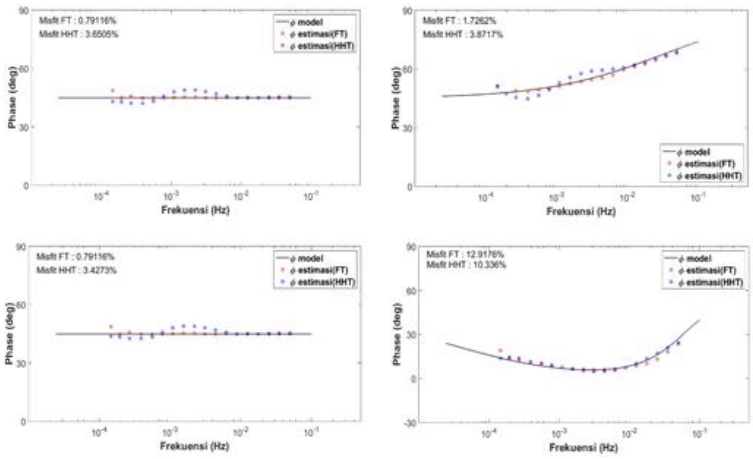

Figure 7. The estimated curve of phases from both HHT and FT method. (a) phase curve of first earth model, (b) phase curve of second earth model, (c) phase curve of third earth model and (d) phase curve of fourth earth model.

5. Conclusion

Based on the results that already obtained, the HHT method can be used as an alternative method to process the MT data. This method can be used to decompose MT signals into monocomponent signals which enable us to analyze and eliminate noise in MT signals more easily. In addition, this method has the advantage of characterizing a non-stationary MT signal, as compared to the conventional method of Fourier transform.

Acknowledgements

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Study on Performance and Environmental Impact of Sugarcane-Bagasse Gasification

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Abstract

Sugarcane bagasse gasification can solve the energy problems. This research examined the effect of temperature and difference of biomass form (fiber and pellet) on the performance and environmental effect of sugarcane-bagasse gasification (downdraft system). Yield of syngas, value of cold gas efficiency (CGE) and carbon conversion efficiency (CCE) were predetermined for performance of gasification. The result showed that the performance of gasification was affected by temperature and biomass form. Yield of syngas, CGE, and CCE increased as temperature increased. The yield of syngas increased by the change of biomass form (fiber to pellet), meanwhile each value of CGE and CCE decreased. For the environmental effect, the yield of CO_2 decreased as the temperature increased, but the change of biomass increased the yield of CO_2. The largest value of syngas yield, CGE and CCE were obtained at the same temperature which was 1050 ^oC, but in different biomass form. For the largest value of syngas yield was obtained in pellet form, meanwhile for CGE and CCE were obtained in fiber form. The largest value of syngas yield, CGE and CCE were0.69 (kg-feedstock), 71.02% and 88.16% respectively. The largest CO_2 yield was 0.374 kg/(kg-feedstock) at 800 ^oC (pellet form).

Keywords: gasification, sugarcane bagasse, downdraft system, environmental impact.

1. Introduction

Fossil fuels are the unrenewable energy and the largest greenhouse gas emitters and bad environment cause in the world. New energy is needed to fulfil the world energy requirement and then world energy reserve will be safe (Balat, 2008; Wicakso, et al.,2017). Biomass is one of the many alternative energies for the future energy, because biomass is categorized the renewable energy andthe energy from biomass not only will make a good effect to the environment, but also the carbon produced by biomass gasification can be recycled. Biomass can supply the world energy till 2050, because biomass asresource of energy is great in quantity (Bahri, et.al., 2012).Indonesia has biomass in great quantities, some of which are bagasse, leaf waste, and wood waste. Sugarcane waste was produced by sugar mill, and the production of sugarcane in Indonesia reaches 53.612.133 tons per year (BPS-RI, 2012). Hugot, (1986) and Paturau, (1982) explainedthat, one ton of sugarcane produced 115 kilogram of the crystal sugar, 300 kg of the sugarcane bagasse, 30-40 kg of thewaste residue filtering, 20- 50 kg of the molasse, 3,5 kg of the ash, and the other materials, and140 millions of sugarcane bagasse was produced per year in Indonesia by the process.

Biomass is one of the many fuels that was categorized environmentally friendly, so biomass is highly potential to replace the fossil fuel as energy resources (Balat, 2008; Sunarno, et al.,2017). Because ofits hydrogen and carbon contents, biomass can be converted to carbon dioxide and water by the oxygen, this phenomena is known as combustion reaction. The carbon was obtained in the form of cellulose. Also becaue of its contents, biomass can be used to replace the role of fossil fuels (Zhai, et.al., 2016). Generally, with thermal process at high temperature, biomass can be converted into the gaseous and liquid product.

Sugarcane-bagasse is the residue of extraction process and obtained from sugar factory. Generally, the sugarcane bagasse can be used to produce the paper and as the raw material of animal feed (Pandey et al., 2000). Sugarcane bagasse contains 55-60% of fibers, 30-35% of piths, 10-15% of the soils, and some soluble substances. The chemical contents of sugarcane bagasse are 46-47% of celluloses, 24-26% of pentose, 20-21% of lignin, and 10-15% of other

compounds. In other hand, sugarcane bagassehas 50% of water contents having 16,30 MJ/kg of lower heating value (LHV) (Edreis et.al., 2013).

Gasification process is a thermal process and can convert the biomass into syngas, solid products like char and liquid products like tar. Gasification occurs in the limited oxygen environment (20-40% of oxygens) (Tsai et al., 2006;Sarker et.al., 2015). The difference of gasification systemsis at the steam resource and flow direction of syngas. There are five types of gasificationsystems : downdraft, updraft, inverted downdraft, cross draft, and fluidized. The downdraft gasification system was the best gasification system, because it has limitation production of tar (Reed an Das, 1988). Gasification does not only produce the syngas, but also byproduct. The gasification byproducts are liquid products (tar) and solid product (char). Gasification process occurs at medium and high temperature and in atmospheric conditions. The medium temperature of process isat 350-400 ^{o}C, and high temperature is at 700-1000 ^{o}C (Fledmann, 2008). Gasification process occurs inthe gasifier reactor which has four process zones(drying, pyrolysis, oxidation, and reduction). The drying process (draying zone) is the evaporation of tar and water and occurs at the temperature above 150 ^{o}C. The pyrolysis process is the evaporation of volatile matter (the conversion of the biomass to the char) and occursat the temperature between 150 ^{o}C and 700 ^{o}C (Reed and Das, 1988). The oxidation process is the burning process and occursat the temperature between 700 ^{o}C and 1500 ^{o}C.The oxidation zone produces heat used for heating process in the drying, pyrolysis, and reduction zones. Reduction process or gasification process is the main process to produce the syngas. This processis caused by the reaction of carbon, carbon dioxide, and steam to produce carbon monoxide and hydrogen (Balat et al., 2009). Gasification processes areinfluenced bytemperature, particle size, residence time, water contents, and speed of gasifier agent.

This research explained about the effect of temperature and difference of biomass form (fiber and pellet) on the performance and environmental effect of gasification process.For the performance of gasification, this research was done by calculating the syngas yield, value of the cold gas efficiency (CGE) and value of carbon conversion efficiency (CCE).

2. Materials and Methods

2.1. Raw Material

Sugarcane bagasse was obtained from PT. Perkebunan Nusantara X (PERSERO), Surabaya, Indonesia. Physical composition of bagasse was 43-52% of fiber contents, 46-52% of water contents, 80-120 kg/m^3 of bulk densities and 2-6% of soluble solids. The Proximate and ultimate analysis of sugarcane-bagasse was presented in Table 1. Bagasse was in fiber and pellet forms, where pellet form had 0,7 cm in diameter and 6 cm in length. The real density of pellet and fiber form were 541,6 kg/m^3 and 158,5 kg/m^3.

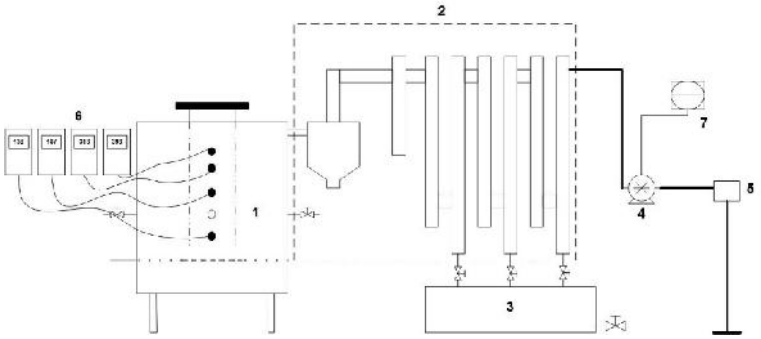
Table. 1. Proximate and ultimate analysis of sugarcane-bagasse

No.	Proximate Analysis	(%weightt)	Ultimate Analysis	(%weight)
1.	Fixed Carbon	7	Carbon (C)	23,7
2.	Volatile Matters	42,5	Hydrogen (H)	3,0
3.	Moisture	49	Oxsygen (O)	22,8
4.	Ash	1,5	Moisture (H_2O)	49
5.			Ash	1,5

2.2. Equipment

The fixed bed downdraft gasifier was shown by the Figure 1. Gasifier unitconsisted of reactor unit (20 cm of inlet diameters and 80 cm of total height), and equipped bycyclone unitsand vacuum pump. The cyclones (4 in total) were used to separate the solid phase,oil phase, and syngas. Vacuum pump was used to draw gasifier agent (the air). Four

thermocouples were used to control and determine temperature zones.The syngas was taken with the syringe (12 ml) and saved in the vacutainer. The syngas analyzerwas Gas Chromatography (GC) SHIMADZU GC 14 B Japan by the SUS Packed Column Propak Q, 5 m x 4 mm I.D.



1. Reactor 2. Cyclone 3. Tar camber 4. Blower
5. Syngas burner 6. Thermocouple 7. Voltage Regulator

Figure 1. The gasification reactor set-up

2.3. Procedure

Gasification process was carried by enteringthe sugarcane-bagasse from the hopper (top of reactor) until the volume was full. The oxygen was flowed (12,3 m/s) by the vacuum pump from the hopper (top of reactor) to the drying, pyrolysis, oxidation (combustion zone), and reduction zone (gasification reaction). The power of pump was kept at 70 to 80 Volt (by voltage regulator). Initial temperature was recorded by thermocouples. Initial time was recorded by stopwatch. Syngas product was formed from the process came into the cyclones units and then tar condensed to the tar chamber, and thenthe syngas product came out to syngas outputs. When temperature of variable was reached, the gasification process was stopped and syngas could be taken by syringe (12 ml) and vacutainer (10 ml). The process time could be calculated using the recorded final time of process by stopwatch.

2.4 Equation

The yield of syngas is calculated by the equation of :

$$\text{Yield} = \frac{mass\ of\ syngas}{mass\ of\ biomass\ consumptions} \quad (1)$$

Cold gas efficiency (CGE) is calculated by the equation from (Sarker at al., 2015) :

$$CGE = \frac{LHV_{gas} \times V_{gas}}{LHV_{feedstock} \times m} \quad (2)$$

LHV_{gas} can be calculated by the equation from (Jain at al., 2000):

$$LHV_{gas} = \sum_{i=1}^{n} (Y_i . LHV_i) \quad (3)$$

Carbon conversion efficiency (CCE) is calculated by the equation from (Sarker at al., 2015):

$$CCE = \frac{Yx100x(CO\% + CH_4\% + CO_2\% + 2(C_2H_2\% + C_2H_4\% + C_2H_6\%))x12}{m\ x\ (1 - X_{ash})x\ 22{,}4\ x\ C\%} \quad (4)$$

$V_{gas}$and Y are the volumetricflow rate of syngas (Nm^3/h), m is the biomass consumption rate (kg/h), $LHV_{feedstock}$ is caloric value of feedstock (Mj/kg), $LHV_{gas}$is total of lower heating value of syngas, Y_i is volume fraction of syngas, $LHV_i$is lower heating value of syngas, $X_{ash}$is the biomass ash content, C% is carbon content of sugarcane-bagasse.

3. Results and Discussion

From this research, the volumetric flowrate of syngas was 0.007011 m^3/s (constant), and the biomass consumptions on the fiber form by the temperature at 800, 950, and 1050 ^oC were

910, 1100, and 1500 grams, while in the pellet form atsame temperature the results were 3750, 4610, and 5020 grams. Time process of gasification on the fiber form at the temperature of 800, 950, and 1050 ^{o}C were 9, 11, and 15 minutes, while on the pellet form at same temperature were 21, 26, and 30 minutes. Temperature of syngas ranged at 30-45 ^{o}C. Waldheim and Nilsson (2011) showed that the LHV value of H_2, CO, and CH_4 were 10.783, 12.633, and 35.883 Mj/Nm^3. Density of CO and H_2 were 0.956 and 0.956 (kg/m^3) (Braker and Mossman, 1980). Table 2 explained about the % volumetric of syngas.

Table 2. The %volumetric of syngas (%)

Oxidation zone of gasifier (^{o}C)	Fiber (%volumetric)				Pellet (%volumetric)			
	CH_4	CO	CO_2	H_2	CH_4	CO	CO_2	H_2
800	0.846	14.466	6.434	3.025	1.040	10.973	15.392	10.618
950	0.856	15.532	6.251	2.925	2.622	15.542	15.278	12.080
1.050	1.051	16.112	5.280	3.150	2.867	17.673	8.2970	11.312

3.1. The Effect of temperature and difference of biomass form on the syngas yield

The yield of syngas could be calculated by the Equation 1 and yield of syngas could be calculated by total yield of CO, CH_4, and H_2. Mass of syngas could be calculated by the combination of density and volumetric flowrate of syngas.

Figure 1 explained that the yield of syngas increased when the temperature process increased (in fiber and pellet form). The increasing of temperature processhad increasing effect for biomass or carbon consumption, and this phenomenoncouldcause the increasing of the %volumetric of syngas. In the other hand, the increasing of temperature process caused the tar to crack and H_2O to become the simple molecule (syngas). Feng et al. (2011) and Ge et al. (2016) explained that the yield of syngas increased by the increasing of the temperature. By sugarcane-bagasse form change (from fiber to pellet form), the yield of syngas decreased . It occured because the biomass (carbon) consumption in pellet form of biomass was bigger than in fiber form, and its difference was significant. In the other hand, %volumetric of syngas in the pellet form was bigger than in fiber form, but thedifferencewas not significant. These resultswere similar with the experimentsresulted by Bridgewater (1995), Hernandez et al. (2010), and LV at al. (2004).

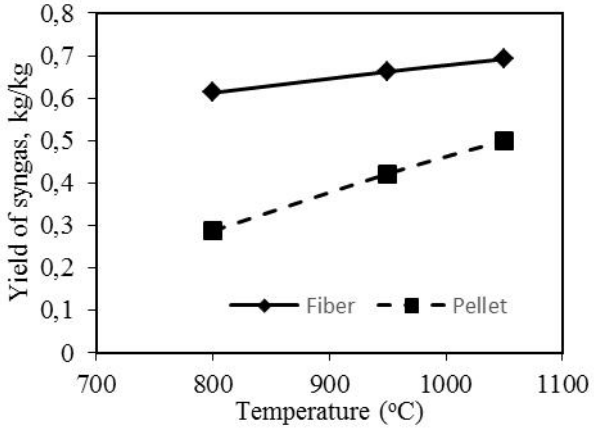


Figure. 1. Effect of temperature and difference of biomass form on the yield of syngas by the sugarcane-bagasse gasification

3.2. The Effect of temperature and difference of biomass formon thecold gas efficiency (CGE) value

Figure 2 showed that the CGE value increased because of increasing of the LHV_{syngas} value by the increasing of the temperature process. Volumetric flowrate and biomass

consumption were almost similar on each variable of different temperature. These resultswere similar to the experiments resulted by Hernandez et al. (2010), Couto et al. (2015), Niu et al. (2013), and Miao et al. (2013).The CGE value decreased by the change of biomass form (fiber to pellet form). Change of biomass form (fiber to pellet form) caused LHV_{syngas} value to increase not significantly. In the other hand, the change caused the biomass consumption rate to increase significantly (volumetric flowrate was not changed). Hernandez et al. (2010), Bridgewater (1995), and LV at al. (2004) found the similar trend result.

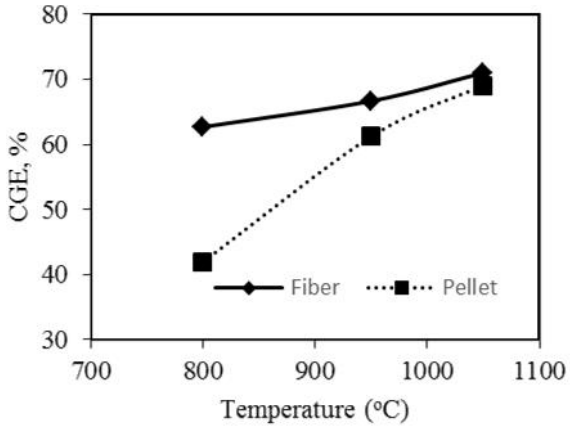


Figure 2. Effect of temperature and difference of biomass form on the Cold Gas Efficiency (CGE) value of syngas by the sugarcane-bagasse gasification

3.3. The Effect of temperature and difference of biomass form on carbon conversion efficiency (CCE) value

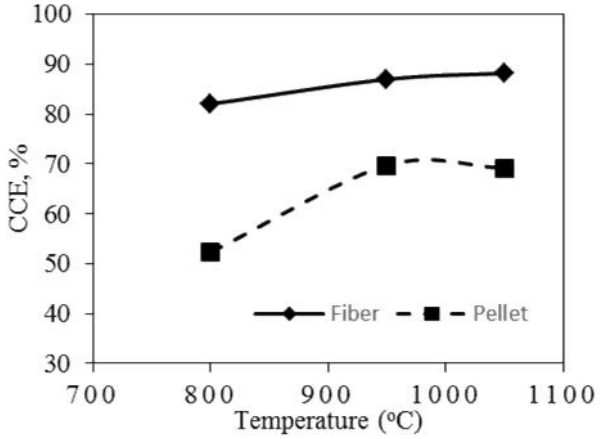


Figure 3. Effect of temperature and difference of biomass form on the Carbon Conversion Efficiency (CCE) value of syngas by the sugarcane-bagasse gasification

Figure 3 explained that the CCE increased not significantly bythe increasing of the gasification temperature. The increasing of CCE was caused by the increasing of % volumetric of syngas. By the increasing of temperature, the volumetric flowrate was almost similar at the different temperature. In the other hand, increasing of temperature caused biomass consumption increased not significantly. These resultswere similar to experiments resulted by Ge et al., (2016) and Couto et al. (2015). Change of sugarcane-bagasse form (fiber to pellet)caused the decreasing of the CCE value, this phenomenon was caused by the increasing of the operation time, and affected on the increasing not significantly of the carbon production (included %volumetric). In the other hand, this change caused the biomass consumption to increase significantly, but the volumetric flowrate did not changed. These

resultswere similar to the experiments resulted by Karimipour et al., (2013) and Inayati et al. (2016).

3.4. The effect of temperature and difference of biomass form on the yield of CO_2

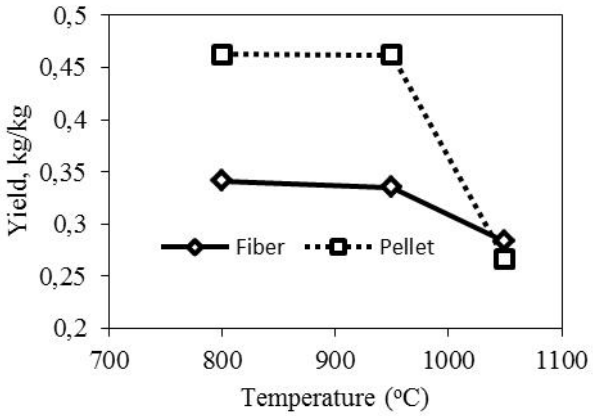


Figure 4. Effect of temperature and difference of biomass form on the yield of CO_2 by the sugarcane-bagasse gasification

Figure 4 explained that the yield of CO_2 decreased because H_2O of the process was cracked by the increasing of temperature process. This reaction happened in the shift conversion reaction.The decreasing of H_2O caused the yield of CO_2 to decrease. These resultswere similar to the experiments resulted by Murakami et al. (2013). By the change of biomass form (fiber to pellet), the yield of CO_2 increased. This phenomenon happened by increasing of the process time, so consumption of biomass or carbon increased. These resultswere similar to the experiments resulted by Luo et al. (2010) and Lv et al. (2004).

4. Conclusion

This research explained that the temperature and the biomass form change (fiber to pellet) influenced the sugarcane-bagasse gasification. The syngas yield, CGE, and CCE increased as temperature increased. For the biomass form change (from fiber to pellet), the yield of syngas increased but CGE and CCE value decreased. For the environmental impact, the yield of CO_2decreased by the increasing of the temperature, but increased by the biomass form change. The largest value of syngas yield was 0.69 kg/(kg feedstock). The largest value of CGE and CCE were 71.02% and 88.16% respectively. The largest CO_2 yield was 0.374 kg/(kg feedstock).

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The Effective Extension Methods for Prevention of Anthrax Diseases on Smallholders Farming in Supproting West Nusa Tenggara Province as A World Halal Tourism Destination

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Abtract

The province of West Nusa Tenggara (NTB) in addition to known as the world's best halal tourism destination and beef cattle producing areas is also one of the endemic areas of Anthrax disease in Indonesia. Therefore, in supporting the provision of food of origin of livestock in the form of original, healthy, whole, and halal (ASUH) meat is necessary prevention efforts, because Anthrax disease is a zoonotic disease that can be transmitted to livestock and humans. One effort that can be done is to provide extension to the community. To find out the most effective extension methods from various existing methods have been conducted research on 10 districts/cities as NTB from December 2016 to March 2017. The research was conducted by survey and data collection methods conducted by interviewing and using questionnaires. Data are tabulated and analyzed descriptively to determine the most effective extension methods. The results showed that if the target number of extension is very much or bulk then the most effective extention method is public meeting (big meeting). If the number of extension targets is a limited group of up to 20 people then the method of extension group discussion is the most effective method. If individual outreach goals are the most effective method of home visit extension.

Keywords: effective extension methods, anthrax prevention, livestock farming, NTB

1. Introduction

In 2016 the Province of West Nusa Tenggara (NTB) has been designated as the world's best halal and honeymoon destination. The impact of the predicate number of domestic and foreign tourist visits from year to year continue to increase. In 2016 the target of tourist visits to NTB reaches three million people (Department of Culture and Tourism NTB, 2016). To support it is necessary efforts to provide food supplies, especially meat that is safe, healthy, whole and halal (ASUH). In Indonesia the main source of beef to meet the needs of the community comes from smallholders farming and very few of the feedloters and the rest of imported beef.

NTB Province is one of the provinces in Indonesia known as Bali cattle warehouse to supply cattle breeding needs for 18 provinces in Indonesia. NTB is also known as beef cattle supplier for Jakarta, Bogor, Depok, Tangerang, Bekasi and West Java. Almost 99% of the total population of cattle in NTB as much as 1,002,731 in 2013 is a cattle farming business and very few or even no large livestock companies. Given West Nusa Tenggara Province is one of the producer and surplus areas of cattle production hence its position becomes very strategic in contributing to the sufficiency of national meat based on community farms (Mashur, 2016).

In addition to being the world's best halal tourist destination and beef cattle producer West Nusa Tenggara Province is also one of the endemic areas of Anthrax disease in Indonesia. Based on the results of the survey in April 2000, at least 10 provinces have been declared by the Agriculture Department at risk for livestock business such as Jambi, West Java, Central Java, East Java, West Nusa Tenggara, East Nusa Tenggara, Central Sulawesi, South Sulawesi, Southeast Sulawesi , And Papua (Bisnis Indonesia, 2000). According to the Directorate of Animal Health at the Directorate General of Livestock in Indonesia, there are 11 provinces with endemic status of Anthrax (Susan M. Noor *et al.*, 2001). The first province to be attacked was North Sulawesi (1832), then West Java (1886). Epidemics in Central Java, South Sulawesi, East Nusa Tenggara and West Nusa Tenggara occurred between 1906-1957,

while the latter occurred in the Special Region of Yogyakarta (DIY) in 2003. Anthrax incidents are repeated annually reported in four provinces, namely NTT, NTB, Central Java and West Java.

In the province of NTB for 11 years reported cases of Anthrax in cattle every year. Based on the location of the incident, the most reported Anthrax case from Sumbawa Island, while on the island of Lombok relatively few cases of Anthrax, even in East Lombok district has never reported any cases. Anthrax incidence in livestock in the long term (1984-1994) in NTB Province tended to decrease with linear regression equation Y = 6.04 - 0.0162X. Based on the month of the incident Anthrax case increased in the end and beginning of the year during the rainy season. As an effort to control the disease Anthrax, from 1974 has been vaccinated on the island of Sumbawa and since 1992/1993 all districts in NTB Province, especially in areas prone to Anthrax disease vaccination including the area of East Lombok (Sri Wahyuni and Edi Basuno, 2006) .

The history of Anthrax disease in NTB has been known since 1955 on Sumbawa Island, but it is well known with the death of seven people in 1982 in the village of Mbawa Donggo District after eating goat meat affected by Anthrax disease. The latest information about Anthrax disease occurred in Moyohilir sub-district attacked buffalo livestock and resulted in six people suspected of being attacked by Anthrax disease in October-November 2004. Anthrax disease is an acute infectious animal disease which is very dangerous because it can spread to humans (zoonosis) and can cause death if not treated immediately (Mashur, 2014).

Anthrax disease is increasingly being discussed and considered important because in addition to affecting human health and livestock, it also has a negative impact on the economy, especially livestock trade both nationally and internationally. In addition, it turns out Anthrax disease affects the socio-political and security of a country because this bacterial endospora has the potential to be used as a biological weapon. In animals, the main source of infection of Anthrax disease is soil. During the final period of the disease in animals, the Bacillus Anthracis vegetative bacteria will go out in large quantities with the blood of the sufferer naturally passing through the ear, nose and anus holes. These bacteria immediately form the endospores and remain silent on the ground for years even up to 60-70 years. This is likely to be a source of infection from the continuous Anthrax (Rahayu, 2015).

Areas that have been infected with Anthrax disease will be difficult to release. The economic loss caused by Anthrax disease is considered quite high although the exact figure is not yet known. Losses include vaccination costs, medical expenses in case of illness, livestock deaths, decreased productivity (labor, meat and milk), decreased reproduction and emerging threats to public health because anthrax disease is zoonotic.

For that, in order to prevent the emergence of Anthrax disease is very dangerous it is necessary efforts to improve public health knowledge through extension activities. According to Law No. 16 of 2006 on Agricultural Extension System, Fisheries and Forestry (SP3K) Agricultural Extension, Fisheries, Forestry, hereinafter called extension is a learning process for the main actors and business actors so they are willing and able to help and organize themselves in accessing information markets, technology, capital and other resources, in an effort to improve productivity, business efficiency, income and welfare, and to raise awareness in the preservation of environmental functions (Agricultural Extension Agency and Human Resources of the Ministry of Agriculture, 2006). In order for the extension activities to be more optimal it is necessary to select the most effective extension method. The most effective method of technology dissemination in the technology adoption process is showcase technology (technological title/technology demonstration) method (Mashur, 2005; 2015). New breeders know Anthrax at an advanced stage. All breeders know that Anthrax is very dangerous for livestock and humans, but 37.5% sell cattle that have shown the symptoms of Anthrax. All farmers acknowledge vaccination is the most effective way and counseling is a

top priority in anthrax control. Implications of anthrax control strategies need to be pursued through the socialization of Anthrax diseases that need to be adjusted to the age of farmers, education and communication facilities owned by farmers. Livestock extension programs need to be optimized through counseling on management, ranging from feed, welfare, health and reproduction (Sri Wahyuni and Edi Basuno, 2006).

2. Materials and Methods

The study was conducted on 10 districts/city in West Nusa Tenggara from December 2016 until March 2017. Data collection was done using survey method using statement list. Respondents interviewed were cattle ranchers on the community livestock business as many as 200 people. Farmers are given the option to answer the most effective extension methods to prevent Anthrax disease. There are three methods of extension proposed in the list of statements, namely the method of counseling with mass approaches, groups and individuals. Each respondent will choose 5 extension methods on each approach that is judged most effective by giving a skore on each choice. Each method chosen is given a skore of effectiveness, ie SJ = very ugly, with score 1; J = ugly, with a score of 2; SK = very less, with score 3; K = less, with a score of 4; C = enough, with a score of 5; S = medium, with a score of 6; CB = good enough, with a score of 7; B = good, with a score of 8; SB = very good, with a score of 9-10.

In the method of mass suppression is provided with a choice of 15 methods, namely general meetings (broad meetings), radio broadcasts, TV broadcasts, film screenings, brochures, bulletins, magazines, folder spread, leaflet spread, pamphlet/Posters, banner installation, billboards installations, VCD playback and internet. A group approach is provided with a selection of 10 methods of extension, ie group discussion, farmer's course, workshop, demonstration, field trip, field trip, Farm Fiel Day, flash card, flip chart and Whats App (WA) group. As for individual approach, there are 13 choices of extension methods, such as home visit, spouse study, correspondence, telephone connection, Short Massage Service (SMS), Black Berry Messenger (BBM), Face Book (FB), Whats App (WA), Instagram, Email, Fax, Line and Smart Manager.

All data is tabulated using the Exel Program. To find out the most effective extension method according to the farmer farmer's choice is stated based on the highest number of rank scores and the number of voter respondents. Data analysis is done descriptively based on tabulation result data.

3. Results and Discussion

The level of knowledge of cattle farmers in the smallholders farming in West Nusa Tenggara on Anthrax disease is still very low. Approximately 25.84% of respondents said they knew or heard of Anthrax disease in cattle, while 74.16% of respondents said they did not know information about Anthrax disease. In general, farmers on the island of Sumbawa know more about Anthrax disease when compared with cattle ranchers on the island of Lombok. This is in accordance with the results of Sri Wahyuni and Edi Basuno (2006) research that based on the location of the incident, the most reported Anthrax case from Sumbawa Island, while on the island of Lombok the number of cases of anthrax is relatively small, even in East Lombok regency never reported any cases.

Farmers' knowledge of Anthrax disease is mainly about the causes and symptoms of the disease, prevention and treatment. The main known cause is the dirty environment (cage, feed). While the symptoms of Anthrax disease he recognizes, among others, fever, weak, easy to fall, breathless, black blood out of the nose, mouth, stomach swelling and sudden death.

To find out the most effective extension methods for the prevention of Anthrax disease in cattle farming in NTB to support NTB Province as a provider of safe, healthy, whole and halal meat (ASUH) in order to make NTB the world's best halal tourism

destination, three the choice of extension methods based on the number of extension targets, namely mass extension methods, groups and individuals. The most effective types of extension methods in each of these methods based on the results of this study can be presented in Tables 1, 2 and 3.

3.1 Mass of Extension Method

The result of the research shows that in the mass counseling method, the number of respondents who choose General Meeting or Meeting method as the most effective counseling method in giving information about the prevention of Anthrax disease in West Nusa Tenggara to the farmers in the cattle farming business in supporting the NTB Province as the destination World's best halal tourism in the provision of original, healthy, whole and halal meat (ASUH) as much as 95%. This is indicated in addition to the number of respondents who voted the most also by the number of scores all respondents showed the highest ranking with a total score of 1410 and the average score of scoring 8.49. This means that the respondent's assessment of the effectiveness of this extension method is well-rated, as shown in Table 1 below. The reason for the respondents choosing the method of public meeting (the grand meeting) as the most effective counseling method because with the amount of targetedness (khlayak) that can be reached very much in one period of time extension activities, the cost of providing counseling is relatively cheap and does not require extension workers) a lot. The weakness of the General Meeting method is that the material conveyed is limited to the easy to remember things. Things that are technical although submitted but are hard to remember in full. Therefore, other extension methods are needed as a combination of these extension methods. In addition to the General Meeting method as well as extension methods are selected in a row based on the ranking, namely movie screening, TV broadcasting, brochure distribution and radio broadcasting. Whereas based on the mean score of skore then the most effective sequencing method is general meeting, VCD playback, internet, movie screening, and radio broadcasting. The results of this study in accordance with the results of research Isnaini (2015) that the mass approach is used to convey direct or indirect messages to many people at once in the same time. This method is used to attract public interest and attention to the recommendation of farming. This method gives 37% influence to all methods. To conduct a good agricultural extension activities it is necessary to use a variety of methods.

Table 1. Ranking of the Most Effective Mass Extension Methods Based on Media Type

No	Type of Media	Number of scores (rank)	Score average (rank)	Number of respondents choosing (rank)	Maximum score	Minimum score
1	General meeting	1.410 **(1)**	8,49 **(1)**	**166 (1)**	**10**	2
2	Broadcasts	**462 (5)**	7,11 (10)	65 **(5)**	10	2
3	TV Broadcast	**723 (3)**	7,61 **(5)**	95 **(3)**	10	3
4	Movie Playback	**892 (2)**	7,82 **(4)**	114 **(2)**	10	2
5	Spread Brosure	**648 (4)**	7,45 (7)	87 **(4)**	10	2
6	Bulletin	73 (15)	6,08 (15)	12 (15)	9	1
7	Magazine	198 (1)	6,60 (14)	30 (11)	9	4
8	Distribution Folder	302 (8)	7,02 (12)	43 (8)	9	1
9	Spreading leaflets	189 (12)	7,27 (8)	26 (13)	10	4
10	Pamplet	114 (13)	7,13 (9)	16 (14)	9	2
11	Poster	114 (14)	7,56 (6)	57 (7)	10	5
12	Banner	416 (6)	7,05 (11)	59 (6)	10	3
13	Billboards	278 (9)	6,95 (13)	40 (9)	10	2
14	VCD Playback	306 (7)	8,27 **(2)**	37 (10)	10	6
15	Internet	226 (10)	8,07 **(3)**	28 (12)	10	4

Source: primary data processed. The numbers (1) - (15) are rank

3.2 Group Extension Methods

In the counseling method, the most effective extension method of the 10 methods chosen is the Discussion Group counseling method with the number of respondents choosing 94% with the number of skill 1.411 and the average score of 8.55. This means that in addition to the number of respondents who memlih most also the average score given very well with the value between good to very good, as listed in Table 2 below. Reasons for choosing group counseling extension method as the most effective group counseling method because through this method farmers can discuss the problems they face together and solved together with the deliberation. With this method will arise the participation of group members to express their opinions. Because this method is done among fellow farmers, it will arise a high sense of kinship. To facilitate the implementation of this method in any discussion accompanied by extension agents or field officers, according to the issues discussed. The weakness of the group discussion method is that not all discussion participants can actively participate. The rank order of the most effective group counseling methods after the group discussion is farming courses, demonstrations of ways or outcomes, field meetings and work gatherings, while based on scores in the following order: group discussions, farm courses, demonstrations of ways/results, study tours. This method is in accordance with the social conditions and norms of the rural community of Indonesia, such as living in groups, mutual cooperation and community spirit. This method can increase the stage of interest and attention to the evaluation stage and try to implement recommended recommendations. The results of this study in accordance with the results of research Isnaini (2015) that the method of the group gives 25% influence on all methods.

Table 2. Ranking of the Most Effective Group Extension Methods By Media Type

No	Type of Media	Number of scores (rankings)	Score average (rank)	Number of respondents choosing (rank)	Maximum score	Minimum score
1	Group discussions	1411 (1)	8,55 (1)	165 (1)	10	1
2	Farmer's Course	1152 (2)	8,35 (2)	138 (2)	10	6
3	Meet the work	855 (5)	7,57 (4)	113 (5)	10	1
4	Demonstration of means/results	928 (3)	7,86 (3)	118 (4)	10	1
5	Field trips	547 (6)	7,39 (5)	74 (6)	10	1
6	Wydiawisata	317 (7)	6,89 (8)	46 (7)	10	2
7	Enjoyable space	881 (4)	7,34 (6)	120 (3)	10	1
8	Flash card	223 (9)	6,03 (10)	37 (9)	9	1
9	Blank map	290 (8)	6,90 (7)	42 (8)	10	2
10	WA group	146 (10)	6,35 99)	23 (10)	10	2

Source: primary data processed. The numbers (1) - (15) are rank

3.3 Individual Extension Method

In the most effective extension method, the most effective extension method of the 13 selected methods is the Home Visiting extension method. Home visits are a direct link between extension workers and farmers and their families in a planned way at home or on farm land to convey prevention efforts Anthrax disease. This method is also known as Anjang Sana or Anjang Karya. The number of respondents who chose this method as much as 97% with the number of scores 1.459 and the average score of 8.58. This means that in addition to the number of respondents who chose the most also the average score given very well with the value between good (8) to very good (9-10), as listed in Table 3. Reasons the respondent chose the method of extension Home Visits as a method of counseling The group is most effective because it can meet directly with the counselor so that will happen kinship high relation. Thus, there is no need to feel shy or reluctant to ask if there are things that are not understood or there are problems encountered. With this method will be more free to communicate, do not spend for transportation, do not take time to go learn.

Table 3. Ranking of the Most Effective Individual Extension Methods By Media Type

No	Type of Media	Number of scores (rankings)	Score average (rank)	Number of respondents choosing (rank)	Maximum score	Minimum score
1	Home visit	1459 **(1)**	8,58 **(1)**	170 **(1)**	10	1
2	Learning individuals	1275 (2)	7,92 (2)	161 (2)	10	3
3	Correspondent	791 **(5)**	6,77 (6)	117 **(5)**	10	2
4	Phone call	1062 **(3)**	6,90 **(3)**	154 **(3)**	10	1
5	SMS	846 **(4)**	6,22 (8)	136 **(4)**	10	1
6	BBM	214 (7)	6,79 **(5)**	32 **(7)**	9	2
7	Face book	260 (6)	6,84 **(4)**	38 **(6)**	10	1
8	WA	145(8)	6,04 **(9)**	24 **(8)**	10	1
9	Instagram	40 (11)	5,00 **(12)**	8 **(11)**	9	1
10	Email	93 (9)	5,81 **(10)**	16 **(9)**	8	1
11	Fax	23 (12)	4,60 **(13)**	5 **(12)**	8	1
12	Line	74 (10)	6,73 **(7)**	11 **(10)**	8	1
13	Smart manager	16 (13)	5,33 **(11)**	3 **(13)**	8	1

Source: primary data processed. The numbers (1) – (15) are rank

This is in line with the opinion of Isnaini (2015) that the benefits of home visit methods are: (1) to strengthen the relationship between the extension agent and the target, (2) to solve the problems facing individual goals, (3) to explain directly and in detail a recommendation, (4) can monitor the extent to which a recommendation has been implemented by the target, (5) can plan liver-to-heart extension activities, (6) be able to cultivate trust to the extension agent if the advice is accepted, (7) encourage farmers to work better The existence of services for their own benefit, (8) accelerate the adoption process and (9) the dissemination of information to other farmers will be faster.

Although this method is perceived to be most effective by farmer farmers, but on the contrary, it is felt that the counselor is less effective because it requires more time, cost and energy for home-to-house visits. If the distance home to the house adjacent the ability of a counselor to visit home at most three farmers farmers. If the distance of distant houses, the extension ability to visit from house to house only one farmer farmers per day. Furthermore Isnaini (2015) said that this method has obstacles, among others; (1) require more time and effort than other methods; (2) the number of farmers to be visited is limited, (3) frequent visits to a farmer will cause prejudice to other farmers.

The extension method is most effective based on the number of scores and the number of respondents assessing is individual learning, telephone connection, SMS and correspondence. While based on the scores of the most effective counseling methods are home visits, pupils learning, telephone relationships, face book (FB) and BBM. The individual method gives 17-18% influence on all methods. Individual relationships are required for farmers to implement recommended recommendations (Isnaini, 2015).

4. Conclusions and Recommendations

The most effective selection of extension methods to convey information on Anthrax disease prevention efforts in the cattle raising business in West Nusa Tenggara in order to support West Nusa Tenggara Province as the world's best halal tourist destination depends on the target of counseling. If the target number is large or bulk then the General Meeting (General Meeting) counseling method is the most effective method. If the number of extension targets is a limited group of up to 20 people then the Group Discussion counseling method is the most effective method for delivering extension materials on prevention of Anthrax disease. And if the target of individual counseling, the method of extension Home Visits or Anjang Sana or Anjang Karya the most effective.

While based on the number of respondents who choose, the number of scores and scores the most effective counseling method to present Anthrax prevention disease prevention materials on the cow farming business in order to support the NTB Province as the world's halal tourism destination of the three methods of approach that is mass method , Groups and individuals are the most effective method of extension of Home Visits or Anjang Sana or Anjang Karya.

Since the three extension methods based on the number of extension targets have advantages and disadvantages, further research is needed to combine the various extension methods to obtain the most effective delivery methods based on the extension resources, the conditions of the target area, the receiving senses, the time, cost, place, facilities and communication media.

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Formula Optimisation of Milk Chocolate Bars Based on the Physical Quality and Organoleptic Characteristics

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Abstract

Cacao (Theobroma cacao L) considers as Indonesia premium export commodity and used widely in food industries, especially on confectionary products. Milk chocolate is worldwide product which defined as fine emulsion of cocoa butter, milk powder, sugars and emulsifier. Usually the used of cocoa butter in chocolate production as total lipid resources increase the manufacturing cost, which then imply the recommendation of cheaper lipid substitution with similar characteristics, such as hydrogenated palm margarine. The study aims to optimise formulation of milk chocolate bars by investigation the effects of margarin as butter substitutes (0%, 10%, 20%); addition of skim-milk powder (0%, 10%, 20%) and addition of lecithin (0.5%; 1% and 1.5%) towards product breaking power (kgf) and sensory attributes. The data is analysed statistically with ANOVA and Duncan Multiple Range Test and showed that breaking power is significantly influenced ($P \leq 0.01$) by cocoa butter substitution, skim-milk powder addition and interaction from both mentioned factors. Moreover aroma (chocolate, milk), appearance (shiny, dull), taste (sweet, milk, biter) and texture (hard, brittle, melted) are organoleptic described by 10 trained panellists while the correlation within examined parameters also presented.

Keywords: chlorogenic acids, luwak coffee, cupping, caffeine

1. Introduction

Cacao (*Theobroma cacao* L*)* is one of premium agriculture commodity since it plays significant role towards Indonesian economic development (Aini, et al., 2015). In Indonesia, cacao mostly grows in Sulawesi Island, Java, West Sumatera and Aceh. These plantations dominantly run by small-scale farmers, with productivity reaches 710 kg/ha (Gumbira Sa'id, 2015). With this high yield, Indonesian cacao classifies as bulk cocoa. This productivity also leads Indonesia as the third largest world exporters for cacao.

This crop mainly cultivated and then traditionally processed on to cocoa bean in producer countries such as West and Central Africa, Vietnam and Indonesia as well as Papua New Guinea (Pereira et al., 2013; Afoakwa et al., 2011). The processed done by farmers, who also grow, harvest, pulp-out, ferment dry and pack the cocoa beans traditionally. Then the beans from several farmers are collected and frequently mixed by middlemen, local traders and exporters and delivered to chocolate manufacturers (de Brito et al., 2001). This mechanism leads low impact towards economic development of cocoa farmers, since the end-product, which is known as chocolate mostly produced in well-developed countries. This derivative product of cocoa beans named as well as confectionary product (Beckett, 1999; Minifie. 1996).

Recently, many efforts has been made in collecting adapted-technology to produce good-quality chocolate for small-scale industries. By doing this attempts, the added value and economic benefit could be gain by local producers. Chocolate, as end-product, known as the most craved food, bring pleasurable feeling by its unique taste and has health benefit (Chiva, 1999; Serafini et al., 2003; El-Kayoubi et al., 2011). Chocolate defines the well-mixing combination of cocoa powder, others sources of lipid or cocoa butter, milk powders, sugars and other additives (El Kayoubi et al., 2011). Chocolate classifies as an emulsion, produced by refining and long-lasting mixing which influence its homogenous particle distribution, size of particles, texture and consistency of chocolate (Afoakwa et al., 2008).

However this approach have some limitations. For instance the expensive price of cocoa butter. Cocoa butter is tryglicerides with consists of stearic acid (34%) and palmitic

acids (27%) and monounsaturated oleic acid (34%) (Beckett, 1999). With this limitations, there is a need to replace or subsidies this lipid with cheaper source, such as some vegetable fats. Talbot (1999) proposed to substitute any other source of lipid which reported to be similar characteristics with cocoa butter in any proportion in chocolate production without having any impact on texture of product. Cocoa butter is reported to have 57.65% of lipid whilst palm olein has around 62-75% of lipid (Rahmad, 2007). In this present study, palm olein is used as substitutes with percentage of 0%, 10% and 20% of w/w, together with three level of milk powder addition by maximum 20% of w/w as reported with Franke (2008) and lecithin as emulsifier additives in three different levels

Previous research reported the effect of palm olein and milk powder on consumer acceptance and melting point of chocolate (Hasni and Rahmad, 2015). This research mentioned that substitution of 10% palm olein, together with 10% of milk powder and 1% lecithin produced milk chocolate with highest consumer acceptance. However the description and characterization of the milk chocolate together the breaking power (kgf) are still unknown. Therefore this reseach aims to determine and describe the characteristics of milk chocolate based on sensory properties and breaking power (kgf). Moreover the optimized formula is also determined in order to have detail recommendation for the local industries.

2. Materials and Methods

2. 1. Materials and Equipment

The materials that have been used in this research such as cocoa powder brand van houten, margarin, skim milk powder, vanili, was buyed from local market in Banda Aceh called Peunayong. Soy's Lecithin and cocoa butter was purchased from Bratachem, Medan. The equipments that has been used are mixer, cast, spoon, clove, scale, analytical scale, and refrigerator, water bath, hardness tester, thermometer and other glass equipment.

2. 2. Methods

Rendomized block design with three factorial and two repetetion as block was used for this research. The first factor is margarin as cocoa butter subtitution with D1=0%, D2=10% dan D3= 20% from total recipe. The second factor is variation of milk addition with R1= 0%, R2=10% dan R3 = 20% from total recipe and thrid factor is addition of emulsifier with A1= 0.5%, A2=1% dan A3=1.5% from total recipe. Significant different test than conduct as the first analysis, if there is a significant impact from each factor, the smallest different test is followed for psychall properties and Duncа's different test is followed for organoleptik test.

Formula for the smallest different test is:

$$BNT_{\sim} = t_{\sim}(v)\sqrt{\frac{2KTgalat}{n}}$$

Duncan Multiple Test formula is:

$$BND_{\sim} = t_{\sim}(\neg)\sqrt{\frac{KTgalat}{n}}$$

annotation:

tα(v) = Konstanta t-student in test level (α) and galat (v)
KT Galat = Galat's Mean
n = Repeatition

2.3. Procedures

The formulation of milk chocolate production was followed Beckett (1999) with mixing of 41% sugars, 6% cocoa powder, 35% cocoa butter, 20% milk powder and

lecithin soya. Samples were prepared by substituting cocoa butter at level 0%, 10% and 20%, addition of milk powder 0%, 10% and 20% and lecithin 0.5%, 1% and 1.5%. The quantities of the ingredients of all formulations are shown in Table 1. The production started from mixing all the materials, conching, tempering with water bath, cooling and packaging.

Table 1. Formulation of Ingredients

Ingredients	1st Level	2nd Level	3rd Level
Palm Olein as Cocoa Butter Substitute (g)	0	50	100
Cocoa Butter (g)	75	125	175
Milk Powder (g)	0	50	100
Cocoa Powder (g)	30	30	30
Sugar (g)	205	205	205
Lecithin (g)	2.5	5	7.5

2.4. Breaking Power (kgf)

Breaking power was conducted by using hardness tester AST-5. This equipment is used base on the need of pressure that used to break a chocolate bar. Befroe sample was put on this equipment, sample need to be freezed at temperature 8-10^{o}C in refrigerator. After we put sample in the equipment we give the pressure start from zero and up respectively till the chocolate bar is broken. The number that shown in monitor is noted. After some repetetion, the average number of pressure is got. Pressure that we have than used in formula below:

$$\tau = \frac{P}{A}$$

Which are : τ = the hardness(kg/cm^2)

P = PressureGaya tekanan dari hasil pembacaan alat (kg)

A = needle's wide (cm^2)

Due to the pressure needle has cone shape with diameter 1.2 cm, the formula then become:

$$\tau = \frac{4P}{\pi d^2}$$

$$\tau = \frac{4P}{3{,}14(1{,}2)^2}$$

where :

$$\tau = \frac{4P}{4{,}52}$$ then the final formula is : $\tau = 0{,}88\ P$

2.4. Sensory Evaluation

Sensory description test is a test that asses characteristic of sensory atribut from comoodity. The atribut which are flavour, shape, texture, and taste are scored by 8 trained panelist. The scale that has been used are 4 scale (4 = very strong, 3 = strong, 2 = weak, and 1 = very weak). The explanation of sensory atributes can be seen in Table 2. Prior to analysis, samples kept at temperature 18oC ±2 for 1 h before evaluation. Samples were served in white plastic plates; water and bread were provided for cleaning the palate between samples.

Table 2. Parameter Description in Description Test of Chocolate

No	Sensory attributes		Description
1	Flavour	Chocolate	Smelled like typical cocoa product from theobromin volatile compound.
		Milk	Smelled like typical milk product or same as fresh cream.
2	Appearance	Bright	The surface is bright like an apple having wax coating.
		Pale	The surface is pale and dull.
3	Texture	Soft	Tender, when pushed leave a trace and damaged.
		Hard	Dense, hard to break and when pushed leave no trace.
		Rigid	Dense, easy to break to be chocolates granule
4	Taste	Biter	Taste that come from *theobromin*, and responded by tongue's base.
		Sweet	Taste from sweetener and responded by tongue's tip.
		Milk	Fresh cream taste from the milk addition.

3. Results and Discussion

3.1 Breaking Power (kgf)

Breaking power defines as the amount of power required to break apart the chocolate bars at temperature 8-10^{o}C. The breaking power of milk chocolate bars varied between 1.14-3 and 23 kgf with average 2.21. ANOVA statistically stated that factor addition of margarine as cocoa butter substitute and addition of milk powder as well as the interaction between two factors significantly influence (P≤0.01) the breaking power of chocolate bars as shown by Figure 1.

Figure 1 showed that the treatment is significantly different with each other, as it followed by different alphabets. The addition of milk powder tend to reduce the breaking power whilst the used of margarine as cocoa butter substitute tend to increase the breaking power. However as can be seen in Figure 1, combination of milk powder and margarine tend to lower the breaking power of milk chocolate bars. The assessment is done after the storage of milk chocolate bars in refrigerator 8-10^{o}C which causing the freeze of margarine. But, substitution of margarine descriptively downsize the organoleptic score for hard texture, whilst the addition of milk powder increase the brittle texture since milk add up the proportion of non-lipid components in the formulation.

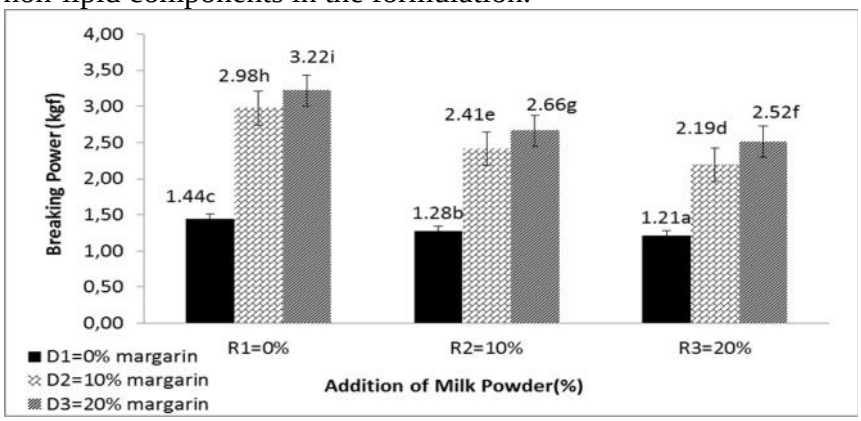

Figure 1 The interaction effect between addition of margarine as cocoa butter substitute and addition of milk powder towards breaking power (kgf) of milk chocolate bars (P≤0.01).

3.2 Descriptive Test

Table 2 shows the effect of substitution of cocoa butter with margarine on sensory properties of chocolate addressed descriptively. This factor independently has significant influence (P≤0.01) towards chocolate aroma, glossy appearances and brittle texture of the bars. Chocolate aroma perceived by panellist in the range 2.82-3.06 (strong) where the trends are aligned with amount of margarine added, however second and third level are statistically have no differences. Margarine as lipid which can absorbed the cocoa aroma from cocoa powder and butter used.

Moreover, the bars has glossy appearance and brittle which statistically influenced (P≤0.01) by the addition of margarine as cocoa butter substitute, where the treatment levels of both parameters are significantly different with each other. The glossy appearance descriptively scaled by panellist between 1.55 and 3.43 (weak to strong) and the brittle texture varied from 1.50 to 2,47 (weak). This is coherent with the ability of margarine to give glossy surface oto the product (Winarno, 1997).

Table 2. Effect of addition of margarine as cocoa butter substitute on chocolate aroma, glossy appearance and brittle texture of milk chocolate bars

Substition of cocoa butter	Chocolate Aroma	Glossy Appearances	Brittle Texture
0% margarin	2.82 a ±0.25	1.55 a ±0.47	1.50 a±0.33
10% margarin	3.04 b±0.23	2.30 b±0.30	2.11 b±0.26
20% margarin	3,06 b±0.21	3.43 c±0.21	2.47 c±0.19

Number followed by similar alphabet showed insignificant differences between treatment level.

Table 3 shows the effect of addition of milk powder towards five sensory properties which statistically proven has been significant influenced by this factor (P≤0.01). All of measured parameters exceptionally glossy appearances perceived by panellist to have increasing score as the amount of milk powder added increases. Downsizing of glossy look occurred since the addition of milk powder caused the formation of blooming, which defines as the presence of white particle at the bars surface. The milk particle apparently could not well-homogenised with other materials. This impact also impact to increase the perceived score of melted and britlle texture, which at the end impact the preferences of panellist towards the milk chocolate bar (Hasni and Rahmad, 2015).

Table 2. Effect of addition of milk powder on chocolate aroma, glossy appearance and brittle texture, melted texture and tasted milk of milk chocolate bars

Addition of milk powder	Chocolate Aroma	Glossy Appareances	Brittle Texture	Melted Texture	Tasted Milk
0% milk powder	2.84 a ±0.11	2.65 b±0.74	1.93 a±0.40	2.29 a ±0.89	2.23 a±0.10
10% milk powder	3.04 b ±0.27	2.41 ab ±0.96	2.00 ab±0.48	2.45 ab±0.84	2.27 a±0.22
20% milk powder	3,08 b ±0.27	2.22 a±0.90	2.16 b±0.57	2.47 b±0.80	2.54 b±0.19

Number followed by similar alphabet showed insignificant differences between treatment level

Figure 2 shows the interaction effect of milk powder addition and margarine as cocoa butter substitute towards hard texture which assessed descriptively. The texture of milk chocolate is softer and melted as the margarine higher, whilst the milk powder impact towards the brittle texture as can be seen in Table 2.

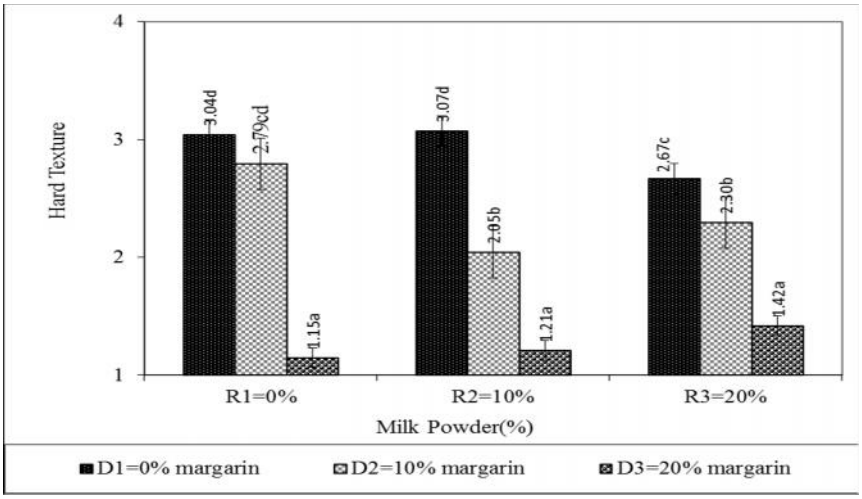

Figure 2 The interaction effect between addition of margarine as cocoa butter substitute and addition of milk powder towards breaking power (kgf) of milk chocolate bars (P≤0.01).

3.3 Correlation

Table 4 Correlation within measured parameters

Parameters	Breaking Power	Aroma Chocolate	Glossy	Dull	Brittle	Hard
Breaking Power	1.000					
Aroma Chocolate	**0.515**	1.000				
Milk Aroma	**-0.462**	**-0.469**				
Glossy	**0.809**	0.441	1.000			
Dull	**-0.827**	**-0.578**	**-0.921**	1.000		
Brittle	**-0.745**	**-0.605**	**-0.824**	**0.843**	1.000	
Hard	**-0.689**	-0.298	**-0.822**	**0.756**	**0.705**	1.000
Melted	**0.757**	0.393	**0.904**	**-0.828**	**-0.836**	**-0.920**

Table 4 shows the correlation between measured parameters, glossy appearance and breaking power statistically correlated with each other since both of parameters influenced by margarine addition, whilst dull and breaking power have negative correlated since dull appearance increases as the milk powder added whereas the breaking power decrease as it adds. Texture melted positive correlated with glossy appearance but negatively correlated with dull and brittle texture. This is because the dull and brittle are associated with milk powder addition whereas melted and glossy are related with margarine.

4. Conclusion

Taking everything into consideration it could be stated that breaking power of milk chocolate is associated addition of milk powder and margarine as cocoa butter substitute. Panellist perceived that milk chocolate tend to have stronger chocolate aroma, very melted texture, glossier appearance as the margarine added, whilst milk powder tend to produce milk chocolate aroma with stronger milky taste, duller appearance, very brittle texture.

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Effect of Design Variation of Corncob Biomass Gasification on Boiling Time and Flaming Duration

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Abstract

The furnace gasification is designed to utilize fuel chunks. Fuel chunks allow the outside air to enter easily through the pores. Examples of fuel chunk are corncobs, coconut shells, waste wood pieces, etc. The main principle of the furnace design is to utilize the outside air coming into the furnace through the hole on the underside. The air coming into the furnace is divided becoming primary air and secondary air. The primary air enters from under the burning sleeve to the fuel, while the secondary air enters from the top hole of the burning sleeve and burns the combustion gas containing fuel-burning substances. In this study, the fuel used was corncob with a diameter of 3-4 cm, a length of 6-7 cm, and moisture contents ranging from 14% to 16%. The furnace used consists of 8 variations of the design model. Free parameters in this study were plate thickness, outer air hole diameter, secondary air hole diameter, and primary air hole diameter. While the bound parameters investigated were coocing time (water boiling time) and flaming duration. The fastest boiling time was 2.07 minutes achieved from the furnace designed with the 1 mm plate thickness, 3 cm outside air hole diameter, 3 cm secondary air hole diameter, and 2 cm primary air hole diameter. Meanwhile, the longest boiling time was 2.41 minutes obtained by the furnace design with the 0.8 mm plate thickness, 2 cm outside air hole diameter, 2 cm secondary air hole diameter, and 1 cm primary air hole diameter. This different result is influenced by the size outside air hole diameter, secondary and primary air hole diameters, and the plate thickness. These parameters cause heat loss through the wall. The longest flaming duration was 13.24 minutes shown by the furnace with the 0.8 mm plate thickness and the air hole diameters of 2 cm, 2 cm and 1 cm. In the mean time, the shortest flaming duration was 9.88 minutes indicated by the furnace with the 0.8 mm plate thickness and the air hole diameters of 3 cm, 3 cm, and 2 cm. With the biggest air hole diameter, the combustion of the fuel occurs faster so that the fuel is oxidized quickly.

Keywords: Corncob, furnace, gasification

1. Introduction

During this time most corn cobs have not been widely used as fuel. These materials are often discarded on farmland or on the roadside as waste. Whereas the energy content is quite large. The energy content of corn cob is 3,500-4,500 kcal / kg or 14.7-18.9 MJ / kg. The combustion temperature of corn cobs can reach 205ºC. Meanwhile, other literature sources mention that with corncob carbonization, its energy content can reach 32 MJ / kg (Watson, 1988 in Prostowo et al., 1998; Mochidzuki et al., 2002). The purpose of this research is to obtain continuous corncob gasification stove product which is equipped with fire extinguisher and flame regulator to facilitate the utilization of alternative energy as a substitute for kerosene. Benefits of the research:

1. Utilization of corn cob for domestic fuel (household) to support PIJAR program (superior program of NTB Province)
2. Facilitate the use of corn cobs as a household energy producer, with a low cost.
3. Development of corn cob stove design that is more suitable applied in rural communities, especially farmers producing corn.

Research Road Map:

Starting from 2004 until 2014, research team has conducted investigation related to new and renewable energy and value engineering consisting of:

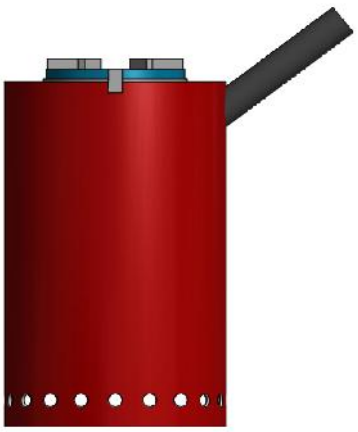
1. The application of value engineering to the cracker feeder boiler to select metal boiler walls and select heat conducting pipes with various types and dimensions of material and

assessed with value engineering to obtain suitable materials that have low heat losses and cheap manufacturing costs.

2. Biomass briquette stove design of semi-automatic continuous ignition system with value engineering method as an effort to facilitate the utilization of alternative energy as replacing kerosene
3. Testing the characteristic of downdraft type gasification furnace fueled rice husk, wood chips and garbage.
4. Utilization of gasification furnace of rice husk as alternative energy substitute of kerosene stove and wood furnace toward self-sufficiency community of energy in poor area of poverty prone (single combustion chamber).
5. Performance of gasification stoves with fuel biomass branches and cutting wastes of dry wood (2014).

3. Materials and Methods

Initial Stove Design



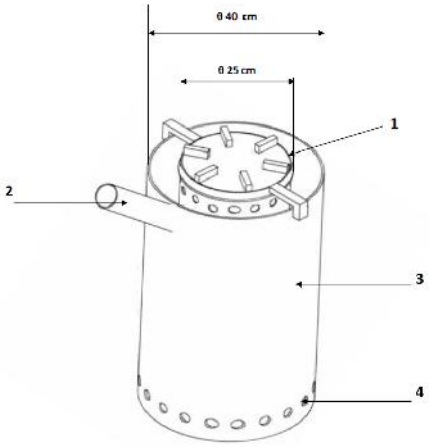


Figure explanation:

1. Combution chamber with a diameter of 25 cm and height of 40 cm.
2. Fuel inlet with the diameter 2.5 inch or 6 cm.
3. Outer body of the stove with a height of 65 cm and the diameter of 40 cm.
4. Air inlet with diameters of 2 cm and 3 cm, and the height of 20 cm.

Tools and Material of the Research were: 1) Ready stove designs (see figure 2 above), 2) Moisture tester (MD814 type), 3) Thermocouple and temperature reader (FOTEK MT48-R type), 4) Digital balance, 5) Dried corn cobs (14 – 16 %), 6) Pan, and 6) Stopwatch

Figure 3 Moisture tester

Figure 4 Temperature reader

Figure 5 Ready stove design

Preparation

1. Dry the fuel at the moisture constant of 14-16%.
2. Weigh the fuel of about 1 kg.
3. Feel the pan with 1 litre of water.

Implementation

1. The fuel is ignited in the combustion chamber, waited until the flame stabilizes. When the flame is stable put the pan on the stove. At that time, the flame time has begun to be counted, and the temperature of the boiling water is recorded (Boiling time).
2. Visual observations of fuel flame are also noted
3. Each test variation is repeated 3 times.

Step:

1. Record the time needed for boiling the water from the beginning till the water temperature reaching value of 98°C.
2. Record the flame duration from the flame gets stable until it is burned.
3. Take a photo of the fuel flame condition especially the top of the combustion chamber for each test variation.

3. Results and Discussion

From the investigation that had been conducted, some data were obtained as shown in Table 1.

Table 1. Effect of stove design variation on the boiling time and flame duration

No.	Variations	Boilling time (minute)	Flame duration (minute)
1	(Plat thickness of 1 mm, hole diameters of 2 cm, 2 cm,	2.34	11.54
2	(Plat thickness of 0.8 mm, hole diameters of 2 cm, 2	2.36	13.20
3	(Plat thickness of 1 mm, hole diameters of 3 cm, 3 cm,	2.07	11.29
4	(Plat thickness of 1 mm, hole diameters of 2 cm, 2 cm, 1 cm, with fire extinguishing system)	2.27	12.26
5	(Plat thickness of 0.8 mm, hole diameters of 3 cm, 3 cm, 2 cm)	2.19	9.52
6	(Plat thickness of 0.8 mm, hole diameters of 2 cm, 2 cm, 1 cm with fire extinguishing system)	2.41	13.24
7	(Plat thickness of 1 mm, hole diameters of 3 cm, 3 cm, 2 cm, with fire extinguishing system)	2.18	11.20
8	(Plat thickness of 0.8 mm, hole diameters of 3 cm, 3 cm, 2 cm, with fire extinguishing system)	2.26	9.88

From table 1, a graph can be made as shown in figure 6:

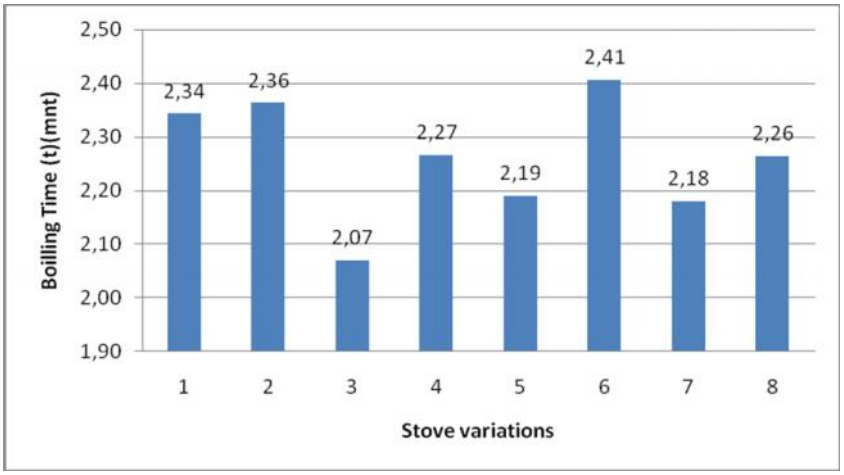


Figure 6. Relationship between stove variation and boiling time

The furnace designed with 1 mm thick plate, 3 cm outer air hole, 3 cm secondary air hole and 2 cm primary air hole, results in the fastest boiling time of about 2.07 minutes. While the furnace with a thick plate of 0.8 mm, 2 cm outer air hole, 2 cm secondary air hole and 1 cm primary air hole, obtains the boiling time of approximately 2.41 minutes. This difference is influenced by external, secondary and primary air holes. The thickness of the plate leads to heat loss through the wall.

From table 1, a graph relating the stove variation and boiling time can be presented, see figure 7.

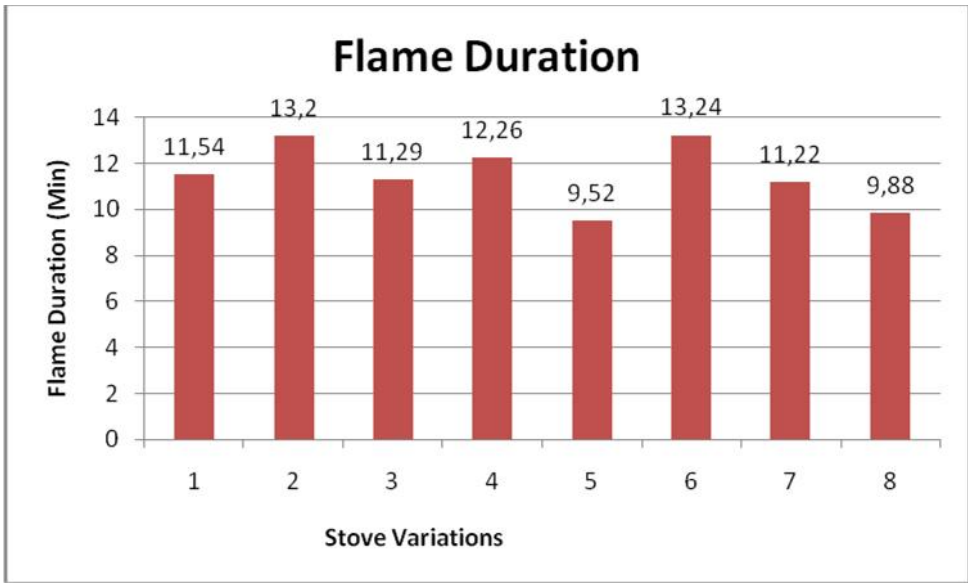


Figure 7. Relationship between stove variation and flame duration

The longest flame duration is 13.24 minutes that is resulted by the furnace of variation 6 with the plate thickness of 0.8 mm the air hole diameters of 2 cm, 2 cm, 1 cm. Meanwhile, the shortest flame duration is 9.88 minutes indicated by the variation furnace 5 with the plate thickness of 0.8 mm of air hole diameters of 3 cm, 3 cm, and 2 cm. With larger diameter holes, fuel combustion takes place faster so that the fuel quickly oxidizes.

Figures 8 Visual condition of the flame generated by the designed stove no 5

Figures 9 Visual condition of the flame generated by the designed stove no 6

The visual observation results show that the upper flue gas combustion by the hot, hot air out of the upper combustion chamber. A large flame is indicated by a stove with a 2 cm diameter of the secondary air hole.

4. Conclusions

1. This research produces the fastest boiling time of 2.07 minutes which is obtained from the design furnace 3 with 1 mm thick plate, 3 cm outer air hole diameter, 3 cm secondary air hole, and 2 cm primary air hole. While the longest time is 2.41 minutes achieved by the design of furnace 6 with a plate thickness of 0.8 mm, the diameter of the outside air hole 2 cm, secondary air hole 2 cm, and primary air hole 1 cm.
2. The difference in results is influenced by the large external, secondary and primary air holes. The thickness of the plate leads to heat loss through the wall. The longest flame length is 13.24 minutes indicated by furnace 6 with 0.8 mm plate thickness of the air hole diameter of 2 cm, 2 cm, 1 cm. The longest flame duration is 9.88 minutes indicated by furnace 8 with 0.8 mm plate thickness and air hole diameters of 3 cm, 3 cm, and 2 cm.
3. With the larger air hole, the combustion occurs quickly so that the fuel oxidized soon.

Acknowledgement

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Activity of Bamboo Rhizobacteria to Inhibit *Fusarium oxysporum* with In Vitro Screening

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Abstract

Rhizobakteria are the colony of bacteria are living in plants rizosfer and one of their potential is Plant Growth Promoting Rizobakteria (PGPR). PGPR is controling the pathogen from plant. The research was an experimental, conducted in Biology Laboratory of FMIPA MataramUniversity in October 2016 - April 2017. The Data analysis used was the Central Tendency that the measurement was based on visible inhibition. The purposes of this reaserch are to know abaout the efectivity of resistibility of isolat bacteria from bamboos root and to know the activity of rhizobacteria from bamboo rhizosfer to inhibit fungal patogenFusariumoxysporum and to analisys the fungal activity of bamboo root extract. The result of this research are six bacteria was isolated from bamboo rhizosfer. That isolates showed no fungal activity to F. oxysporum. The same result also showed by bamboo root extract, is no fungal activity showed to F. oxysporum. It is necessary to conduct the test using different compound extracting methods.

Keywords: Bamboos rhizosfer bacteria, bamboos root extract, antifungal, F. oxysporum

1. Introduction

Fungalis one of peststhat cause diseases in plants. This fungal is generally known to be able to infect various types of plants from various stadia. Physiological disorder that often happens is wilting, to cause death in plants. In addition, according to Asian Vegetable Research and Development Center 1990 in Syamsuddin (2003)fungal is pest that can reduce the quality and quantity of crop production up to 100%. Some fungal causing diseases such as patches on leaves, wilted and collapsed sprouts in plants are caused by *Fusariumoxysporum.*

The prevention of pathogenic pest diseases in plants that are effective, safe for human health and does not pollute the environment is by biological control using biological agents.In general,developed biological agents are natural microbes (Rizobacteria) that live as saprophytes in soil, water and organic materials, as well as those living in plant tissues (endophytes) that are inhibiting growth and competing with target pathogens (Octariana, 2011). According to Sarma et al., (2009) the benefits of rizobacteria from plant roots other than as fertilizers and biological stimulants are also capable of producing growth hormones in plants such as IAA (indole acetic acid), giberelin, cytokine, ethylene and dissolving minerals as antibiotics in plants.

One of the commonly used vegetable pesticides to control pest growth in plants is PGPR (Plant Growth Promoting Rizobacteria). The common ingredientused inmakingPGPR formula is plant roots. This research uses bamboo root.The roots of bamboo are rarely infected by diseases or pests. The soil around the bamboo roots is widely used as a medium for planting crops by local farmers because the roots of bamboo are rich in microbes that are likely to endophytes in plant's root (Asniah et al 2013).Rizobacteria from this bamboo root is a bacteria found in plant rhizosphere, located on the root surface or associated with the roots of various plants and positively affect the plants, therefore rizobacteria from bamboo root is expected to induce plant systemic resistance to obtain healthy agricultural production and environmentally friendly.

2. Materials and Methods

This research began in October to April 2017, conducted in Biology Laboratory, Faculty of Mathematics and Natural Sciences University of Mataram.Preparation of making PDA (Potato dextrose agar) and NA (Nutrient agar)media.

2.1 Bamboo root extract resistivity activity against *F. oxysporum*

Prepared bamboo root extract diluted using DMSO into several concentration, these are 20%, 40%, 60% and 80%. Prepared *F. oxysporum*isolates tested by culturing it in the middle of PDA medium petry dish then incubated in room temperature for 3-4 days. After fungal starting to grow, exact same steril wells made on the left and right side of the petry dish. After that, media tested using bamboo root extract with several concentrations that has been mentioned above. All samples then incubated in room temperature and monitored for its resistivity activity in every concentration. All procedures repeated for 3 times. Nistatin used in control sample.

2.2 Bacteria isolate resistivity activity against *F.oxysporum*.

Isolation of rhizosphere bacteria from bamboo has been done by diluting method. Every grown bacteria tested against *F. oxysporum* in PDA medium. In this study researcher used diffusion well method.

3. Results and Discussion

Six bacteria were isolated from bamboo rhizosphere soil sample in Ketare village. The isolates have various morphological characters and cellular forms. There are 4 bacillus isolates and 2 isolates of coccus-shaped bacteria. There are 3 isolates groupednegativegram bacteria and 3 others arepositivegram bacteria.

3.1 Bamboo Root Extract ResistivityActivity Against *F. oxysporum*.

Based on the result of fungal isolation test using bamboo root extract shows negative result. Every different concentration did not show any inhibition zone made by bamboo root extract.

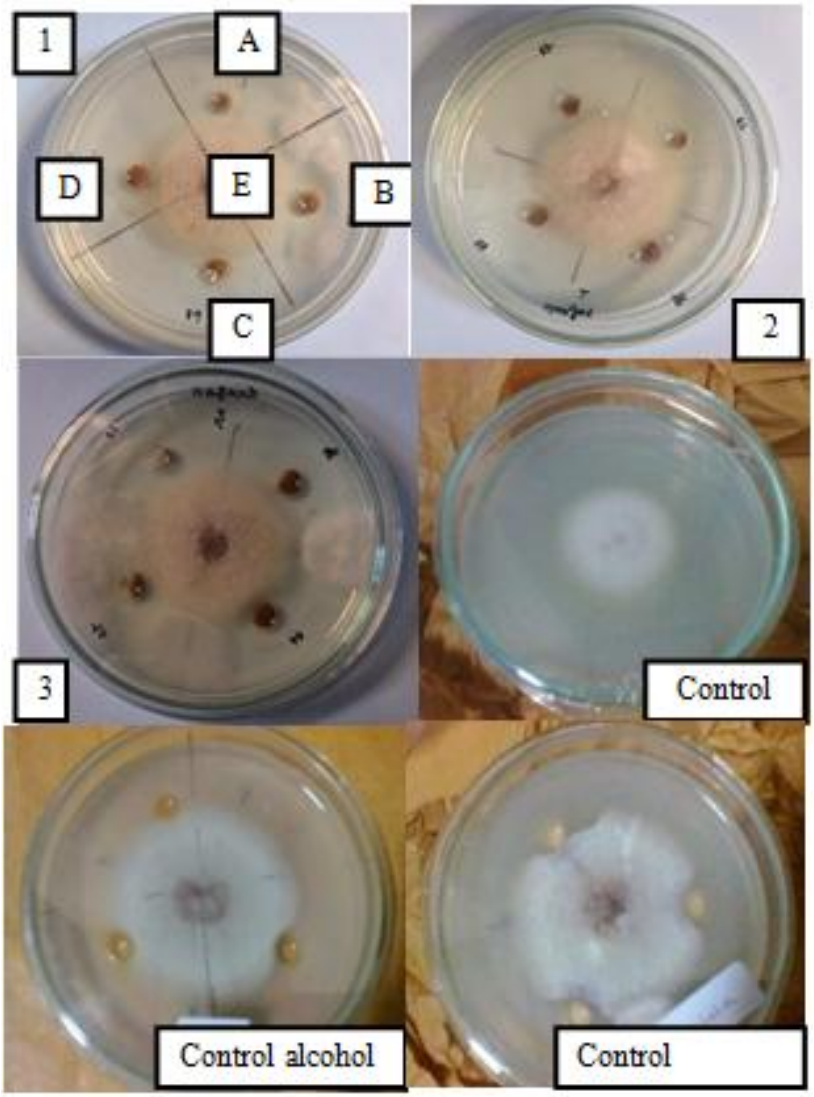

Figure 4.3 Fungal isolates against bamboo root extract test in PDA medium. A: Bamboo root extract with 20% concentration, B: 40% extract concentration, C: 60% extract concentration, D: 80% extract concentration, E: *F. oxysporum*isolate.

Negative results in these tests may be influencedby bamboo's habitat. Bamboo habitat greatly affects roots and soil around roots. In Andari et al., 2013 study stated that the compounds contained in the plant depending on the type of plant and the older the vegetation of plants the influence of rhizosphere against the bacteria will begreater. In quinine plants (*Cinchona ledgerina* Moes) the number of bacterial populations increases with the age of the plant, this is in accordingto research conducted by Antralina et al., 2015. Unlike the usual petung bamboo (Gigantochloaatter) in this study, the older age of the bamboo the less activity of rizhosphere bacteria.

3.2 Bacteria Isolate ResistivityActivityAgainst F. *oxysporum*

Based on a test of F. oxysporum fungi against bacterial isolates shows negative results, which has been tested with three repeating but the result remains the same, there is no inhibition zone on the growth of fungal isolates.

Figure 4.4 showsfungal isolates against bacterial isolates, this result shows fungalthrived. However, the growth of bacterial isolates in the pit is very narrow and unable

to develop. Theabsenceof inhibition zonein this test is may becaused bytheculturemedia that is PDA.

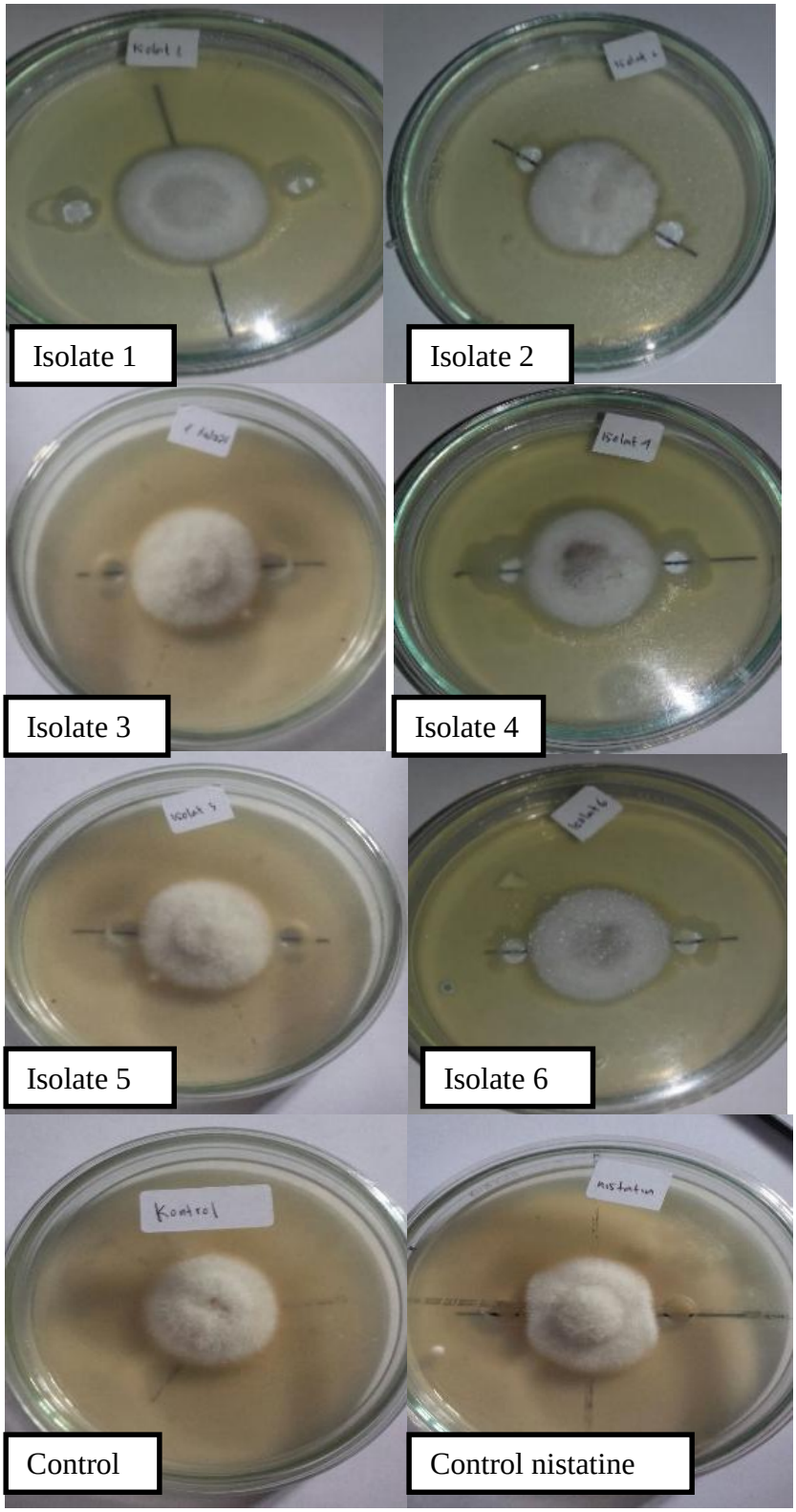

Figure 4.4 The results of fungal test using PDA media. A: Bacteria isolate, B: *F. oxysporum*isolate.

Tests using these PDA media are slowing down the growth of bacteria isolates. Nutritions needed by fungal and bacteria in this test are different so Three is on competition on nutrition between them. This caused absence of inhibitory activity on bacterial testing, so

that the existing nutrients in the PDA media is only absorbed by fungal isolates. This is consistent with the results of testing on bamboo root extracts with fungal isolates showing no inhibition zone on fungal growth.The next possibility is suspected bacterial isolate of this bamboo root has no antifungal compound.

4. Conclusion

From the Research found 6 bacteria isolates from soil rhizosphere samples in Ketara Pujut, Central Lombok. There are 4 bacillus bacteria isolates and 2 coccus bacteria isolates, but all isolates that tested against F. *oxysporum* fungal show negative result. The result of bamboo root extract resistivity shows negatif result either. With no sign of clear zone and inhibiting zone. This result shows that there is no resistivity activity against *F. oxysporum*in both bamboo root extract and rizhospere bacteria isolates.

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Isolation and Identification of Chitinolytic Bacteria from Intestinal Tissue or Tilapia (*Oreochromis niloticus*)

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Abstract

Saprolegniasis is a worldwide serious mycotic winter freshwater disease often affects wild and cultured fishes. Chitinolytic bacteria that possess chitinases has been known to has potential for controlling Saprolegniosis. The purpose of this study was to obtain the chitinolytic bacteria from tilapia (*Oreochromis niloticus*) as biological control of Sarolegniasis. The bacteria were isolated from the intestinal tissue of the tilapia then propagated on LB medium and grown on a minimal medium containing 0.2% colloidal chitin. Colonies of bacteria having clear zones around the colonies were selected and identified by standard microbiological methods. The results of this study showed that there were four types of chitinolytic bacteria from the intestinal tissue of tilapia namely *Bacillus* sp., *Aeromonas punctata*, *Aeromonas hydrophila*, and *Pseudomonas* sp. *Bacillus* sp. was a non-pathogenic bacteria and become the only candidate as the biological controller of *Saprolegnia* infection in aquatic organisms especially Tilapia among the other species. Further reseach to optimize the *Bacillus* utilization as a biological controller in the case of *Saprolegnia* infection is needed.

Keywords: Chitinolytic bacteria, isolation, saprolegniasis, tilapia

1. Introduction

Nile tilapia (*Oreochromis niloticus*) is one of the most commonly cultured fish species worldwide because of their high protein content, rapid growth and good palatability (Cutuli *et al*., 2015). This fish is quite popular in Indonesia. Its selling price especially in West Nusa Tenggara Province is quite high and relatively stable at IDR 27,000-30,000 per kilogram. Due to development of aquaculture, fish fungal infections have also increased (Ali *et al*., 2011). *Saprolegnia* infection is correlated to stress factors such as abrasions, cutenous wounds sexual maturity, poor water quality, crowdness, malnutrition, handling and bacterial and/or parasitic infections (Pickering, 1994).

The case of *Saprolegnia* infection in Tilapia has long been known. This infectious fungal disease is widespread in all stages of the life cycle of fish. The disease causes serious losses in fish farms and hatcheries and considered as one of aquatic disease implicated in mass mortalities of cultured and wild fish in many countries (Husein *et al.*, 2001). The disease appears as cotton wool-like tufts on the body surface causing destruction of the skin and/or fins due to cellular necrosis by hyphal penetration and that is generally restricted to the epidermis and dermis (Fregeneda-Grandes *et al*., 2007).

Fungal infections are difficult to prevent and treat. Prevention and treatment efforts commonly done on the mycotic disease of fish is using chemical drugs such as malachite green, formalin, hydrogen peroxide, and so on. However, the use of chemicals tends to be unfriendly environment and some are carcinogenic (Mayer, 2005). Therefore, friendly strategy for controlling fungal diseases is needed. Biological control, the use microorganisms to control fungal diseases, offers an alternative. Recently, biological control has been focused on microorganisms producing mycolytic enzymes, especially chitinases (CHIs), which are known to hydrolyze chitin, a major component of fungal cell walls (Brzezinska *et al*., 2014). The purpose of this study was to obtain the chitinolytic bacteria from intestinal tissue of tilapia (*Oreochromis niloticus*) as the Sarolegniasis disease biological control.

2. Materials and Methods

2.1 Samples collection

Tilapia weighing 100-200 g of body weight were collected from 4 districts, namely East Lombok, West Lombok, Central Lombok, and Mataram City for isolation of chitinolytic bacteria. Ten samples selected from each location were put into the ice box and taken to the laboratory for further observation.

2.2 Bacterial propagation

Bacteria were isolated from the intestinal epithelium using wire loop and then cultured on nutrient-rich media containing 2 g/L K_2HPO_4, 5 g/L peptone, 3 g/L beef extract, and 5 g/L lactose. Bacterial cultures were performed in 100 mL elenmeyer flask. The bacterial solution was gently rocked overnight at room temperature.

2.3 Screening of chitinase-producing bacteria

Screening of chitinolytic bacteria (chitinase-producing bacteria) was performed on a minimal medium containing 1 g/L KH_2PO_4, 1 g/L NaCl, 7 g/L NH_4SO_4, 0.1 g/L $MgSO_4.7H_2O$, 1 g/L tripton, 1 g/L yeast extract, 15 g/L agar, and 2 g/L colloidal chitin. Colloidal chitin obtained from the Microbiology and Biotechnology Laboratory of Bogor Agricultural University. Serial *dilutions* were used to calculate the concentration of bacteria. A total of 1 mL of propagated bacterial solution was diluted up to 10^9–fold. Twenty microliters (20 µL) of sample were taken from each 10^8 and 10^9–fold dilution and then dispersed on the surface of the agar medium use spatula separately. The bacteria were incubated for 24 hours at room temperature. Colonies of bacteria showing clear zones around the site were purified again on a minimal medium containing 5 g/L colloidal chitin using a streak plate method. The single colony was then isolated using sterile toothpicks and cultured on a new minimal medium containing 5 g/L chitin for further identification.

2.4 Characterization and identification of bacteria

The characterization and identification of bacterial isolate were conducted at Laboratory of Lombok Marine Aquaculture Development Centre using standard microbiological methods according to Holt *et al*. (2000).

3. Results and Discussion

3.1 Results

3.1.1 Isolation and screening of chitinolytic bacterial

The isolation of chitinolytic bacterial isolates was carried out by spread inocula obtained from propagation on Luria-Bertani (LB) broth medium into a minimal salt agar medium containing 2% colloidal chitin as a sole carbon and energy source for bacteria. The chitin degrading organism formed colonies of 1-2 mm in diameter, surrounded by clear zones indicating chitinase activity (Fig. 1).

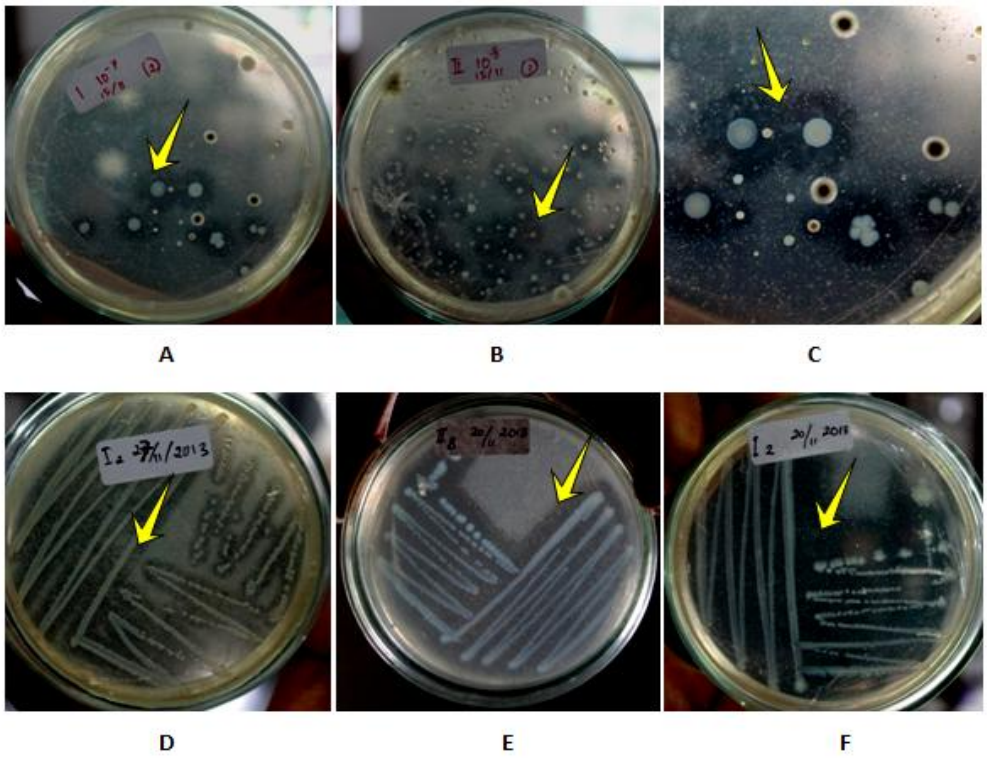

Figure 1. Chitinolytic bacteria characterized by clear zone around the colonies. Description: A-C: Bacterial colonies grown on selective medium containing 2% colloidal chitin; D-F: Purification of chitinolytic bacteria using streak *plate method* on selective agar medium with 2% colloidal chitin

3.1.2 Characterization and identification of bacteria

The results of characterization of bacterial morphological appearance indicate that there were four species of chitinolytic bacteria found in the Tilapia intestine of *Bacillus* sp., *Aeromonas punctata, Aeromonas hidrophila,* and *Pseudomonas* sp.

3.2 Discussion

Chitin, the β-1,4-linked homopolymer of N-acetylglucosamine (GlcNAc), is the most bundant polymer in the marine environment, and the second in nature after cellulose. Chitin is a component of the fungal cell wall (Paulsen *et al*., 2016). The hydrolysis is mediated by chitinolytic enzymes and allows the microorganisms to utilize chitin as a carbon and nitrogen source and chitin turnover is important for the biogeochemical C- and N-cycles. Chitin and chitinolytic enzymes are also of biotechnological interest with potential applications in the food, medical and agricultural sectors (Hayes *et al*., 2008).

The cell wall of fungi as well as *Saprolegnia* sp. contains chitin and some chitinolytic microorganisms can inhibit the growth of fungi by chitin degradation (Hoster *et al*., 2005). Potentially, natural fungicides, such as chitinases, could replace the chemical fungicides in plant biocontrol (Brzezinska *et al*., 2014) and since bacterial chitinases can inhibit fungal growth, they are of particular interest for this purpose.

Detection of chitinase-producing bacteria from natural sources is useful to find the bacteria that can produce antifungal or other novel compounds. A high correlation between chitinolysis and production of bioactive compounds has been reported (Pisano *et al*., 1992; Hoster *et al*., 2005). Microorganisms, which secret a complex of mycolytic enzymes, are considered to be possible biological control agents (Chang *et al*., 2003).

Interestingly, we found that the four selected bacterial isolates were related to bacterial species that have shown their chitinolytic activity. Although isolated successfully, but

Aeromonas is a genus of growing interest due to its pathogenicity to aquatic organisms, its potential pathogenic effects in humans (Dwivedi *et al*., 2008), in fishes (Thampuran *et al*., 1995). *Aeromonas* species are also etiological agents of fish diseases like furunculosis (Reith *et al*., 2008), septicaemia (Singh and Sanyal, 1999) and skin ulcers (Figueras *et al*., 2009). Snieszko (1957) divided the genus into three species: *A. hydrophila, A. punctata,* and *A. liquefaciens.* Mesophilic species, namely *A. hydrophila* causes an assortment of diseases in fish, including motile *Aeromonas* septicemia (MAS), fish rot, soft tissue rot and furunculosis resulting in major die-offs and fish kills around the globe (Joseph & Carnahan, 2000). Epizootic ulcerative syndrome (EUS) in fishes due to *A. sobria* caused great damage to fish farms in Bangladesh and India (Rahman *et al*., 2007). *Aeromonas liquefaciens* contained most of the fish pathogens (Snieszko, 1957). Schubert (1967) confirmed that there was enough biochemical similarity to establish the genus *Aeromonas*, but invalidated species-specific distinctions. Later, Popoff and Vernon (1976) demonstrated that the motile aeromonads could be classified into two distinct species: *A. hydrophila* (composed of the organisms previously described as *A. punctata* and *A. liquefaciens),* and a new species that they named *A. sobria.* Biochemically, *A. hydrophila* hydrolyzes esculin and ferments both salicin and arabinose, whereas *A. sobria* does not utilize these compounds (Lallier *et al.,* 1981).

Some *Pseudomonas* species have been reported to be causative agents of fish disease. Among these, *Pseudomonas anguilliseptica* is considered the most significant for cultured fish, having been described from many species, including turbot (Toranzo *et al*., 2005). However, other species of the genus may also be serious pathogens, such as *Pseudomonas plecoglossicida* in ayu, *Pseudomonas chlororaphis* in amago trout, *P. aeruginosa* in South-American catfish, *Pseudomonas putida* in ayu, rainbow trout and yellowtail and *Pseudomonas fluorescens* in carp, sea bream and tilapia (Austin & Austin, 2007).

Members of the genus *Bacillus* are well known for their potential to secrete a number of degradative enzymes such as chitinase (Schallmey *et al*., 2004; Ajayi *et al*., 2016). Kamil *et al*. (2007) reported that several species of *Bacillus* including *B. lincheniformis* and *B. thuringiensis* showed the highest chitinase activity. Similarly, six chitinases from *Bacillus circulans* WL-12 were reported by Watanabe *et al*. (1992).

The use of live bacteria as biocontrol can harm aquatic organisms especially for pathogenic chitinolitic bacteria strains. Therefore, it is important to characterize and test the pathogenicity of isolated bacteria in nature. The types of bacteria *Aeromonas* spp. and *Pseudomonas* sp. that have been isolated and identified biochemically in this study were known to belong to the group of pathogenic bacteria. However, the successful of *Bacillus* sp. isolation and identification has opened up the possibility of utilization of this bacteria strain as a biological control of *Saprolegnia* sp. infection in aquatic organisms as well as Tilapia.

4. Conclusion

This research has successfully isolated, characterized and identified four types of chitinolytic bacteria from intestinal tissue of Tilapia. The types of chitinolytic bacteria were *Bacillus* sp., *Aeromonas hydrophila, A. punctata,* and *Pseudomonas* sp. *Bacillus* sp. was a non-pathogenic bacteria and become the only candidate as the biological controller of *Saprolegnia* infection in aquatic organisms especially Tilapia among the other species.

The optimization of bacterial utilization of *Bacillus* sp. as a biological controller in the case of *Saprolegnia* infection to Tilapia is needed and becomes the target of further research.

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Structural Behaviour of Spherical Hollow Reinforced Concrete Beam under Flexural Loading

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Abstract

This research was conducted with aims to determine and understand the behaviour of spherical hollow reinforced concrete beam. Five hollow reinforced concrete beams were tested with variations of 1, 3, 5, 7 and 9 spheres resulted the volume ratios of 99%, 98%, 97%, 95% and 94%, respectively. Beams dimension were 200 x 300 mm with effective length of 3000 mm. Steel reinforcements were 3D13 in tension and 2D10 in compression linked together with D10-20 stirrups. The concrete strength of 22 MPa and steel yield-strength of 390 MPawas considered. In addition, one solid beam was also tested as a standard beam. Flexural static loads were applied according to SNI testing standardmethod with two points of loading. Test results indicated that the fracture pattern of all specimens was classified as bending cracks. The presence of spherical hollow has insignificant effect to the structural behaviour of reinforced concrete beam. Cracking moments has 83% decreased and the ultimate moment has only95% decreased. Ductility of the hollow beams was also decreased but it is still acceptable since the ductility ≥2. Therefore, in order to reduce self-weight of reinforced concrete, the use of spherical hollow beam is highly recommended.

Keywords: Concrete beam, hollow sphere, structural behaviour, moment capacity, ductility

1. Introduction

Concrete is a very popular building material in the construction industry because of its strength to withstand high compressive forces. However, the concrete has a weakness with low tensile strength and its need to be combined with other materials such as steel reinforcement. Another weakness is its heavy self-weights which is necessary to have an innovation to the structure by reducing its own weight. The reinforced concrete structural element with the hollow is a structure that is effective enough to reduce its own weight. This research was conducted in the laboratory of Materials and Building Department of Civil Engineering University of Mataram. This study aims to determine and understand the behavior ofspericalhollow reinforced concrete beam structure. While the specific purpose of this study is to obtain the form of geometry modeling hollow cross section that supports the ductility of an element of reinforced concrete structure.

The world consumption for concrete is about 8.8 million tons annually. This consuming material will continues to increase from year to year in line with the increasing needs of basic human facilities and infrastructure. From the increasing use of concrete materials, there are two important aspects to note i.e durability of the concrete material itself and the environmental disturbance caused by Portland cement production. Besides abrasion and landslide by the use of coarse aggregate material, excess sand is also a problem to be prevented. Therefore, the optimization and limitation of the use of concrete materials is essential.

Concrete slab with Bubble Deck system developed by Netherlands (1997) is an innovation of hollow concrete plate elements with no beam (flat plate) and column head (drop panel). This system can be used as floor slab, roof and floor plate. One of the structural advantages of this system is to have a load-bearing capacity that is as good as a massive plate, but with a smaller thickness. This brings the advantages of saving plate construction materials up to 40% to 50%. With the reduction of the plate's own weight, other structural elements will also retain less weight of the plate, and will reduce the required column and foundation dimensions, resulting in a 50% overall material saving for the whole building.

Rahadyanto (2013) conducted experimental hollow beam with the utilization of PET bottle waste. The experimental test was divided into three types, solid beam K-400, K-400 hollow beam and K-300 hollow block. The reasonably stable maximum loads occur in solid beam K-400 with K-300 hollow beam of 77.33 kN and maximum holding moment of 46.40 kN.m. The solid strength ratio of K-400 and the K-300 hollow to the K-400 hollow beam is 1.017. While Ali and Wahid (2008) state that massive blocks reach cracks at higher loads than hollow blocks. The hollow beam has a failure of press with the plan load while the massive block is able to withstand the load greater than the load of the plan.

Canonica (2013) divides the structural form in two levels i.e. global-form (whole form) and local-form (element form/component detail structure). At the global level-form structural efficiency is produced by a form-active structure while at local-form level structural efficiency is obtained by forming a cross-sectional configuration of structural components formed to produce the moment of inertia (I) as large as possible with the least amount of material possible. For structural receiving moment of efficiency can be done by placing the most material on the outermost side of the cross section of the structural component in order to obtain maximum inertia. Correspondingly, Canonica (2013) has also thought to pierce the cross section of the beam in order to reduce its own weight without reducing its flexural strength.

2. Materials and Methods

2.1. Materials

All beams have dimension of 200 mm x 300 mm x 3200 mm and placed on a simple supported position with a clean span of 3000 mm. The beam is planned to fail to carry the load through flexural failure. Three types of modelling are used on beam test specimens with under reinforced reinforcement ratios. Concrete cover between reinforcement is 22.5 mm for all surfaces. The three types of the beam and detail of steel reinforcement shown in the Figure 1.

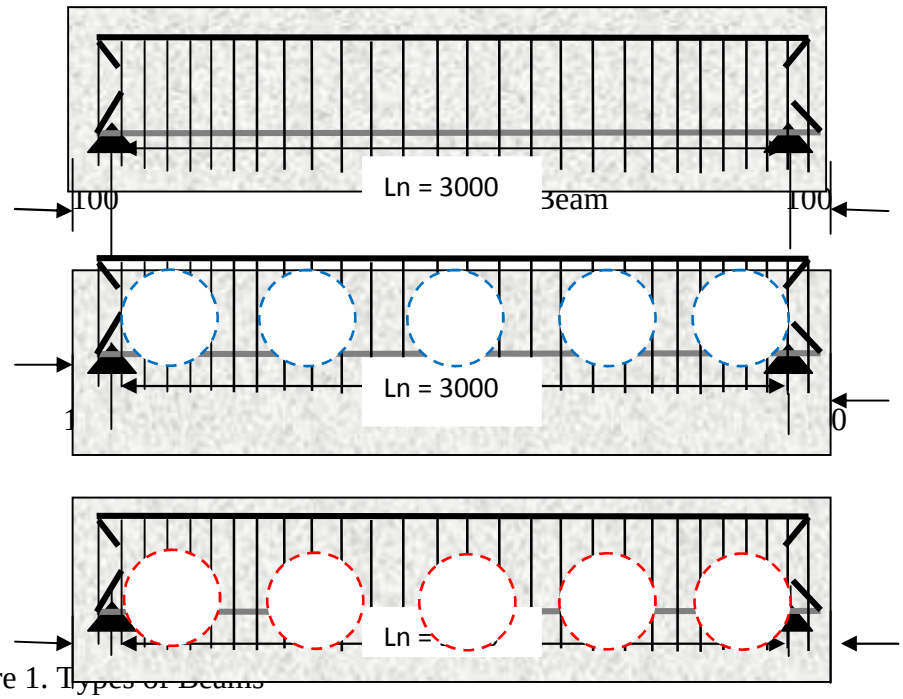

Figure 1. Types of Beams

2.2. Methods

Ten hollow concrete beams were tested by varying the number of balls and the position of the ball in a reinforced concrete beam section. The number of spheres consisted five

variations of 1, 3, 5, 7, and 9 balls resulted the beam volume ratios of 99%, 98%, 97%, 95% and 94%, respectively. The cross section of the beam is rectangular with width b = 200 mm and height h = 300 mm with effective span L = 3000 mm. Two tensile reinforcements type of 3D13 and 2D10 were applied with Ø10-20 mm stirrups. The quality of concrete is fc'22 MPa while steel reinforcement isfy = 390 MPa. For comparison, a solid beam of the same size and reinforcement is also tested as a standard beam. The static bending load is carried out following the SNI testing standard with two points of loading. The load cell is placed in the middle of the span and distributed to two points through the steel profile. Hydraulic jack capacity of 50 tons as a load source connected with load cell. Vertical deflection measurements in the center of the landscape are recorded with LVDT.Load-deflection relationships were recorded until the test specimens collapse. The position of loading beam at the experimental test is shown in Figure 2.

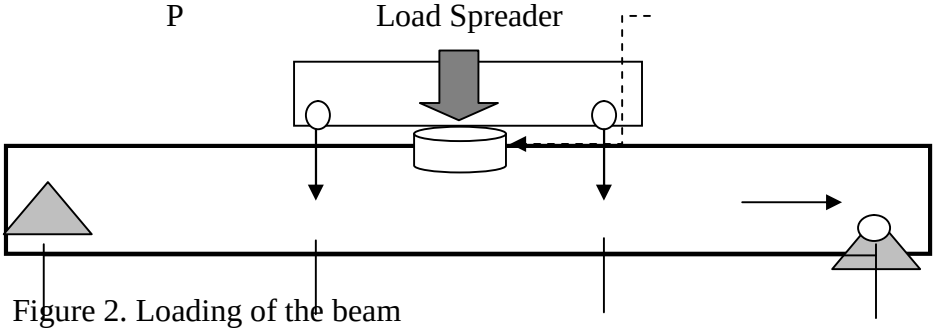

Figure 2. Loading of the beam

3. Results and Discussions

3.1 Flexural Behavior

Behavior of the beam when given a load indicates that when the load is still small the beam is relatively strong to withstand the load marked by the small deflection of the beam. The increased load is increased resulting in cracks starting to appear on the extreme part of the concrete beam. The cracks continue to propagate in the vertical direction as the load increases. Over time, the number of cracks that occur also increases which not only the old cracks become larger and longer but also new cracks are shifted from the initial crack position towards the outside. Pattern of crack that happened also is characteristic of crack bending that is direction of crack perpendicular axis cross section. Finally after the crack appears more and more then the beam loses its strength to withstand the outside load or be said the beam has experienced failure.

3.2 Load-Deflection Relationship

It is seen in the Load-Deflection diagram in the laboratory tests that all test specimens have structural behaviour and capacities of not much different. It is also seen that solid beams (without cavities) have the ability to withstand the best load. The upward curve at the start of the test indicates a slope which is the stiffness of the beam before the first crack occurs. Hence the first crack value greatly determines the behaviour of the bending test object. In addition to obtaining cracked moment values, service moments and ultimate moments, this diagram is also useful for determining ductility of the beam.

The test result values for all specimens are shown in Table 2 showing the load and deflection at the service load and the collapsed load (ultimate) of each specimen.Seen from Table 2 the ductility of the beam with the cavity decreased compared to the less hollow block. However, this decline is considered insignificant. The lowest ductility experienced by the beam with the cavity occurred on the specimen with 9 (nine) hollows of 2.28. Compared to the solid beam with the ductility of 2.78, the ductility of the hollow beam decreased to 82%.

3.3 Structural Behaviour

The magnitude of the first cracking moment (Mr), the service moment (My) and the ultimate moment (Mu) of the experimental results are shown in Table 2. It is seen in the table that the experimental results are larger than the theoretical calculations. This is because in the theoretical calculations the ability of concrete is considered zero when the concrete starts to crack. Also shown in the table, there is a decrease in the strength of a hollow block rather than a cavity beam. Compared to cavity blocks, the hollow beam ability with 9 balls in carrying loads decreased by 94%, 95%, and 95% respectively for Mr, My, and Mu. The magnitude of this decline is considered insignificant so that the use of this hollow ball beam can be recommended for application in the field.

Table 2. Structural Capacity

Series	Beam	Fc' (MPa)	Mr (kN.m)	My (kN.m)	Mu (kN.m)	Δy (mm)	Δu (mm)	Ductility Δu/Δy
1	V-0AB	22,43	10,085	45,04	47,25	14,04	38,98	2,78
2	V-2A	21,57	8,628	42,78	45,41	14,36	35,80	2,49
3	V-3A	23,21	10,415	44,60	46,78	15,36	37,76	2,46
4	V-5A	22,08	8,970	39,56	46,36	15,14	36,76	2,41
5	V-7A	22,42	9,210	42,84	45,36	15,74	36,50	2,32
6	V-9A	22,68	9,785	42,19	45,75	16,50	37,68	2,28
7	V-2B	22,31	9,165	42,95	46,90	12,08	31,23	2,58
8	V-3B	21,95	8,783	43,47	45,34	12,42	30,06	2,42
9	V-5B	22,91	9,915	42,63	45,62	12,32	31,36	2,55
10	V-7B	21,11	8,424	42,87	46,36	12,65	33,05	2,61
11	V-9B	22,49	9,51	42,99	44,78	13,50	34,40	2,55

4. Conclusions

Based on the results of the analysis, several points can be concluded in the following:

1. Test results indicated that the fracture pattern of all specimens was classified as bending cracks.
2. The presence of spherical hollow has insignificant effect to the structural behavior of reinforced concrete beam. Cracking moments has 83% decreased and the ultimate moment has only 95% decreased.
3. Ductility of the hollow beams was also decreased but since the ductility ≥ 2 it is still acceptable for structural element.
4. Therefore, in order to reduce its self-weight of reinforced concrete beam, the use of spherical hollow beam is highly recommended.

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New Record *Phoniscusatrox* in The Developed Ecotourism Area of South Lombok Islan, West Nusa Tenggara

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Abstract

Phoniscusatrox has entered the IUCN Red List with Near Threatened (NT) in Indonesia and Malaysia. The purpose of this study was to ascertain the identification of *Phoniscusatrox* as a new record. The study was carried out in the area of southern ecotourism development of Lombok Island NTB from February-April 2017. A modified net and quadrant for cave ceiling was used to collect bat sample. The results showed that *Phoniscusatrox* was found in one of the ecotourism development sites in the southern of Lombok Island, namely Buwun Cave, Prabu Village, Central Lombok. *Phoniscusatrox* has never had any previous reports found in caves in Indonesia. But it has been reported to be found in the primary forests of Sumatra.

Keywords: *Phoniscusatrox, Ecoturism, South Lombok Island*

1. Introduction

Phoniscusatrox is a Near Threatened bat species (NT) because it has a population close to 30% for the last 15 years. This occurs due to significant deforestation, thus approaching the qualification for vulnerability under Criterion A2c. This rate of decline is expected to continue due to ongoing deforestation (Huston and Kingston, 2008).

Phoniscusatrox was first reported to exist by Miller (1965). However, Hill (1965) mentions that the taxonomy of Phoniscus is uncertain because some experts estimated thatPhoniscus is very similar to Kerivoula (Ryan, 1965, Koopman, 1993, 1994). But, others consider Phoniscus and Kerivoulaare separated (Le Souef and Burrell, 1926, Miller, 1931, Tate, 1941, Medway, 1969, Lekagul and McNeely, 1988; Corbet and Hill, 1992; Flannery, 1995; Simmons, 2005).

Morphological characteristics that can show Phoniscus and Kerivoulaare separated components from the same genus is the tragus. Tragus in Phoniscus has a wider and curved shape while Kerivoula has a narrower tragus with pointed tip (Corbet and Hill, 1992). In addition, Suyanto (2002) adds tragus color to Phoniscus is more pale or tends to white while Kerivoula color is similar to the color of the ear.

The distribution of *Phoniscusatrox* has been reported in several countries in Peninsular Malaysia (Struebig et al 2006), Vietnam and Thailand as new records (Thong et al, 2006), while in Indonesia, it has been reported in the check list for Bukit Barisan National Park in South Sumatra (O'Brien and Kinnaird 1996). Furthermore, Huston and Kingston (2008) reported re-existence in Sumatra (Indonesia), and Sabah in Borneo Malaysia. More recently by Miranti (2013) Phoniscusatrox is in the forest area of Batang Toru in the western part of North Sumatra.

Phoniscusatrox is one type of bat that has never been reported on the island of Lombok by previous bat researchers (Kitchener, 2002). But by 2014, According toFajri, et al (2014), the presence of Phoniscusatrox has been reported to exist, but it can not be ascertained.

Thus, this study aims to re-identify bats of Phoniscusatrox species based on their morphological characteristics

2. Materials and Methods

The study was conducted from February to April 2017 in 4 caves in the ecotourism development area of the southern island of Lombok. The four caves are Gale Gale (Central

Lombok), Buwun Cave (Central Lombok), Kenculit Cave (Central Lombok), and Giant Cave (East Lombok).

The tools used to collect bat samples are the Mist Net, the harp net and the modified quadrant, the slider, paraffin tub, and the digital camera. The research material used for anesthesia of bats and bat collection is 4% formalin. The captured bats are then identified in the FMIPA Biology Laboratory of Mataram University to determine their type and morphological measurements. Identification refers to the book of Indonesian bat (Suyanto, 2001).

3. Results and Discussion

Diagnosis. The morphological characteristics of Phoniscusatrox located in the ecotourism development area of the southern part of Lombok Island is relatively small, has a very well developed tragus. In addition, it has a pointy molar bulge, and a tail with the entire tail immersed in the interpellal skin membrane. The shape of the nose is not tubular, has no nose leaves and has no folds around the nose. The right and left ears are separated by white and dreary tragus. On the wing and leg fingers, there is no thickening of the skin under the wing fingers and the third wing finger no longer than the first wing fingers.

Below are some pictures as a marker of the morphological characteristics of Phoniscusatrox located in the ecotourism development area of southern Lombok Island at figure 1.

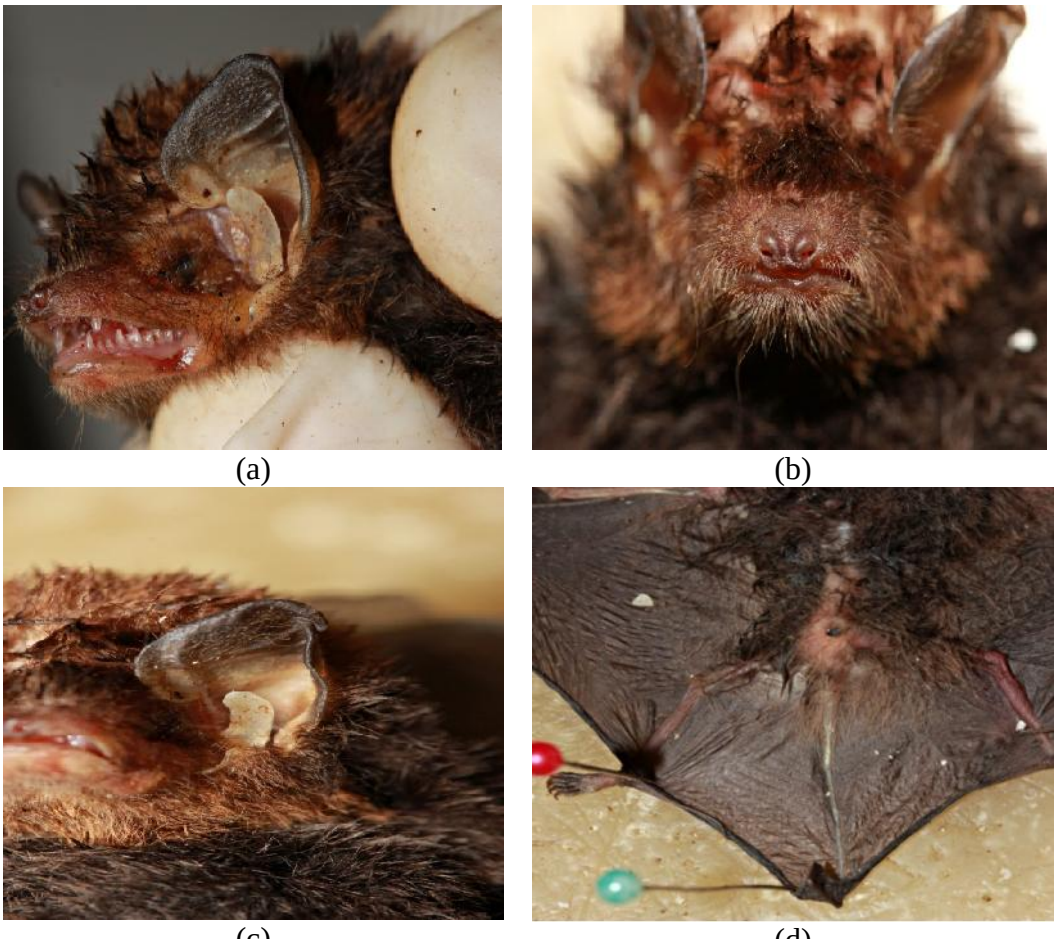

Figure 1: (a) Tragus develops, (b) Tubular nose shape and has no nose leaves (c) tragus is white and the tragus with a deep notchnear the base (d) The tail with the entire tail is immersed in the intercellular skin membrane

Ecology. In this study, Phoniscusatrox was found in one cave located in the area of ecotourism development of the southern region of Lombok Island, which is located in Buwun

Cave in the village of Prabu. In the cave is not only inhabited by Phoniscusatrox, but there are also other species such as *Rhinopomamicrophyllum*,*Miniopteruspusillus*, and *HipposederosaterEonicterisspeleae* and *Rhinolophusacuminatus.*

Buwun Cave is a cave far from human reach even not known by human existence. Phoniscusatrox, has never had any previous reports found in caves in Indonesia even caves in other countries in the world. However, in some forests it has been reported as in primary forest of Sumatra (Suyanto, 2001; Miranti (2013)). The presence of Phoniscusatrox in Thailand is also found in degraded forests at 150 dpl (Thong, at al., 2006 and Hutson et al. (2008)).

Phoniscusatrox has been listed on the IUCN Red List with Near Threatened (NT) or almost extinct in Indonesia and Malaysia (Fleming & Paul, 2009). This becomes interesting because Phoniscusatrox is found in Buwun cave located in ecotourism development area south of Lombok Island.

Phoniscusatrox in Buwun cave is collected using Mist net, Harp net and quadran modification. P. atrox perched at the end of the cave, forming colonies of more than 20 individuals / colonies. Based on 30 samples examined there were 6 individual females and 24 male individuals.

4. Conclusion

Phoenix atrox was found recently in Lombok island especially in the area of Ecotourism development in the south part of Lombok.

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The Application of Ground Pumice in Foamed Concrete for Accoustic Material

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Abstract

Current acoustic materials mostly have deficiencies such as they are not fire resistant, low durability, not safe for health, and expensive. One alternative material that can be utilized for acoustic material is foamed concrete but its density may be still considered high. This paper discusses the application of ground pumice for foam concrete to further decrease the density and hence to further increase the porosity for better acoustic material. A series of laboratory test were carried out where the foam concrete mixes were made of water, ground pumice as fine aggregate, and foam agent. The used water-cement ratio *w/c* was 0.3, the volumetric ratio of cement : ground pumice was 1 : 0.75; 1 : 1; 1 : 1.25; 1 : 1.5 and 1 : 1.75, and the amount of foam was 57% to 59% of the mortar absolute volume. Laboratory tests involved compressive tests using 50 mm x 50 mm x 50 mm specimens and sound absorber tests based on ASTM E 1050-98. The test results show that the density of foam concrete with ground pumice could reach around 0.74 to 0.78. Meanwhile the achieved compressive strength was quite low that is only 0.4 to 0.67 MPa. Foam concrete with volumetric cement : ground pumice ratio of 1 : 0.75 could have sound absorption coefficient of 0.9 – 1.0 for the frequency range between 1500 to 2500 Hz. Based on these test result, it can be concluded that the foam concrete using ground pumice can be used for sound absorbing acoustical materials but must be applied as filler only due to its low compressive strength.

***Keywords*:** foam concrete, pumice, compressive strength, sound absorption coefficient, acoustic material

1. Introduction

Most of the sound can be heard by humans comes is from objects that vibrate, so then it takes an object that can reflect and absorb sound perfectly. Several studies to find a sound absorber in acoustic room have been conducted. According to Doelle (1986), sound absorption is a change in sound energy into another form, usually heat, as it passes through a material or when striking a surface. Sound absorber materials made of porous materials, resonators and panels. The efficiency of the sound absorption a material at a given frequency is expressed by the sound absorption coefficient α.

According to Cox et al (2004) there are various ways of measuring sound absorption, including measurements using impedance or standing wave tubes, two microphone free field measurements, multi-microphone techniques for non-isotropic and non-planar surfaces , the buzzing method and the local measurement of the sound absorbing properties in room. In this research using impedance tube with transfer function method.

Current acoustic materials mostly have deficiencies such as they are not fire resistant, low durability, not safe for health, and expensive. Along with advances in technology, thinner and lighter materials construction was applied. One alternative material that can be utilized for acoustic material is lightweight mortar. In this research, lightweight mortar is made from a mixture of cement with ground pumice and foam is often called foam concrete. According to Satyarno (2015), foam concrete is a concrete with many air content or cavity in the concrete.

Foam on this mixture using a foaming agents that can form air bubbles that make the concrete becomes lighter. Concrete foam can also be made using lightweight aggregates such as pumice. Pumice as one of the lightweight aggregates has good potential as structural material considering its quality that can achieve the quality of normal concrete. In addition, the advantages of using pumice are more environmentally friendly because it can be utilized without going through the combustion process, unlike other lightweight aggregates. Advantages of foam concrete, among others: has a good heat resistance value *(thermal*

insulator), has a good sound insulation and fire resistance *(fire resistant)*. Hence, this research aims to make foam concrete which consists of a mixture of cement with ground pumice and *foaming agent* to lower the density and increase the cavity as better acoustic material.

2. Materials and Methods

3.1 Materials

Materials were used in this research consist of:

1. PPC types of portland cement.
2. Ground pumice from East Lombok
3. Water
4. Foaming agent from CV. Gunung Derajat, East Java.

3.2 Mix Design

This research has parameters to be achieved a lightweight foamed concrete and adequate compressive strength. Foamed concrete plan was 800 kg/m^3 and water-cement ratio w/c was 0.3 as expected with this *w/c* can minimize the formation of air cavities that are not controlled by the evaporation of residual amounts of cement hydration so that the cavity formed by the foam can be controlled. Volumetric ratio of cement : ground pumice are:

1) 1:0.75
2) 1:1
3) 1:1.25
4) 1:1.5
5) 1:1.75

The amount of foam was 57% to 59% of the mortar absolute volume.
Mix design using absolute volume with equation are:

$$V_j = \frac{V_a B_{sa}}{B_{ja} B_{sa}} + \frac{V_s B_{ss}}{B_{js} B_{sa}} + \frac{V_p B_{sp}}{B_{jp} B_{sa}} \qquad (1)$$

or

$$V_j = \frac{W_a}{B_{ja} B_{sa}} + \frac{W_s}{B_{js} B_{sa}} + \frac{W_p}{B_{jp} B_{sa}} \qquad (2)$$

Where:

V_j = volume absolute
V_a = volume of water
B_{sa} = unit weight of water
B_{ja} = density of water
V_s = volume of cement
B_{ss} = unit weight of cement
B_{js} = density of cement
V_p = volume of fine aggregate
B_{sp} = unit weight of fine aggregate
B_{jp} = density of fine aggregate
W_a = weight of water
W_s = weight of cement
W_p = weight of fine aggregate

.

Table 1. Mix proportion of foamed concrete per m^3

Volumetric ratio of cement : ground pumice	Mix proportion per m^3			
	Cement (kg)	Ground pumice (kg)	Water (kg)	Foam (kg)
1 : 0.75	467.49	192.26	140.25	4.46
1 : 1	432.82	237.34	129.85	4.42
1 : 1.25	402.93	276.19	120.88	4.38
1 : 1.5	376.91	310.02	113.07	4.34
1 : 1.75	354.04	339.75	106.21	4.31

2.3 Number of specimens

Compressive strength test of 7 and 28 days using cubes 5 x 5 x 5 cm specimens for each variation as much as 6 specimens. Sound absorption coefficient test performed at 28 days using cylindrical molds 3 and 10 cm in diameter with a thickness of 1,5 cm for each variation as much as 2 specimens.

3.4 Test Procedure

3.4.1 Density

Tests of density are performed when the mortar is 7 and 28 days. The density can be calculated using the formula:

$$(¥) = \frac{W}{V} \quad (3)$$

Where:

¥ = density

W = weight of specimen (kg)

V = volume of specimen (m^3)

3.4.2 Compressive Strength

Compressive strength test of 7 and 28 days using 5 x 5 x 5 cm specimens using compressive strength machine. The compressive strength can be calculated using the formula:

$$\pm m = \frac{Pmaks}{A} \quad (4)$$

Where :

$\pm_m$ = compressive strength of mortar (MPa)

P = maximum pressure (N)

A = area of the specimen (mm^2)

3.4.3 Sound absorption coefficient

Sound absorption coefficient test performed at 28 days using cylindrical molds 3 and 10 cm in diameter with a thickness of 1,5 cm using standing wave tube based on ASTM e 1050-98. The formula to calculate sound absorption coefficient are:

$$\sim = 1 - |R|^2 \quad (5)$$

Where:

α = sound absorption coefficient

R = reflection factor

3. Results and Discussion

4.1 Density

Table 2 shows the density test result.

Table 2. Dry density test result

Code	Volumetric ratio of cement : ground pumice	Density (kg/m^3)
F1	1 : 0.75	782.80
F2	1 : 1	772.60
F3	1 : 1.25	770.60
F4	1 : 1.5	759.40
F5	1 : 1.75	749.90

Based on Table 2, it can be seen that the volumetric ratio of cement and ground pumice increase then the dry density of the mortar getting smaller. This is due because of the increasing amount of ground pumice then the mortar weight becomes lighter. The relation between density with the weight of ground pumice can be seen in Figure 1.

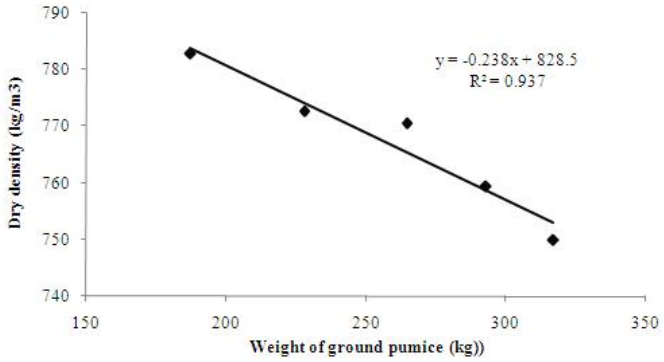

Figure 1. Relation between dry density with the weight of ground pumice

Compared with research conducted by Bing et al (2012), the density in this study is lighter. In the study of Bing et al (2012) the lowest density reached 844 kg/m^3 in variation I with 50% foam, whereas in this study, the lowest density produced was 749.90 kg/m^3 in volumetric ratio of 1: 1.75.

4.2 Compressive Strenght Test

Figure 2 shows the compressive strength test result.

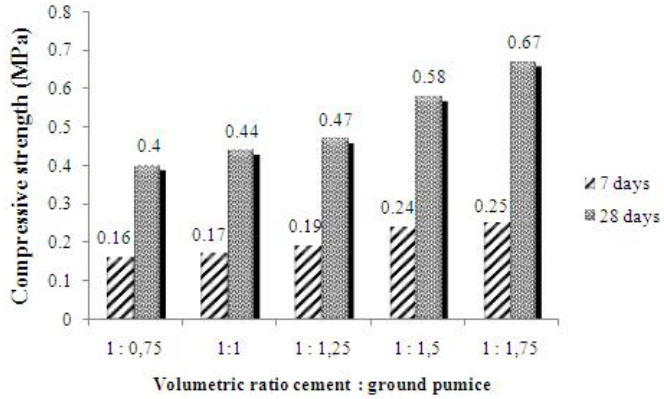

Figure 2. Compressive strength of 7 and 28 days

Figure 2 shows that the larger of the volumetric ratio of cement and ground pumice cause increased the compressive strength value. Compressive strength at 28 days around 0.40 to 0.67 MPa, the highest compressive strength at a ratio of 1: 1.75 was 0.67 MPa. This is because the void formed in the foam mixture is less with increasing volumetric ratio of

cement : ground pumice. The compressive strength is influenced with air void. The relation between the compressive strength of 28 days with the air void can be seen in Figure 3.

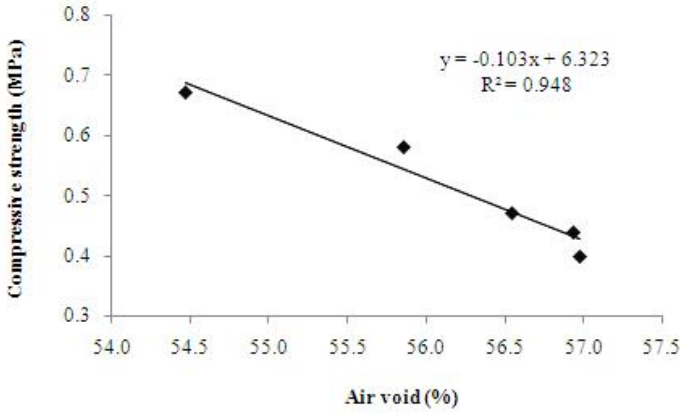

Figure 3. The relation between compressive strength and air void

Figure 3 shows that the less of void air causes increase compressive strength in mortar. This is in accordance with Nugraha's (2007) statement that the strength depends on porosity.

The process of making mortar with foam is without compaction, because it will cause the foam break. Then the mortar that is made should not too dry, but should not also too liquid which will affect the produce of air void.

If the mortar with foam compared to the research conducted by Bing et al (2012), the compressive strength of the mortar in this research was lower. In Bing et al (2012) research weight of 800 kg/m³, can produce compressive strength of 14 MPa, whereas in this research, the highest compressive strength only 0.67 MPa in volumetric ratio of 1:1.75. The high compressive strength generated by research of Bing et al (2012) from the use of fly ash, silica fume and PP fibers with the amount of foam was 50% of the foam concrete volume.

4.3 Sound Absorption Coefficient Test

Test of the sound absorption coefficient in this research refers to the standard ASTM E 1050-9, using samples of two kinds of size diameter of 10 cm and 3 cm. The test sample with a diameter of 10 cm is used at a frequency of 125-1000 Hz, meanwhile diameter of 3 cm is used at a frequency 1000-6300 Hz. In this discussions will be more emphasis on the results of testing in high frequency (1000-6300 Hz). Table 3 and Figure 4 shows the sound absorption coefficient result.

Table 3. Sound absorption coefficient result (α)

Code	Volumetric ratio of cement : ground pumice	Sound absorption coefficient	Frequency (Hz)
F1	1 : 0.75	0.993	2344
F2	1 : 1	0.884	1672
F3	1 : 1.25	0.590	1784
F4	1 : 1.5	0.473	1568
F5	1 : 1.75	0.422	1296

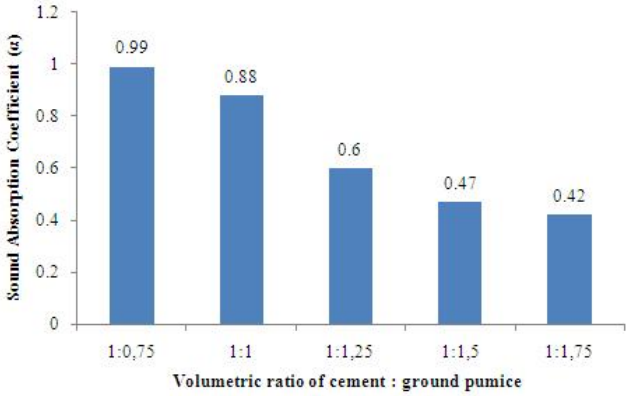

Figure 4. Sound absorption coefficient result

Figure 4 shows that the larger volumetric ratio of cement: ground pumice, the sound absorption coefficient getting lower. This is because the larger the volumetric ratio of cement: ground pumice the void formed fewer so the lower of sound absorption coefficient was the fewer void. The relation between air void with sound absorption coefficient can be seen in Table 4 and Figure 5.

Table 4. Relation between air void with sound absorption coefficient

Volumetric ratio of cement : ground pumice	Air void (%)	Sound absorption coefficient
1:0.75	56.97	0.993
1:1	56.94	0.884
1:1.25	56.55	0.590
1:1.5	55.86	0.473
1:1.75	54.47	0.422

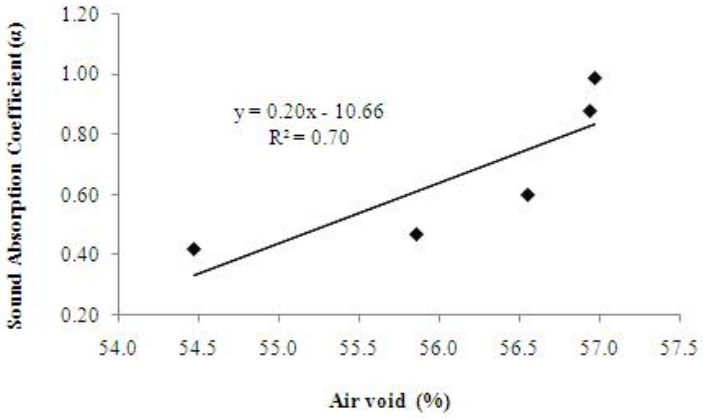

Figure 5. Relation between air void with sound absorption coefficient

The results of this study is different from the results of the research conducted by Amrullah (2009). Research of lightweight concrete made from pumice by Amrullah have sound absorption coefficient (α) which efficient at high frequencies. The composition variations of the mixture between the cement and ground pumice have sound absorption coefficient (α) around 0.89 to 0.96 at the frequency of 8000 Hz. Highest of the mix composition variations ratio is 1: 6 (1 cement : 6 ground pumice) with α = 0.96 at the frequency of 8000 Hz. Sound absorption coefficient in this study efficiently at medium frequency. The highest of mix composition variations ratio is 1: 0.75 (1 cement: 0.75 ground pumice) with α = 0.99 at the frequency of 2344 Hz.

4.4 Acoustic Material Classification

ISO 11654:1997 (*Acoustical Sound Absorber For Use in Building-Rating of Sound Absorption*) has some building materials categories class based on sound absorption coefficient, which can be seen in Figure 6.

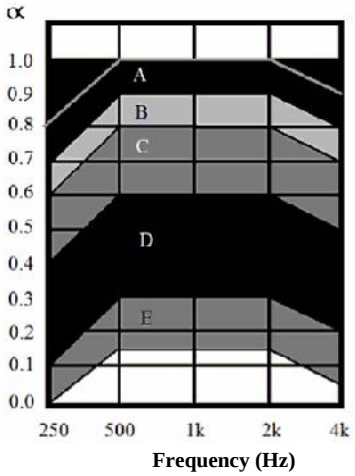

Figure 6. Acoustic performance of *Building Absorber* according to ISO 11654:1997

Figure 7 shows sound absorption coefficient result for all variations.

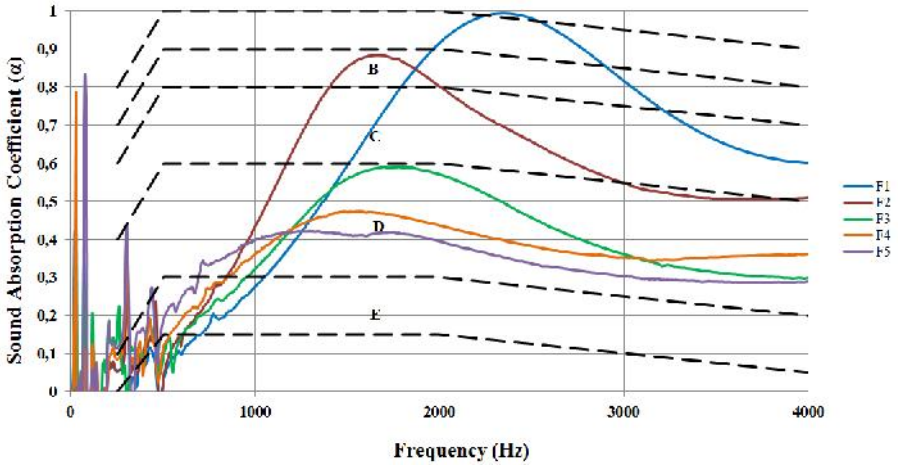

Figure 7. Graph of sound absorption coefficient all variations

Based on Figure 7 that according to ISO 11654: 1997, the mortar mix with volumetric ratio of cement : ground pumice = 1: 0.75 (F1) was in class A where the sound absorption coefficient values ranged from 0.9 to 1 in frequency range of 1500 to 2500 Hz.

Volumetric ratio of cement : ground pumice = 1 : 1 (F2) was in class B where the sound absorption coefficient values ranged from 0,8 to 0,9 in frequency range of 1500 to 2000 Hz.

Volumetric ratio of cement : ground pumice = 1 : 1.25 (F3) was in class D where the sound absorption coefficient values ranged from 0.3 to 0.6 in the frequency range of 1500 to 2000 Hz.

Volumetric ratio of cement : ground pumice = 1 : 1.5 (F4) was in class D where the sound absorption coefficient values ranged from 0.3 to 0.6 in the frequency range 1500 to 2000 Hz.

Volumetric ratio of cement : ground pumice = 1 : 1.75 (F5) was in class D where the value of the coefficient sound absorption ranged from 0.3 to 0.6 in the frequency range 1000 to 2000 Hz.

Based on the sound absorption coefficient, foam concrete in this study can be applied for acoustic material but only as a *filler* because foam concrete with ground pumice has low compressive strength.

4. Conclusions

Based on results, can be concluded:

1. The addition of foam causes density of mortar lighter and decrease in compressive strength.
2. Density foam concrete could reach around 749.9 to 782.8 kg/m^3, the compressive strength is 0.40 to 0.67 MPa.
3. Based on the compressive strength and density, mortar with foam can be applied for non structure used, one of the them is acoustic material.
4. Based on the sound absorption coefficient, foam concrete in this study can be applied for acoustic material but only as a filler.

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Chemical Compounds Analysis of Green Bean and Its Effect on *KopiLuwak* Cupping Quality

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Abstract

Kopi Luwak known as one of premium coffee due to its unique processing and its superior cupping quality. This research aims to determine the chemical compounds, defined as caffeine, chlorogenic acids and sucrose of Luwak green coffee and the impact of these components towards the cupping quality. The work has been done by collecting six samples of coffee Luwak from the three various farms in Gayo Highland, which then processed onto green bean. The examined parameters are sucrose (%), caffeine (%) and chlorogenic acids (%) which measured with chromatography methods, then cupping test of brewed drink are done by professional Q-coffee grader followed SCAA standard. The results present that the Luwak coffee has sucrose contents 5.61-10.50%, caffeine 1.13-1.25% and chlorogenic acids 3.61-4.84%.Moreover, the Luwak coffee noted to have a chocolaty, nutty, herby, spicy and fishy aroma. The obtained chemical data then correlated with cupping attributes (fragrance, flavor, aftertaste, body, acidity, balance, uniformity, clean cup, sweetness and overall). Partial Least Square by Unscrambler 14.1 showed the positive correlation between sucrose and chlorogenic acids and all sensory attributes, specifically mentioned that these two chemical compounds are anti-correlated with overall and fragrance of brewed drink. On the other hand, caffeine tends to have a weak relationship to seven measured sensory attributes.

Keywords: chlorogenic acids, Luwak coffee, cupping, caffeine

1. Introduction

Coffee is brewed drink which preferable globally. Coffee is consumed not only for the joyful of its flavor but also for its health benefits (Farah, 2006; Maurya, 2016). Coffee flavor is influenced by many factors such as processing techniques. Generally, coffee processing is divided onto wet and dry processed. Besides that, some of the coffee producers combined both processed which named either semi-wet or semi-dry processed. These processes are aimed to obtain with coffee premium quality with desired characteristics. But excluding from the process above, there is the unique coffee processing which the product entitled as *KopiLuwak*(Sunarhanum, 2014; Ghosh and Venkatachalapathy, 2014).

Kopi Luwak is one of popular coffee in the world. This animal-treated coffee is produced from coffee cherries which eaten by Asian palm civet named as *Luwak (Paradoxorus hermaphroditus)*, which then excreted without the coffee pulp together with its feces (Panggabean, 2011). The feces then are collected, clean washed, dried and process generally (Yusianto et.al., 2010; Muzaifa et al., 2016).

*Kopi Luwak*knownas coffee with premium cupping quality, this reputation made an increased demand towards*opiLuwak*. But since the process is very versatile and depends on the *Luwak* intestines as the only media, the product is very limited and the price soared. As consequences, *KopiLuwak* is claimed as the most expensive coffee in the world. Badly, this coffee also an easy target for food fraud by counterfeiting it in both original and mixed from (Jumhawan et al., 2013; Rahardjo, 2013).

Kopi Luwak which processed by not involving the animal itself seems as promising future as an alternative solution for *Kopi Luwak* limited production and fraud. The artificial

fermentation of *Kopi Luwak*could be done by imitating the fermentation process occurred in *Luwak* intestine. The enzymes and microbes in *Luwak*digestion system are predicted to have the main part in coffee fermentation. However, the study of biochemistry mechanism and coffee fermentation in *Luwak* digestion systems is not fully understood up to now. Moreover, characterization of *Kopi Luwak*quality is also not fully observed and reported. This condition above is an impact of limited research in this topic and commodity, since the production of *Kopi Luwak* either wild or caved is limited and only in certain regions.

Some researchers claimed that *Kopi Luwak* as an exotic coffee. This is an impact of this unique production and believed to have preferable cupping quality which is influenced by many factors. The fermentation in *Luwak* intestine and picking the best coffee cherries predicted to form specific cupping quality of coffee (Marcone, 2004; Panggabean, 2011; Hadipernata, 2012; Marcone, 2004). Furthermore there also a prediction thatthe proteolytic enzyme is involved in *Kopi Luwak* fermentation, which caused low level of protein contents of *Kopi Luwak* than regular coffee. Few researchers have been tried to modify coffee cupping quality as good as *Kopi Luwak* (Martinez dan Balaban, 2009; Cuang-Hoang, 2012; Takahashi, 2012).However, in order to have sufficient results, preliminary research which obtain specific characteristics of *Kopi Luwak* is definitely required. Therefore, this research aims to study the correlation within chemical compounds and cupping quality of *Kopi Luwak.*

2. Materials and Methods

Materials of this research are green bean of *KopiLuwak,* column Agilent Zorbax Carbohydrate, aquadest, column Sunfire C18m, CGA standard, acetonitrile, acetic acid and methanol.

2. 1. Coffee Sampling

Kopi Luwak was collected from six *Luwak* farm, The chosen location is coffee farms were located beside the forest in Bener Meriah district. Collected coffee then clean washed, dried up to moisture content 12%. Furthermore, the parchment coffee was hulled, produce the green bean. The resulted green bean was placed in vacuum container prior to analysis.

2. 2. Sample Extraction

Green bean is grounded and weighed for 2 g. the sample then extracted with aquadest, homogenized by a ultra-sonication method for 30 minutes, agitated with vortex for 2 minutes then continued by centrifugation with 4000 rpm for 5 minutes. The resulted supernatant was filtered with 0.2 m nylon membranes. The filtered supernatant is ready to be injected intoa chromatography column.

2.3. Sucrose, Caffeine and Chlorogenic Acids by High Performance Liquid Chromatography (HPLC)

HPLC is used to analyse sucrose, caffeine and chlorogenic acids of green bean of *Kopi Luwak.* In details, sucrose used column Agilent Zorbax Carbohydrate 4,6x150 mm with a combination of acetonitrile-water ration 90:10 as active phase 1.2/minutes with 10 ml injection volume. For caffeine and chlorogenic acids, the used column is Sunfire C 18 5 m (150 x4,6 mm), acombination of 0.1% acetic acids and methanol with ratio 80:20 as active phase at 1 ml per minutes with an injection volume of 10 ml. Furthermore, especially for caffeine and chlorogenic acids, UV detector was arranged at 278 nm.

2.4. Cupping Quality

Cupping quality is measured based on *Specialty Coffee Association of America* (SCAA, 2009). The procedures were done by three q-grader from Gayo Cupper's Team (GCT), who professionally and commercially examine coffee quality. 100 g green bean was

measured, roasted at medium scale (55 Agtron scale) a day prior to cupping take place. Then the roasted coffee is grounded 20 mesh. Each sample was presented on fiverepetitions (glasses) by pouring 8.25 g grounded coffee with hot water 93^{o}C then kept for 3 minutes before the assessment started. The measured parameters were fragrance/aroma, flavor, acidity, body, uniformity, clean up, aftertaste, balance, sweetness and overall (SCAA, 2009).

Fragrance/aroma is an assessment of the aroma of coffee powder as well as brewed drink. Fragrance should be examined at first 15 minutes for dry ground powder. The procedure is done by sniffing the coffee powder at close. Then aroma is examined by pouring the powder with hot water, kept for 3-5 minutes. After that, the crust at the surface is stirred 3 times to broke out the crust and the aroma is examined. Sniffing aroma is done with theback of the spoon which allows the foam to run down the cup.

Then flavor, aftertaste, acidity, body and balance is examined in sequence, usually 8-10 minutes from the infusion. These five parameters are evaluated when the temperature of coffee liquor at 71^{o}C. The evaluation starts by exhilarating the liquor into the mouth in aspecial way. By doing this, the liquor would be able to cover the palatable area as large as possible, especially the tongue and upper palate. By doing so, the retro-nasal vapors are at its maximum intensity at these elevated temperatures, where flavor and aftertaste are marked at this point. Then as the liquor temperature decreases to 65^{o}C, acidity, body and balance are followed. The cuppers assessbalance as how well the mixture combination of flavor, aftertaste, acidity, and body in a way to produce synergistic combination.Next parameters are sweetness, uniformity and cleanliness are sequentially assessed when the brewed drink temperature down to 21^{o}C. For this evaluation, one sample is placed on five different cups. Then each coffee grader should examine on each individual cup, the maximum marks for each cup are 2 points (total 10 points for each sample). The next parameter is overall, which refers to the holistic perception of coffee, the score must be marked after all attributes are evaluated with a similar procedure like sweetness. Last is the final score, defined as sum up of all scores excluded the defects.

2.4. Data Analysis

Data is analyzed descriptively, presented in table and graph with standard deviation. In order to evaluate the correlation with chemical compounds and cupping quality, Partial Least Square is used with Unscrambler X 10.0 Software.

3. Results and Discussion

3.1 Cupping Test

Table 1. Cupping Quality of Six Samples of *Kopi Luwak*

Sample	Sensory Attributes Measured by SCAA Cupping Test Standard							
	Fragrance	Flavor	Aftertaste	Acidity	Body	Balance	Overall	Total
KL1	7.80	8.00	7.80	7.50	8.00	7.80	7.80	84.50
KL2	8.00	7.80	7.80	7.50	8.00	8.00	7.80	84,75
KL3	8.00	7.80	7.50	7.50	8.00	7.80	7.80	84,00
KL4	8.00	8.00	7.80	7.50	7.80	7.50	8.00	84,75
KL5	8.00	8.00	8.00	7.80	8.00	7.80	8.00	85,75
KL6	7.80	7.50	7.80	7.50	8.00	8.00	7.80	83,75
Average	7.93	7.85	7.78	7.55	7.97	7.82	7.87	84.50

The cupping quality of *KopiLuwak*could be seen in Table 1, where the average of the total score is 84.50. The Table 1 also shows that all samples classified as specialty coffee based on Table 2, which categorized the specialty coffee should have atotal score above 80.00. The

highest total score belongs to Sample KL5 (85.75), whilst the lowest is sample KL6 (83.75). Compared to previous research (Muzaifa and Hasni, 2016) who reported that wild palm civet coffee has total score 85.25. Based on Table 2, KL 5 considers as excellent quality, whilst the others samples are a coffee specialty with very good classification. Based on Table 2 as well, aftertaste and acidity of KL 5 are in excellent quality scale and also the highest among others. Acidity is categorized as aroma and taste sensations, describe as delicate and crisp, lush and rich, powerfully tart but sweet at same time. On the other hand, aftertaste or alternatively named as mouthfeel is flavor that lingers after the liquor is swallowed (Taylor and Rozen, 1994; SCAA, 2009). Compared to another sample, KL 6 has the lowest value of flavor among other samples. Flavor is main quality standard in cupping test, which holistically combination aroma and taste, where aroma perceived by volatile compounds inhale through the nose (Petracco, 2001) with basic taste perceived by tongue receptors (Rawson and Li, 2004).

Table 2. Quality Scale and Total Score Quality Classification

Quality scale			
6.00 – Good	**7.00 –Very Good**	**8.00 – Excellent**	**9.00 – Outstanding**
6.25	7.25	8.25	9.25
6.5	7.5	8.5	9.5
6.75	7.75	8.75	9.75
Total Score Quality Classification			
90-100	Outstanding	Specialty	
85-89.99	Excellent		
80-84.99	Very Good		
>80.0	Below Specialty Quality	Not Specialty	

Table 3 showed the detected aroma perceived by q-grader during cupping test assessment. Aroma perceived by retro-nasal which occurred when q-grader smells the coffee ground. The volatile compounds reach nasal cavity through the pharynx (Petracco, 2001), then the receptors sense the volatiles and send its response to the brain as odor recognition based on Q-grader knowledge (Mombaerts, 2001). Aroma is key attributes that classify the quality and consumer preferences for coffee products (De Maria et al., 1996). Muzaifa and Hasni (2016) mentioned that Arabica coffee which produced in the regularprocess noted to have nutty, choco, herby aroma with citrus flavor as presented in Table 3. These mentioned remarks also present in all coffee samples in this research. Therefore this remarks could be named as thespecific aroma of Arabica Gayo. Whilst the others aroma might be results of Luwak consumption and its processing techniques. Based on Table 3, *fishy* is noted in all samples of *KopiLuwak,* whereasgardenpeas, biscuit, spicy spread all over samples. The noted of fishy could be a negative impact of *Luwak* gut fermentation. Luwak uses its keen sensesto select its diet, which hypothetically adds a specific and distinct aroma to the resulted coffee bean.

On the other hand, KL 6 and KL 1 which has a lowest total score, also noted to have *slight earthy*, *watery* and *aged* aroma. These remarks classify as off odor which decreases the aroma quality of the coffee. The aroma remarks are represented the coffee processing techniques and characteristics of single coffee origin.

Table 3. Aroma Description of *Kopi Luwak*

Sample	Aroma Description
KL1	Chocolaty, floral, nutty, toasty, slightly earthy, herby, gardenpeas, mint, fishy
KL2	Chocolaty, nutty, herby, fishy, toasty, tobbacco like, tangerine, slighty earthy
KL3	Nutty, wattery, fishy, chocolaty, citrussy, slightly woody, sweet
KL4	Nutty, chocolaty, wattery, fishy, biscuity, gardenpeas, herby
KL5	Nutty, herby, sweet, fruity, fishy, spicy, lemongrass
KL6	Nutty, aged, chocolaty, toasty, herby, fishy, slight earthy

3.2 Caffeine, Sucrose and Chloregenic Acids of *KopiLuwak (green bean)*

Caffeine, as derivative compounds of xanthine, is main alkaloid compounds in coffee bean. Caffeine reported having acontribution towards the bitterness of coffee liquor (Flament, 2002). Based on Table 4, it could be seen that all samples have caffeine contents between 1.13-1.25% with average 1.20 %. This result could be used as a proof towards sample authenticity, where the coffee variety iseaten by *Luwak* is Arabica (unmixed with Robusta). This result also inherence Farah (2012), who reported that Arabica has lower caffeine contents (0.9-1.3%), whereas robusta has double caffeine contents, approximately 2% or more (Ghosh dan Venkatachalapathy, 2014; Farah, 2012).

Table 4. Caffeine, chlorogenic acids and sucrose content of *Kopi Luwak* (green bean)

Samples	Caffeine (%)		Chlorogenic Acids (%)		Sucrose (%)	
KL 1	1.25	±0.01	4.84	±0.21	10.5	±0.21
KL 2	1.13	±0.06	4.06	±0.16	5.61	±0.21
KL 3	1.21	±0.01	3.61	±0.59	7.7	±0.39
KL 4	1.24	±0.02	3.92	±2.08	5.09	±0.13
KL 5	1.19	±0.02	3.71	±0.14	8.28	±0.21
KL 6	1.19	±0.03	3.76	±0.50	6.23	±0.13
Average	1.20		3.98		7.23	

Chlorogenic acid is main polyphenol compounds in coffee. As mentioned by Clifford (2000), coffee is beverage with high contents of chlorogenic acids. All *Kopi Luwak* samples in this research have chlorogenic acids in the range 3.61-4.84% with theaverage value 3.98%. These results are slightly lower from previous studies. Farah (2012) reported that Arabica which produces regularly has chlorogenic acids between 4.1-7.9%, whereas robusta between 6.1-11.3%. A number of chlorogenic acids present in coffee, together with quinic acids might have large contribution towards bitterness of coffee liquor (Farah et al., 2005; Ginz and Engelhardt, 2001). Besides that, chlorogenic acids also reported being used as bioactive compounds (Antonio et al., 2011), which acts as an antioxidant that could prevent cell and organs from oxidative reactions (Belay and Golap, 2009).Another measured component is sucrose, where the contents varies from 5.09 up to 10.50% and average 7.23%. Sucrose is carbohydrate in forms of disaccharides which presents in Arabica coffee green bean in range of 6.00-8.00%. Sucrose is major components degrades duringcaramelization in coffee roasting, as well as Maillard, which reported to have a responsibility to transform carbohydrate such as sucrose and reducing sugar to volatile compounds such as furan as flavor precursor (De Maria et al., 1996; Poisson et al., 2009).

3.3 Partial Least Squares

Partial Least Square Algorithm calculates the linear regression and correlation by pointing sucrose, caffeine and chlorogenic acids as independent variables whereas seven sensory attributes assessed based on SCAA (2009) standard used as dependent variables. Unscrambler 10.0 Software mapping the score of samples and illustrate the correlation between variables in order to observe the fundamentalrelation between these variables.

Figure 1a shows the score of all samples. The blue circle shows the measured data meanwhile the red circle represents the expected data based on its validation. From the Figure 1a, it could be seen that two outstanding samples KL 5 and KL 3 are placed in Quadrant I, whilst the KL2 and KL4 are in Quadrant III. KL 6 is placed alone in Quadrant IV but has similar trends with other samples. The outlier is sample KL 1 since it is placed alone and the blue and red circle have too far distance. KL 2 and KL 4 have asimilar total score of cupping test and shared similar trends, low value in acidity. On the other hand, KL 5 and KL 3, even though the score is different both of samples shared thesame value for fragrance, body, balance and overall attributes. Then by knowing the outlier samples, the researcher can acknowledge the valuable sample in this research.

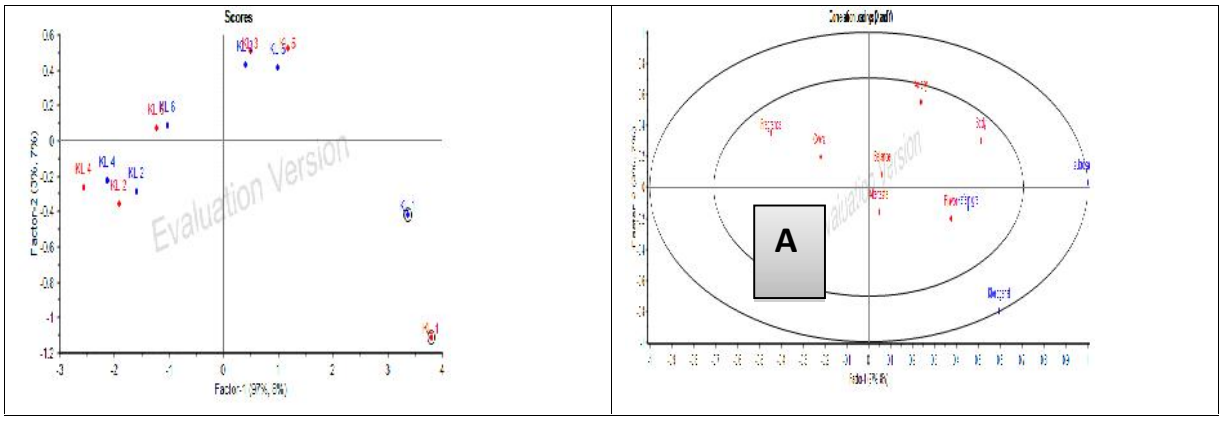
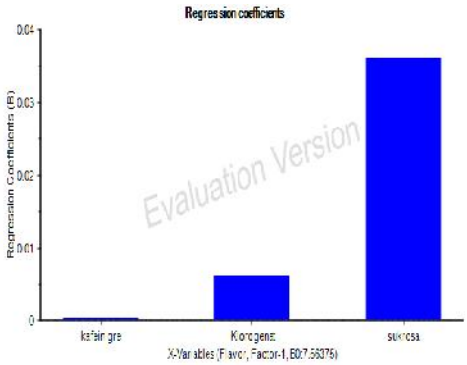


Figure 1. (A) Scores of six samples in PLS Plot (B) Correlation Loading between chemical compounds and sensory properties of *Kopi Luwak*

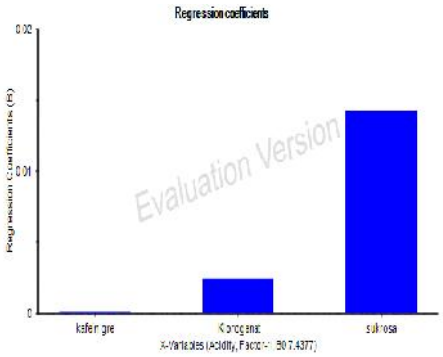
Figure 1b shows that caffeine, sucrose and chlorogenic acids have a strong relationship with all sensory attributes. It could be seen from all the sensory attributes are placed in an inner circle which 97% explained by independent variables, specifically sucrose and chlorogenic acids in theouter circle. Moreover, only fragrance overall is placed in thenegative quadrant, which explained negative correlation for all independent variables as presented in Figure 2f and 2g. The detail correlation between independent variables and each sensory attribute presented in Figure 2.

Regression between the independent variables and sensory attributes well explained in Figure 2. For instance, it clearly can be seen that caffeine which is in correlation loading, is placed in thesame inner circle with all perceived sensory attributes, showed weak regression coefficients for all sensory attributes. Caffeine is assumed by Clarke and Macrae (1985), has influences towards body attributes of coffee liquor. But then Flament (2002) argued that caffeine, even as the mainalkaloid found in coffee with bitter characteristics, only responsible for up to 10% of coffee bitterness, which commonly perceived as body attributes. But the trends are different for sucrose. Sucrose and chlorogenic acids showed strong positive correlation with flavor, aftertaste, acidity, body, and balance, where the regression coefficients of sucrose slightly higher than chlorogenic acids. Many researchers published strong arguments related to the contribution of sucrose in flavor formation of coffee or chlorogenic acids in acidity and aftertaste. During roasting, sucrose and other carbohydrates such as arabinogalactan are responsible for caramelization products, meanwhile sucrose

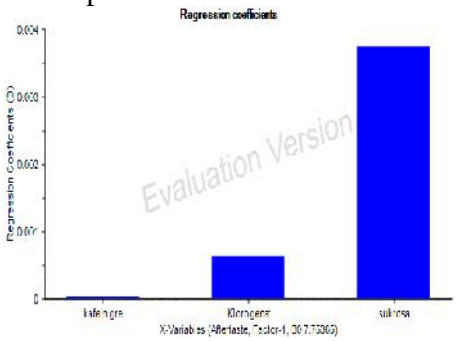
together with reducing sugars and amino acids are responsible for Maillard reactions (Lee et al., 2015).



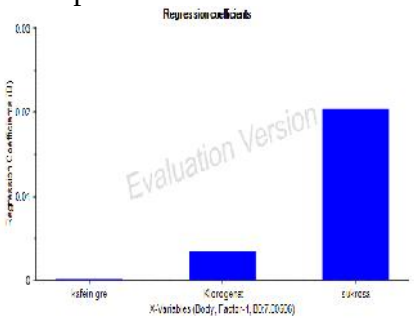
a. Independent variables with Flavor



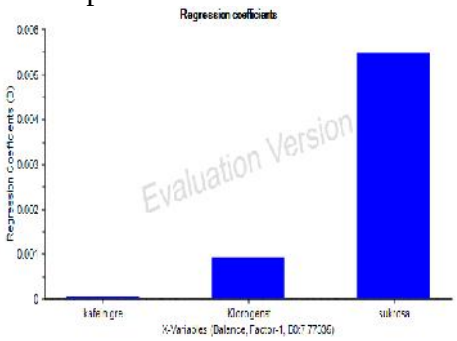
b. Independent variables with acidity



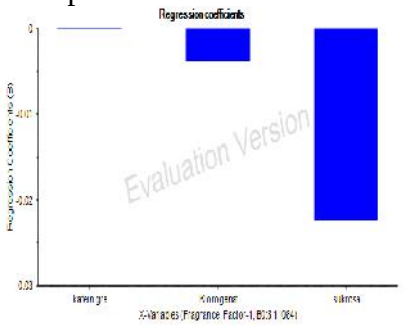
c. Independent variables with aftertaste



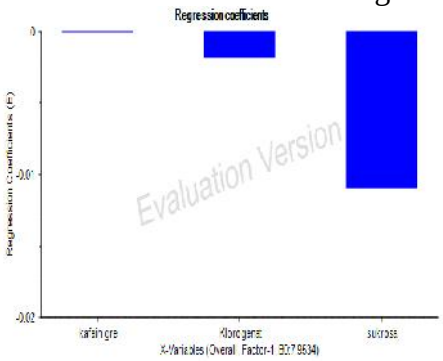
d. Independent variables with body



e. Independent variables with balance



f. Independent variables with fragrance



g. Independent variables with overall

Figure 2. The regression coefficient of independent variables to sensory attributes of *KopiLuwak*.

Sucrose and chlorogenic acids in green bean play a role as aroma precursors since the aroma and sensory properties are formed during roasting (Lee et al., 2015). Therefore the relationship between the precursors and perceived sensory attributes are urged to know (Franca et al., 2005; Farah et al., 2006).Sucrose and chlorogenic acid are reported to have a positive correlation with acidity, sweetness, body, balance, and flavor (Sunarhanum, 2014).

Flavor is attributes perceived by nose and tongue, a combination between aroma and taste. Therefore the explanation towards aroma mechanism should be similar tothe aroma. Sucroses is degraded and transformed to furans which are exhibited caramel, sweet-roasted and nutty aroma (Akiyama et al., 2008; Burdock, 2010; Fors, 1983). The complexity of aroma is assumed to have a linear relationship with flavor intensity of coffee, which then explained why KL 4 and Kl 5 are considered to have the highest score of flavor since there is no off-odor present in aroma remarks (Table 3). Acidity is perceived by combination of astringency and sweetness, which then explained why chlorogenic acids that bring tarty and astringent taste and sucrose for sweetness are positively correlated with this attributes. However, high amounts of chlorogenic acids in green coffee may exhibit undesirable and unpleasant phenol and catechol during roastings (Trugo, 2003).

Moreover, fragrance and overall reported to have aweak negative correlation (<-0.01) with all three independent variables. Since overall describes the whole perception of cupping quality and fragrance is perceived by inhaling the aroma reveals form the coffee ground. It can be assumed that these two dependent variables are not affected by the sucrose, caffeine and chlorogenic acids contents of green coffee *Luwak*.

4. Conclusion

Taking everything into consideration it could be stated that chemical compounds of the green beans aresignificantly influenced the cupping quality of coffee as a brewed drink. Sucrose isthe main component which influences flavor, acidity, aftertaste whilst chlorogenic acids responsible for acidity andbody of brewed drink. The further research should be done to emphasize the formation of volatile compounds in aroma descriptors of Gayo Arabica coffee, especially the specific characteristics. Furthermore, the derivative of sucrose and chlorogenic acids transformation in Gayo Arabica coffee especially *KopiLuwak* should be investigated in detail as well.

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Quality of Gayo Arabica Coffee Affected by Farm Altitude and Coffee Varieties

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Abstract

Gayo Highland is not only known for its Arabica coffee premium quality, but also as a main Arabica coffee producer in Indonesia, with more than 100.000 ha smallholder coffee plantations. Since 2010, Gayo Arabica coffee has been granted Geographical Indication certificate, enabling farmers to claim their coffee as a single origin coffee with apremium price. Nowadays, in addition to coffee bean physicalquality, most consumers also require assessment of its cupping performance. As a holistic product, coffee quality is often considered asa manifestation of thecomplex process from coffee farm to coffee cup. The aims of this research areto investigate the influence of farm altitude (1000-1100; 1200-1400; and >1500m.s.a.l (metersabove sea level) and coffee varieties (Gayo 1, Gayo2, Ateng Super and Multi-varieties) on pH, moisture content and cupping quality based on SCAA International Standard. The statistical analysis (ANOVA) showed that farm altitude significantly influences ($P \leq 0.01$) all measured parameters, whilst the coffee variety only influences ($P \leq 0.01$) pH of brewed coffee drink. Moreover interaction of both factors also has asignificant influence on pH ($P \leq 0.01$) and cupping test score ($P \leq 0.05$). The study also reveals that there is some specificity of fragrance found in Gayo Arabica Coffee, and proves that farm altitude has a linear relationship with coffee cupping quality.

Keywords: farm altitude, specialty coffee, cupping test, Gayo Arabica Coffee

1. Introduction

The definition of specialty coffee early announced by Erna Knutsen in 1978, which used to explain coffee which produced in specific geographic areas where is noted as asuitable location to produce coffee bean with unique sensory profiles (Muzaifa and Hasni, 2016). As specialty coffee, the criteria used to classify coffee beans are far more complex than the general standard. It includes physical aspects namely size classification, color, defects notification as well as the cupping quality which describes sensorial properties of coffee itself as a brewed beverage (Ribeiro et al., 2012; Farah, 2012). This quality is also combined with the recent finding related coffee health effects perfectly open new market of Gayo coffee, as Arabica coffee with specialty quality and geographic identification.

Gayo Highland is coffee area production with elevation levels varied from 800 up to above 1600 meters above sea level. It includes the coffee area in BenerMeriah and Takengon districts, where the land condition is perfect for coffee plantation based on farmer indigenous knowledge (Mawardi et al., 2008; Mawardi et al., 2009). Similar to other coffee production, *Coffeaarabica*and *Coffeacanephora* are the famous commercial species of *Coffea*genus (Rendoen et al., 2014). These two species are then locally hybrid and cultivated by farmers (Mawardi, 2008; Hulupi, 2014). Nowadays, there are three local varieties adopted by farmers which named as Gayo 1, Gayo 2 and Dwarf trees (Karim et al., 2009; Mawardi et al., 2009).

Many reports have been claimed that the whole coffee process from farm to cup havea tremendous effect on its quality (Flament, 2000). The post-harvest and coffee processing techniques effect have been reported internationally which stated it mainly involved on thw formation of aroma precursor (Farah, 2012; Afoakwa, 2008). Furthermore,Muzaifa and Hasni (2016) also explored the effect of different processing techniques towards physical appearance, chemical compounds and sensory quality of Gayo coffee. But for farm process which combination of coffee varieties, soil and climate condition as well as farm management practices classifies as major factors which contribute towards compounds of coffee flavor

precursor (SCAA, 2009; Maier, 2005, SCAI, 2011) are not yet well defined and fully investigated. Although several reports have been stated that elevation considers as environmental factors to perceived premium quality for single origin effect, as presented by Guyot et al., (1996) for Guatemala coffee, and others in several central American countries (Avelino et al., 2005; Bertrand et al., 2006; Decazy et al., 2003). Therefore this research would like to emphasize the investigation towards effect on coffee varieties and elevation level towards Gayo coffee quality as single origin coffee based on Specialty Coffee Association of America (SCAA) standard. By doing so, the research will able to emphasize specific elevation level which has the best contribution on cupping quality for available local varieties in Gayo Highland.

2. Materials and Methods

This work used Randomized Block Design with two factors, named as Local Variety (V1: Gayo 1; V2: Gayo 2; V3: Dwarf Trees and V4: Multi-varieties) and Elevation Level (m.s.a.l) (T1= 1000-1100; T2= 1200-1500; and T3= above 1500). Each treatment is repeated three times, wherein total samples are 36 samples. The data then analyzed by ANOVA with SPSS 17.0. The green bean processing was conducted in farm plantation areas, whilst the pH and moisture contents analyzed in Food Analysis and Agricultural Product Laboratory-Department of Agricultural Product Technology – Syiah Kuala University. For cupping test and physical appearance was done by Gayo Cupper Team as Q-Grader in Takengon, Central Aceh Indonesia.

2. 1. Materials

The local varieties used in this research are Gayo 1, Gayo 2, Ateng Super and Multi-varieties. Based on this varieties, coffee cherries are collected on three location areas in BenerMeriah (Bebesan and Bies) and Takengon (Bandar and Bukit) districts. The coffee then processes by semi-wash methods, a common traditional method in Gayo Highland.

2.2. Green Bean Processing

The fully-ripe coffee cherries selected picked, sorted from green, leaves, and dirt. The cherries are cleaned and pulped. Fermentation started by placing the coffee bean in plastic bags for 12-18 hours to mucilage removal. It continues by washing the coffee, drained by plastic bin and sun drying until the moisture contents up to 40%. Next step is the coffee bean is hulling to remove the husk, then the bean is re-dried up to 8-13% of moisture contents. The green bean then analyzed based on its moisture contents, physical appearance, pH of brewed drink and cupping quality (Abubakar and Karim, 2009)

2.3. Moisture contents and pH

The green bean was evaluated for moisture and pH level (AOAC, 2000) based on the work design. By doing so 36 samples of green bean were analyzed.

2.4. Cupping test

Cupping test is sensory properties assessment which used the descriptive method in an organoleptic way. The test run by coffee 3 (three) Q-grader as professional trained assessor, who able to identify coffee based on its origin and to differentiate and note the coffee quality based on ten attributes (fragrance/aroma, flavor, acidity, body, uniformity, clean cup, aftertaste, balance, sweetness and overall). The test followed the procedures of cupping test by on Specialty Coffee Association of America (SCAA, 2009). It involved roasting of coffee bean in middle roasting with 55 Agtron Scale, grounded up the coffee up to 20 meshes. The brewed coffee is brewed with ratio 8.25 gr of ground coffee and 150 ml hot water (93^{o}C). In order to classify as specialty coffee, each sample obliges to have minimum 6 for each attribute

and total score 80. The score is varied from 1 to 10, whilst the total score is a summarize value of all ten attributes.

3. Results and Discussion

3.1. Moisture contents of green bean

Based on SCAA standard (2009), the moisture content of coffee specialty is in range of 9-13%. The green bean from this work has moisture contents between 11.00-14.30% with average 12.90%. Therefore, it can be said that the moisture content of green bean fulfill SCAA requirement. The ANOVA showed that elevation level (m.s.a.l) has significant influence (P≤0.01) towards the moisture content of green bean as presented in Figure 1.

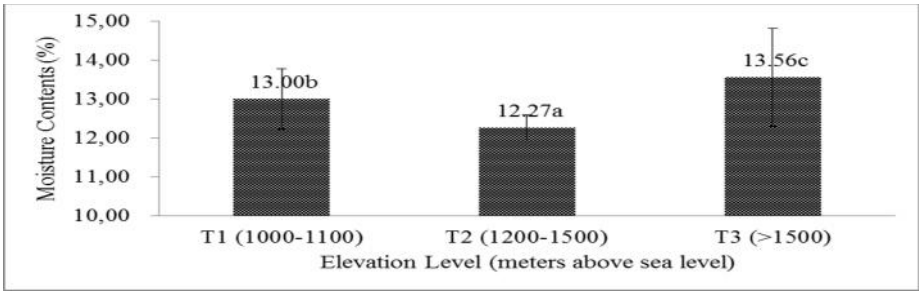

Figure 1. Influence of elevation level (m.s.a.l) towards moisture contents of green bean with $LSD_{0.05}$=0.39 and KK= 3.59%, a numberfollowed by similar alphabet shows in-significant differences

Figure 1 showed based on $LSD_{0.05}$that moisture contents in each elevation level are varied and significantly differentiate. The lowest moisture (12.70%±0.60) content belongs to green bean harvested at location area with altitude 1200-1500 m.s.a.l whilst the green bean were picked up from land with elevation level above 1500 m.s.a.l has the highest moisture contents (13.45%±1.04). Furthermore, elevation level 1000-1100 m.s.a.l produce green bean with moisture contents 13.06%±1.16. This difference might be an impact of humidity level as well as rainfall in this three altitudes. As suggested by Bertrand et al., (2012) coffee producing areas should have tropical climates, where the condition of this climate temperature and annual rainfall empirically proven to have a positive correlation with the elevation level. Most Arabica coffee growing areas has annual rainfall in the range 1500-2500 mm with optimum temperature 15-24^{o}C (Mitchell, 1988). However, detail research should be done to investigate the effect of this Gayo Highland climate condition towards quality properties of Gayo coffee.

3.2. pH of brewed drink

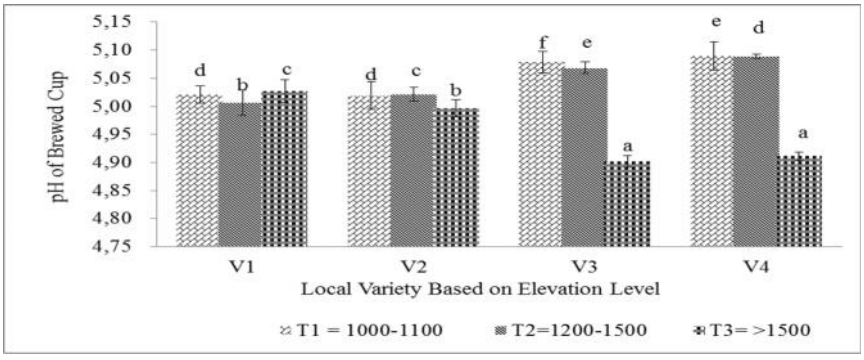

Figure 2. Influence of interaction between Gayo local varieties and elevation level (m.s.a.l) (VT) towards pH of brewed drink with $LSD_{0.05}$=0.03 and KK= 13.53%, number followed by similar alphabet shows in-significant differences

pH or acidity level defined as an alkali indicator of product. Brewed drinks from this work have pH in the range of 4.90±0.01 -5.09±0.03 with average pH is 5.02. The ANOVA presents that all two factors and its interaction are significantly influenced (P≤0.01) towards pH of resulted brewed drink. The interaction of two factors is presented in Figure 2. Based on $LSD_{0.05}$, Figure 2 showed that each Gayo coffee local varieties, particularly V2, V3 and V4tend to have lower pH when the elevation level of plantation areas is higher.Acidity level of brewed drink could be considered as aphysicalpresent of acidity attributes in coffee as beverage. This is matched with acidity score, as one of sensory attributes assessed in cupping test, where the acidity score increases when the coffee is planted on higher elevation, especially Dwarf Trees (V4). The Gayo local varieties are results of independent hybrid process by farmers over the years and has successfully adapted Gayo climate condition. V1 is named as Gayo 1, originally known as ArabustaTimtim which locally hybrid by farmers in Takengon, Great Aceh. V2 is Gayo 2, previously named as Bour-bour, a tall version of ArabustaTimtim in BenerMeriah. The dwarf trees is V3 and V4 refers to multi-varieties. Based on this result, the gathered information is for V1 the lowest pH (5.02±0.02) obtained for coffee harvested on 1200-1500 m.s.a.l (V3), whilst for other local varieties are more suitable to be planted above 1500 m.s.a.l.(V2= 5.00±0.02; V3= 4.90±0.01; V4=4.91±0.01).

2.3. Cupping test score

Cupping test is organoleptic method which described 10 sensory attributes entitled as *fragrance/aroma, flavor, acidity, body, uniformity, clean cup, aftertaste, balance, sweetness* and *overall*. Score is varied from 1 to 10, but to be classified as specialty coffee, the minimum score for each attribute should be 6 and the total score should be 80 (SCAA, 2014). In this work, cupping test score defined as total score perceived by sample, where the range varies between 80.02±2.09 -85.48±0.42 and the average score is 83.31. Compared to SCAA standard, all of 36 samples fulfill the SCAA requirements and classifies as specialty coffee. ANOVA test presents that factor elevation level and interaction between two factors have significant influence (P≤0.01) towards cupping test score of coffee. The Figure 3 and Figure 4.

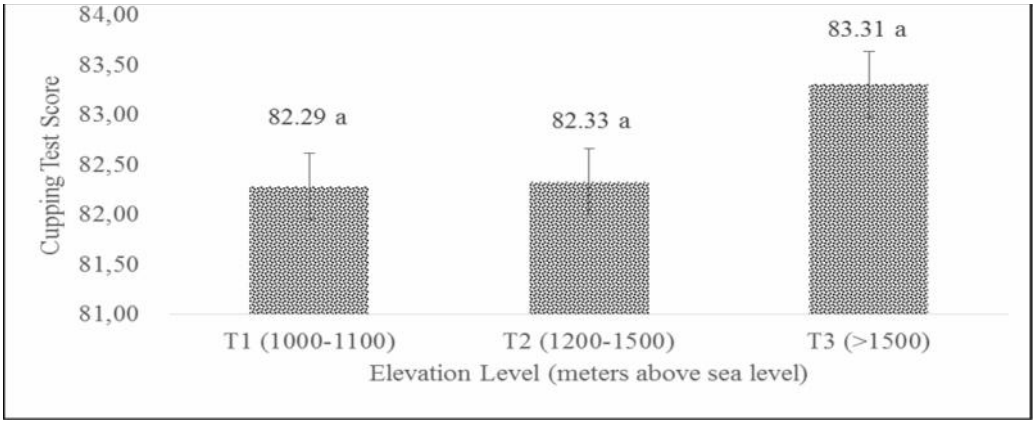

Figure 3. Influence of elevation level (m.s.a.l) towards cupping test score with $LSD_{0.05}$=1.71 and KK= 4.51%, number followed by similar alphabet shows in-significant differences.

Figure 3 shows the effect of elevation level towards cupping test score, where $LSD_{0.05}$ shows level of variables are not significantly difference with each other, even though the

tendency presents that the cupping score is higher when elevation level rises. This results is aligned with previous studies that coffee from higher elevations in Guatemala claimed to produce better cupping quality (Guyot et al., 1996), and continued conformed by Avelino et al., (2005), Bertrand et al., (2006) and Decazy et al., (2003). However since in Gayo Highland the local varieties are varied the relation between elevation level and local varieties should be examined as presented in Figure 4. Furthermore Bertrand et al., (2012) investigated that sensory attributes such as aroma and acidity were correlated with cool climates, whereas the defects quality attributes such as green and earthy are increasingly note as the temperature increases. As cool climates commonly present in higher elevation level, therefore it would have contribution towards the increase of cupping score and quality of beverage. In this study, the aroma characteristic of 36 samples are presented in Table 1.

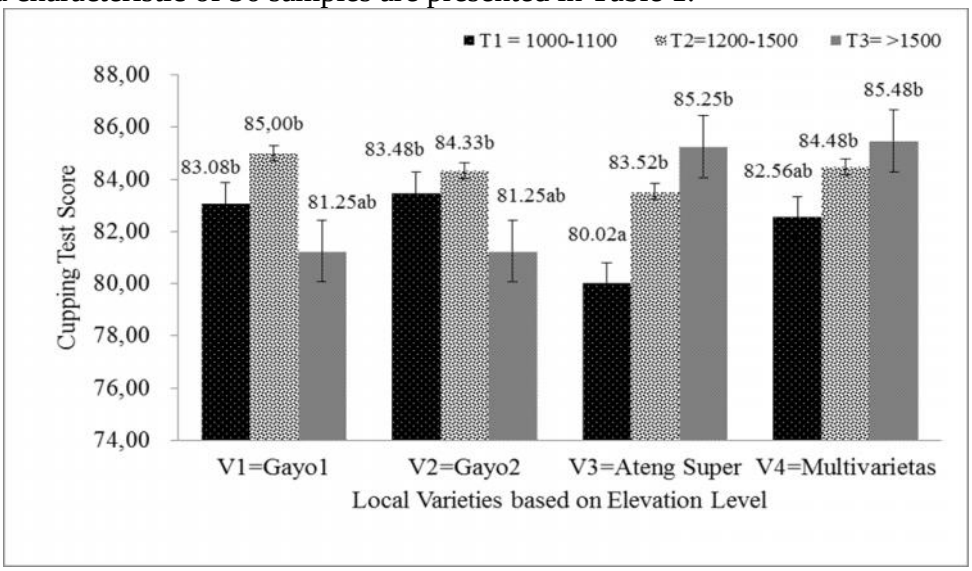

Figure 4. Influence of interaction between Gayo local varieties and elevation level (m.s.a.l) (VT) towards cupping test score with $LSD_{0.05}$=3.42 and KK= 4.51%, number followed by similar alphabet shows in-significant differences

Figure 4 picturizes interaction between local varieties and elevation, where the highest cupping test (85.48±0.42) belonged to Multi-variety planted on area above 1500 m.s.a.l. The lowest score exhibited by Ateng Super which planted on lowest elevation (1000-1100 m.s.a.l), this sample also presents in-significant differences with Gayo 2 and Gayo 3 plant in similar elevation area. As present in Figure 4 as well, for Ateng Super and Multi-variety the cupping test score empirically increases as location area elevates. On contrary, Gayo 1 and Gayo 2 obtained lowest cupping test if they are planted in higher elevation. Furthermore, based on the Figure 4 as well, it can be concluded that Gayo 1 exhibit better quality drink on 1000-1100 m.s.a.l, Gayo 2 on 1200-1500 m.s.a.l. This condition is also aligned with previous study done by Wahyuni et al.(2013) which suggested that Arabusta Tim or Gayo 1 suitable if is planted on elevation < 1200 m.s.a.l, Gayo 2 or Bour-bour and Ateng Super obtained premium quality drink on location > 1400 m.s.a.l.

2.3. Fragrance remarks

Except the intensity of ten attributes, SCAA cupping test also identify the available fragrance noted during the inhalation of coffee ground at the beginning of test. Table 1 shows the remarks of coffee samples which are successfully noted by Q-grader. From the Table it could be seen that caramel fragrances such as nutty, chocolaty, peanut are present in all varieties and all elevation level. This results also similar as presented by Muzaifa and Hasni (2016), which stated that Arabica regular produced by semi-washed processing has nutty, chocolaty, herby with citrus flavor. Nutty defined as a light, brown musty aromatic which

associated with nuts, wheat, whole and dried grains, whereas chocolaty refers to cocoa burn, sweet and bitter characteristics commonly present in cocoa beans and cocoa derivative product. Moreover, sweet or sour aromatic flavor such as herby, citrusy, fruity, floral considered as pleasant aromatic flavor which associated with sweet or sour product (Bhumiratna et al., 2011). This present fragrance could be associated with the type of shade trees used by farmers (Hasni, 2010).

Table 1. Fragrance of Gayo Arabica Coffee Based on Local Varieties and Elevation Area

Sample	Final Score		Aroma/ Fragrance Remarks
Elevation 1000-11100 meters above sea level			
Gayo 1	83.08	± 0.34	**Nutty**, herby tobacco like, slightybittery, **spicy, caramelly**
Gayo 2	83.48	± 0.14	Choco powder, creamy, sweet, herby, slighty greenish
At.Super	80.02	± 2.09	Roasted peanut, corn, soyebean, tarty, sweet, slighty floral
Multvar	82.56	± 0.72	**Bright nutty, chocolaty, caramelly,** toasty, tea like
Elevation 1200-1500 meters above sea level			
Gayo 1	85.00	± 0.17	Choco powder, **bright nutty**, cinamon, fruity, citrusy, milky balance, floral, tobacco
Gayo 2	84.33	± 0.20	**Chocolaty, nutty,** toasty, caramelly, tropical fruity, syirupy, beef like, tobacco
At.Super	83.52	± 0.14	**Chocolaty, nutty**, Herby, grassy, fruity, tobacco, tarty
Multvar	84.48	± 0.04	**Dark chocolaty, nutty,** fruity, **caramelly**, creamy, tobacco, tarty
Elevation > 1500 meters above sea level			
Gayo 1	81.25	± 5.09	Choco powder, bright nutty, cinamon, fruity, citrusy, milky balance, floral, tobacco
Gayo 2	81.25	± 5.09	Choco powder, sweet, bright nutty, slighty woody, floral, fruity, tobacco
At.Super	85.25	± 0.23	**Dark choco,** biscuit, fruity, tobacco like, tarty, pine-apple like
Multvar	85.48	± 0.42	**Dark chocolaty, nutty**, fruity, caramelly, creamy, tobacco, tarty

4. Conclusion

Taking everything into consideration it can be said that Gayo Highland has huge potential to be specialty coffee producers, since the land condition is suitable. Elevation area empirically proven has significant influence towards sensory quality of coffee, however each local variety profound to have specific preference towards the elevation. The Gayo Arabica coffee has specific fragrance characteristic, where are chocolaty, nutty and spicy fragrance which proven to present in all local varieties. Furthermore, next study should be done to breakdown the environmental factors such as harvesting time, temperature, rainfall towards sensory quality and measure the relationship between the measured factors.

Acknowledgements

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Profesional Caring Factor Factors in Providing Services to Clients in Puskesmas

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Abstract

Puskesmas as the provider of basic health services are required to always improve the quality of servants. Nurses as health human resources are required to always provide professional services to clients. Nurses have a primary duty of care. Caring behavior as a form of professional performance of nurses in providing services to clients. Therefore need to be found and studied further how caring factor owned by professional nurse at Puskesmas. The purpose of this study was to find the factors that are caring professional behavior of nurses in providing services to clients. This research was conducted by distributing caring questionnaires to 99 nurses of Puskesmas as research respondents. Factorial analysis technique with AMOS was done to find out the factors forming caring behavior of nurse. The results showed that caring nurses at Puskesmas were altruistic humanistic (p = 0.087), confidence and expectation (p = 0.017), sensitivity (p = 0.011), mutual trust (p = 0.011), positive-negative feelings (p = 0.635) creative problem solving (p = 0,000), interpersonal teaching learning (p = 0.002), creating a supportive, protective, correctiveenvironment (p = 0,000), helping basic human needs (p = 0,000), recognizing spiritual phenomena (p = 0.032) with loading factor above 0.03. The implication of this research is the formation of caring instrument that contains caring factors of professional caring nurses in providing services to clients. Caring instruments can be used to measure caring behavior of nurses and as instruments for further research development.

Keywords: Caring Factor, Professional Performance, Nurse at Puskesmas

1. Introduction

Puskesmas as the provider of basic health services are required to always improve the quality of servants. Nurses as one of the health team members are also required to always provide good service to patients or clients. Marrison and Burnard (2009) say that nurses have the primary duty of giving care. The nurse who cares for the client means giving care to the client.

Caring is the essence of nursing that differentiates with other professions and dominates, unifies, and animates nursing actions (Watson, 2008). Caring is a core process (Watson, 2008; Marisson & Burband, 2009) and caring is central to nursing practice (Potter & Perry, 2009).

The purpose of caring is the behavior of nurses in providing nursing services consists of efforts to protect, enhance, preserve / perpetuate humanity by helping others in the process of healing illness, suffering and its existence helping others to increase knowledge and self-control with a human touch (Watson, 2008).

Assembly of honor nurse code of nursing PPNI (National Nurses Association of Indonesia, 2005) states that nurses are obliged to behave professionally by wearing uniforms, always clean, polite and friendly, responsive, ready to help, good listener, using therapeutic communication, attentive, disciplined and if promised to be fulfilled. Caring is the moral ideal of a task-oriented behavior (Watson, 2008).

The fundamental problem in the nursing profession of Indonesia today is that nurses are still not carrying out the role of caring professionally in providing nursing care to clients (Nursalam, 2014). Caring nurse behavior is very necessary in nursing service, but not all nurses behave caring.

Reynolds and Scoott (2000) argue that the ability to empathize with healthcare professionals on clients is still low, whereas in such relationships it is necessary to demonstrate empathy to clients. The nature of the relationship between nurse and client is a major factor determining the condition of medical consultation, such as client satisfaction, compliance with medical rules, which ultimately affect the health of the client (Sugiarto, 2002).

Caring is a caring behavior as a form of professional performance of nurses in providing services to clients. Therefore need to be found and studied further how caring factor owned by professional nurse at Puskesmas. Based on the above description it is necessary to review and identified caring professional factor nurses in providing services to clients.

In this study, caring nurse professional identification in providing services to clients. The purpose of this study was to find the factors that are caring professional behavior of nurses in providing services to clients. Finally create an adequate instrument in photographing caring behavior of nurses which is the essence of the behavior of professional nurses.

2. Materials and Methods

This research is quantitative research using Confirmatori Factor Analysis (CFA) statistic method. Prior to the statistical tests the data were collected using methodological research steps.

The methodological steps of this study are designed as follows: (1) determine the caring of nurses as the variables that the instrument will develop, (2) develop the conceptual and operational definitions of the caring nurse variables, (3) arrange the caring nurse questionnaire as a rating instrument based on Likert scale, (4) performs theoretical validity to the expert as a judgment expert for grain selection, (5) conducts trials, (6) analyzes grains and finds caring factors.

Behavior caring performance nurses are prepared based on performance indicators caring nurse's performance. Caring is built on 10 caratif factors (Watson, 2008), 1) Humanistic altruistic values, 2) Instilling / enabling faith and hope, 3) Sensitivity to oneself and others, 4) Developing a helping-trusting, human caring relationship, 5) Promoting and acceting expression of positive and negative feelings, 6) Systematic use of scientific (creative) problem-solving caring process 7) Promoting interpersonal teaching-learning 8), Providing for a supportive, protective, and / or corrective mental, social, spiritual environment, 9) Allowing forexistential-phenomenological dimensions.

The instrument consists of 50 statement items in favorable form, given to 99 nurses as research respondents. Each item provided 4 choices of answers, ie never, rarely, often, very often. The choice of this answer using the likert scale by means of scoring is never score 1, rarelyscore 2, often score 3, and very often score 4. Data is analyzed by confirmatory factor analysis (CFA) using AMOS program.

3. Results and Discussions

Unidimensionality testing using CFA (Confirmatory Factor Analysis) with AMOS (Analysis of Moment Structure) program. The results show that all items have a good difference (above 0.3).

a. Test of caratif factor 1 (humanistic - altruistic values)

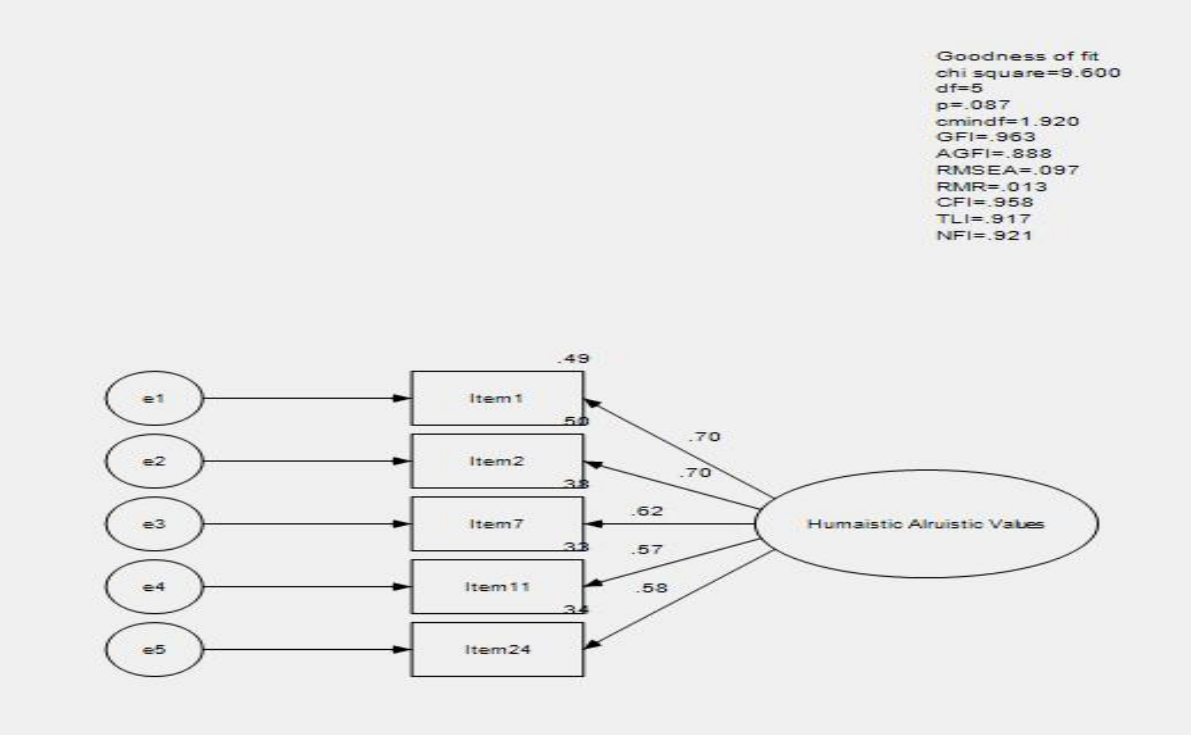

Figure 1. Factor Analysis Humanistic - altruistic values

The result of processing shows that the value of loading factor at 5 (five) items has a value above 0.3 with p = 0,087 indicator is valid and means that the indicator is significant in measuring a constraint. Atruistic humanistic regression weight in table 1 below:

Table 1. Regression Weights Values of Attractive Humanistic

No item	*Caratif Factors*	*Estimate*
Item 24	*<--- altruistic humanistic*	*0,582*
Item 11	*<--- altruistic humanistic*	*0,575*
Item 7	*<--- altruistic humanistic*	*0,619*
Item 2	*<--- altruistic humanistic*	*0,704*
Item 1	*<--- altruistic humanistic*	*0,700*

Source: statistical results

Geanellos (2002) in his study of hospitality among nurses and clients, and justified by Korsah (2011), shows nurses who smile, joke, speak in a gentle tone and show attention to clients will improve the quality of communication between nurses and clients. This shows that the nurse is able to form an atruistic humanistic value in the implementation of nursing service to the client. altruistic humanistic feelings and acts provide the foundation of the best human awareness and professional care (Watson, 2007).

b. Test of caratif factor 2 (Instilling / enabling faith and hope)

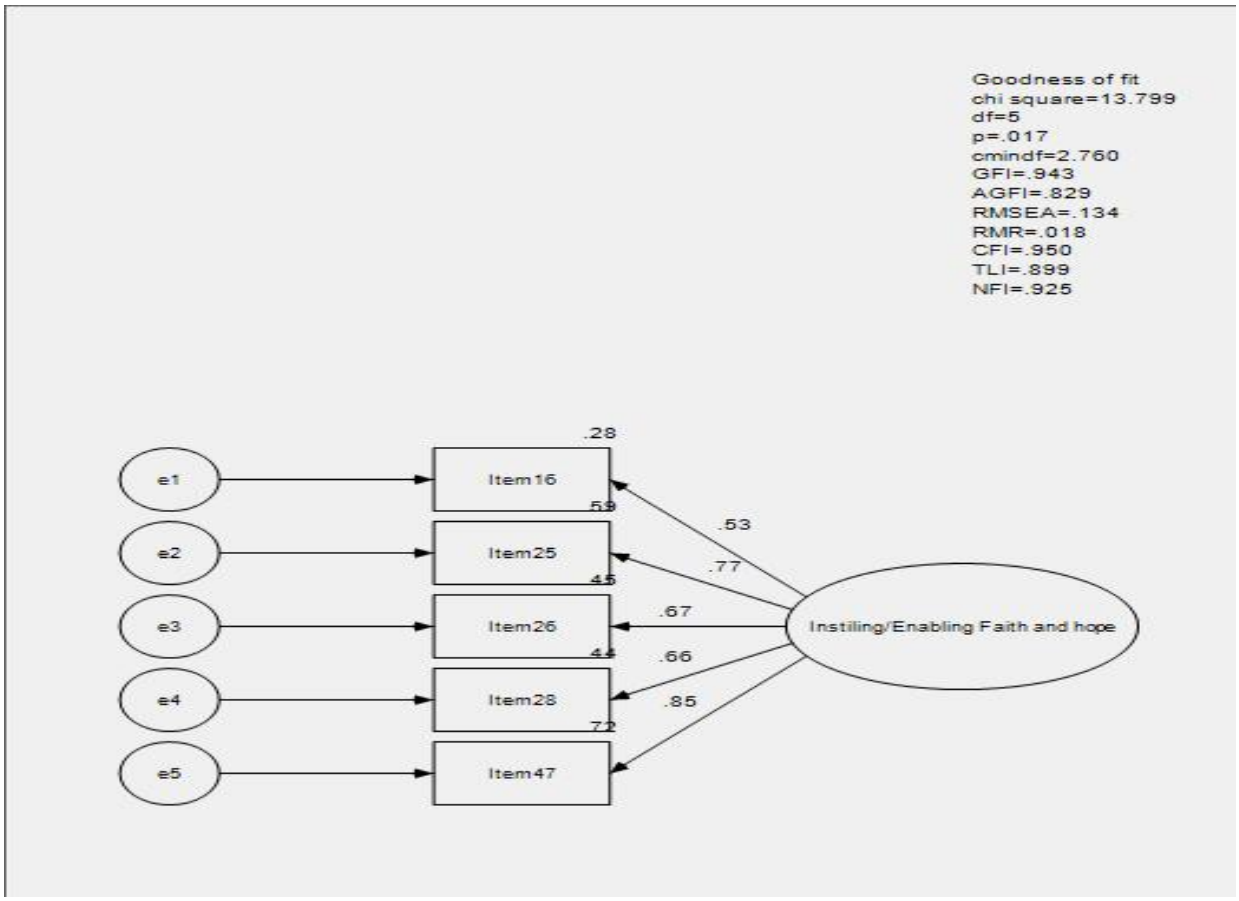

Figure 2. Factors Analysis Instilling / enabling faith and hope

The result shows that the value of loading factor at 5 (five) items all have value above 0.3 with p value = 0,017, this number is below p ≤ 0.05 then the indicator in question is valid and means that the indicator is significant in measuring a constancy . Regression weight of belief and expectation in table 2 below:

Table 2. Regression Weights Faith and Hope

No item Caratif Factors	*Estimate*
Item 47<--- Faith and Hope	*0,851*
Item 28 <--- Faith and Hope	*0,664*
Item 26 <--- Faith and Hope	*0,674*
Item 25 <--- Faith and Hope	*0,771*
Item 16 <--- Faith and Hope	*0,525*

Source: statistical results

Nurses must maintain confidence and hope and a deep belief system, even when there is nothing left to do medically (Watson, 2007). This shows that nurses are able to instill confidence and hope in the implementation of nursing services to clients. Nurses should instill hope in patients to cultivate a sense of their presence (Suliman, et al., 2009).

c. Test of caratif factor 3 (Sensitivity to oneself and other)

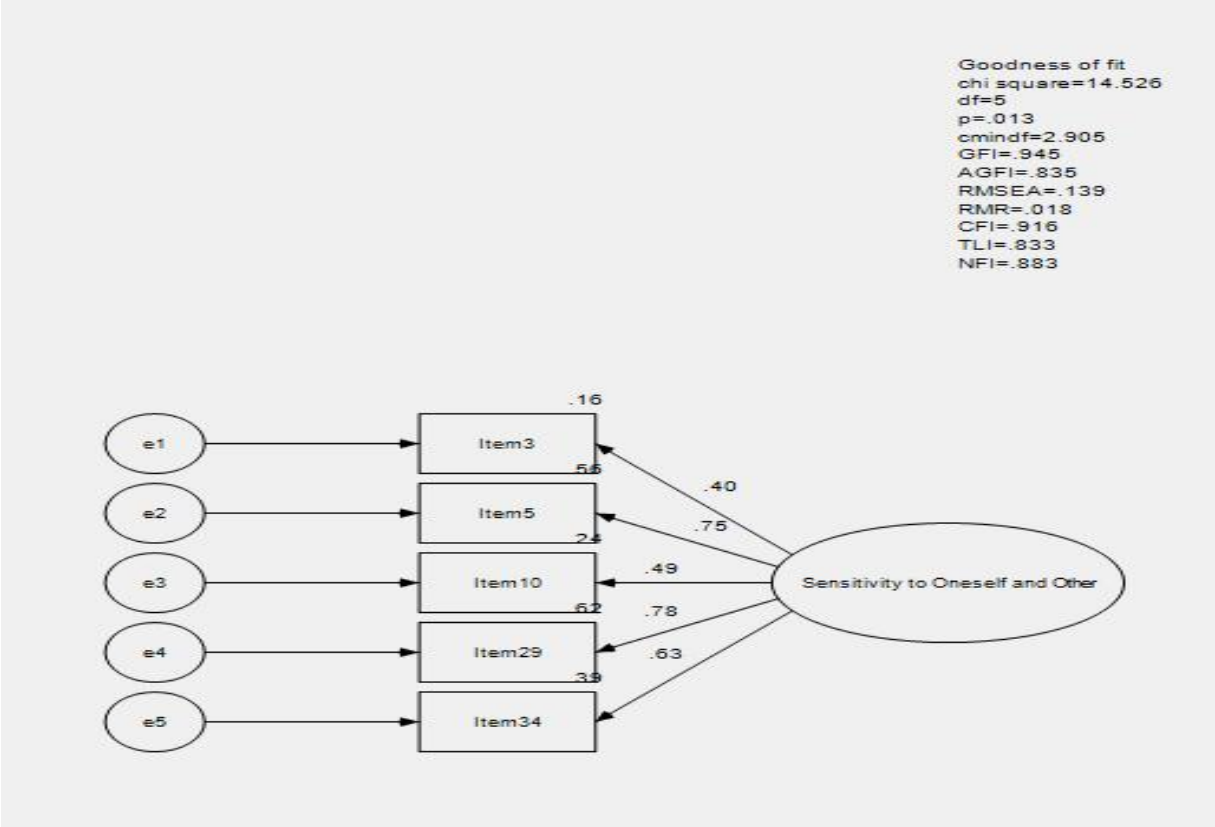

Figure 3. Factor Analysis Sensitivity to oneself and other

The result shows that the value of loading factor at 5 (five) items all have value above 0.3 with p value = 0,013, this number is below p ≤ 0,05 then the indicator in question is valid and mean that indicator is significant in measuring a constancy . Regression weight sensitivity in table 3 below:

Table 3. Regression Weights Sensitivity

No item *Caratif Factors*	*Estimate*
Item 34 <--- Sensitivity Value	*0,627*
Item 29 <--- Sensitivity Value	*0,785*
Item 10 <--- Sensitivity Value	*0,493*
Item 5 <--- Sensitivity Value	*0,750*
Item 3 <--- Sensitivity Value	*0,398*

Source: statistical results

The sensitivity to self and others is empathy and able to place themselves in the client's position, feel or concern about the expression of suffering expressed by the client (Stuart & Laraia, 2010).

This shows the nurse is able to grow sensitivity to self and others in the implementation of nursing services to clients. The nurse can induce positive interaction between nurse-clients by showing empathy (Moghaddasian et al., 2013).

d. Test of caratif factor 4 (Developing a helping-trusting)

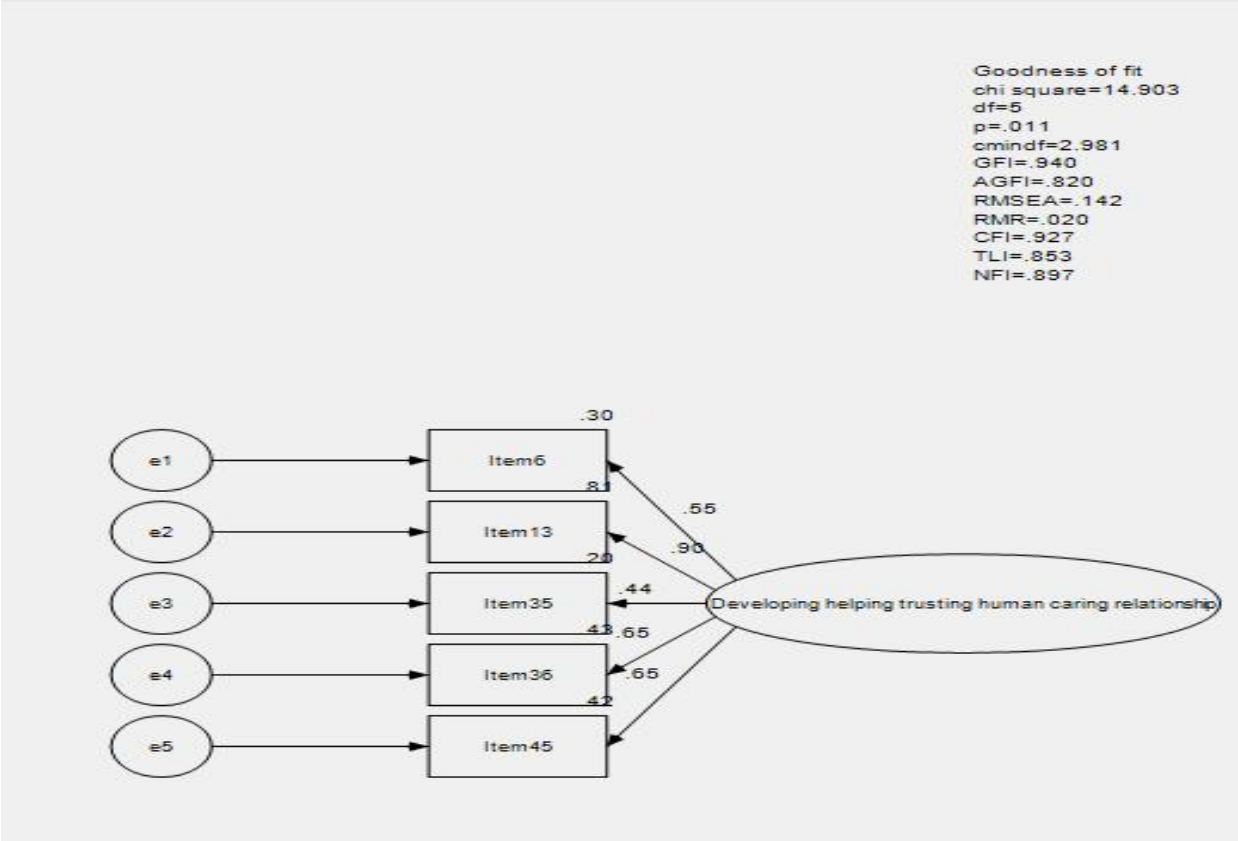

Figure 4. Factor Analysis Developing a helping-trusting

The result shows that the value of loading factor at 5 (five) items all have value above 0.3 with p value = 0,011, this number is below p ≤ 0,05 then the indicator in question is valid and mean that indicator is significant in measuring a constancy . Regression weight trust each other in table 4.

Table 4. Regression Weights Believe each other

No item	*Caratif Factors*	*Estimate*
Item 45	<--- Believe each other	*0,647*
Item 36	<--- Believe each other	*0,653*
Item 35	<--- Believe each other	*0,442*
Item 13	<--- Believe each other	*0,897*
Item 6	<--- Believe each other	*0,550*

Source: statistical results

The nurse provides information honestly (Tomey & Alligood, 2006) and fosters a relationship of trust (Marrison & Burnanrd, 2009). Talking honestly is closely related to trust and affects the credibility of the nurse (Babatsikov & Gerogianni, 2012). This shows that nurses are able to develop trust relationships in the implementation of nursing services to clients. Nurses form a trusting relationship that respects personality, maintains dignity and dignity, giving hope for a more meaningful future will facilitate better healing (Swatson & Wojnar, 2004).

e. Test of caratif factor 5 (Promoting and accepting expression of positive and negative feelings)

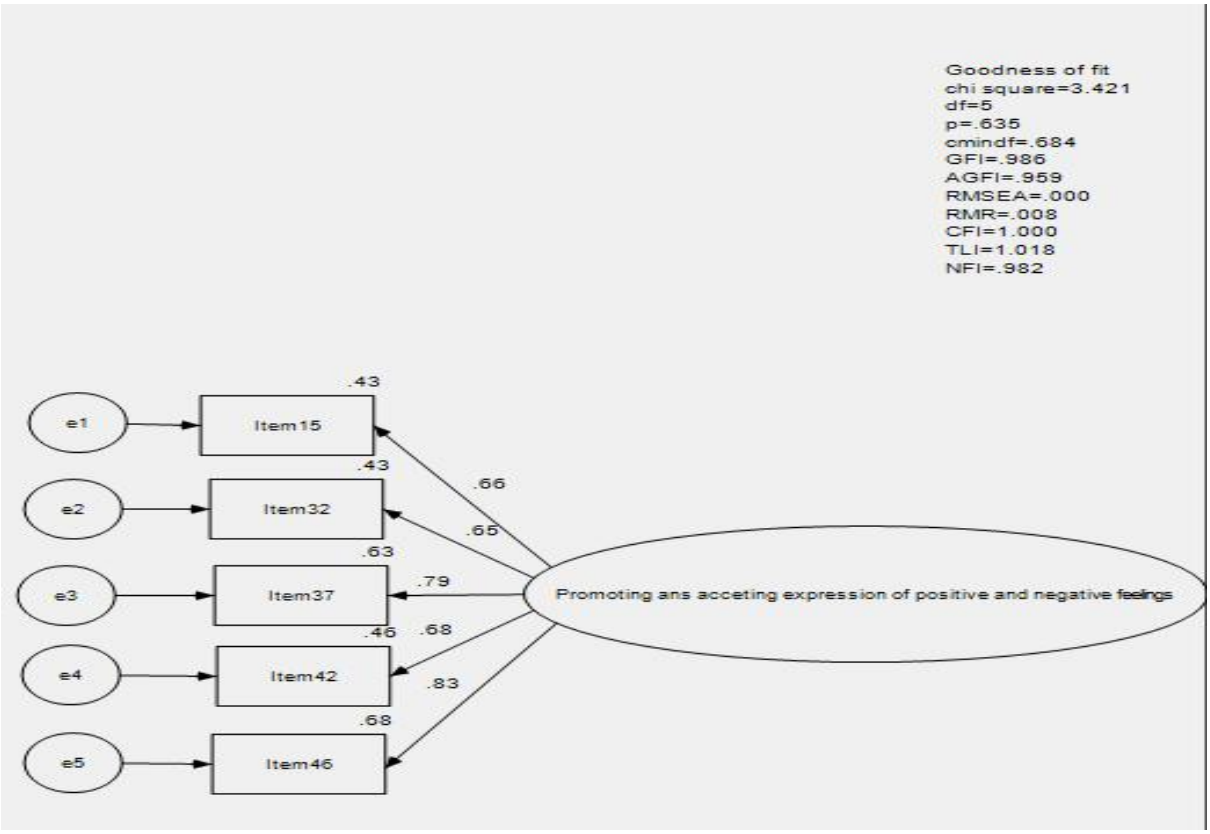

Figure 5. Factor Analysis Promoting and acceting expression of positive and negative feelings

The result shows that the value of loading factor at 5 (five) items has a value above 0.3 with p = 0.635, the indicator is valid and means that the indicator is significant in measuring a constraint. Regression weight trust each other in table 5.

Table 5. Regression Weights Positive Negative Expressions Expression

No item *Caratif Factors*	*Estimate*
Item 42 <--- Positive Negative Expressions Expression	*0,678*
Item 37 <--- Positive Negative Expressions Expression	*0,794*
Item 32 <--- Positive Negative Expressions Expression	*0,652*
Item 15<--- Positive Negative Expressions Expression	*0,658*
Item 46 <--- Positive Negative Expressions Expression	*0,826*

Source: statistical results

Nurses should provide opportunities and encourage clients, in addition to understanding and receiving different positive and positive thoughts and feelings in different situations (George 1995: Stuart & Laraia, 2010). This shows that nurses are able to improve and accept the expression of positive and negative feelings of clients in the implementation of nursing services to clients. Nurses can present and support the disclosure of positive and negative feelings as part of a deeper connection and passion for the client (Lachman, 2012).

f. Test of caratif factor 6 (Systematic use of scientific / creative problem solving caring process)

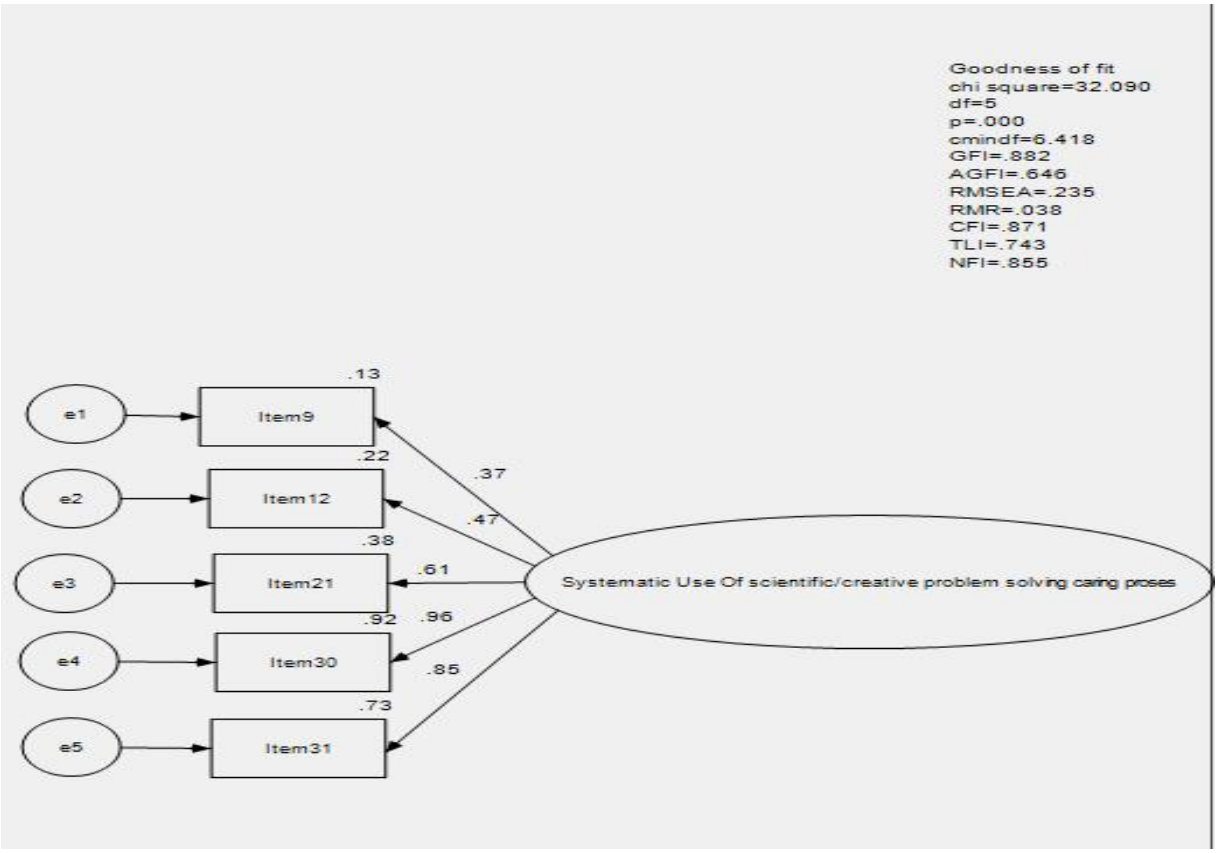

Figure 6. Factor Analysis Systematic use of scientific / creative problem solving caring proces

The result shows that the value of loading factor at 5 (five) items all have value above 0.3 with p value = 0.000, this number is below p ≤ 0.05 then the indicator in question is valid and means that the indicator is significant in measuring a cone. Regression weight of mutual trust can be seen in table 6 below:

Table 6. Regression Weights Creative Problem Solving

No item *Caratif Faktor*	*Estimate*
Item 30 <--- Creative Problem Solving	*0,961*
Item 21 <--- Creative Problem Solving	*0,613*
Item 12 <--- Creative Problem Solving	*0,472*
Item 9 <--- Creative Problem Solving	*0,366*
Item 31 <--- Creative Problem Solving	*0,854*

Source: statistical results

This shows that nurses are able to use the creative caring process in solving problems in the implementation of nursing services to clients. nurses have an important role in building communication among other health professionals. The end result of professional communication care is effective care and improved outcomes (Ghiyasuandian, et al., 2015).

g. Test of caratif factor 7 (Promoting interpersonal teaching-learning)

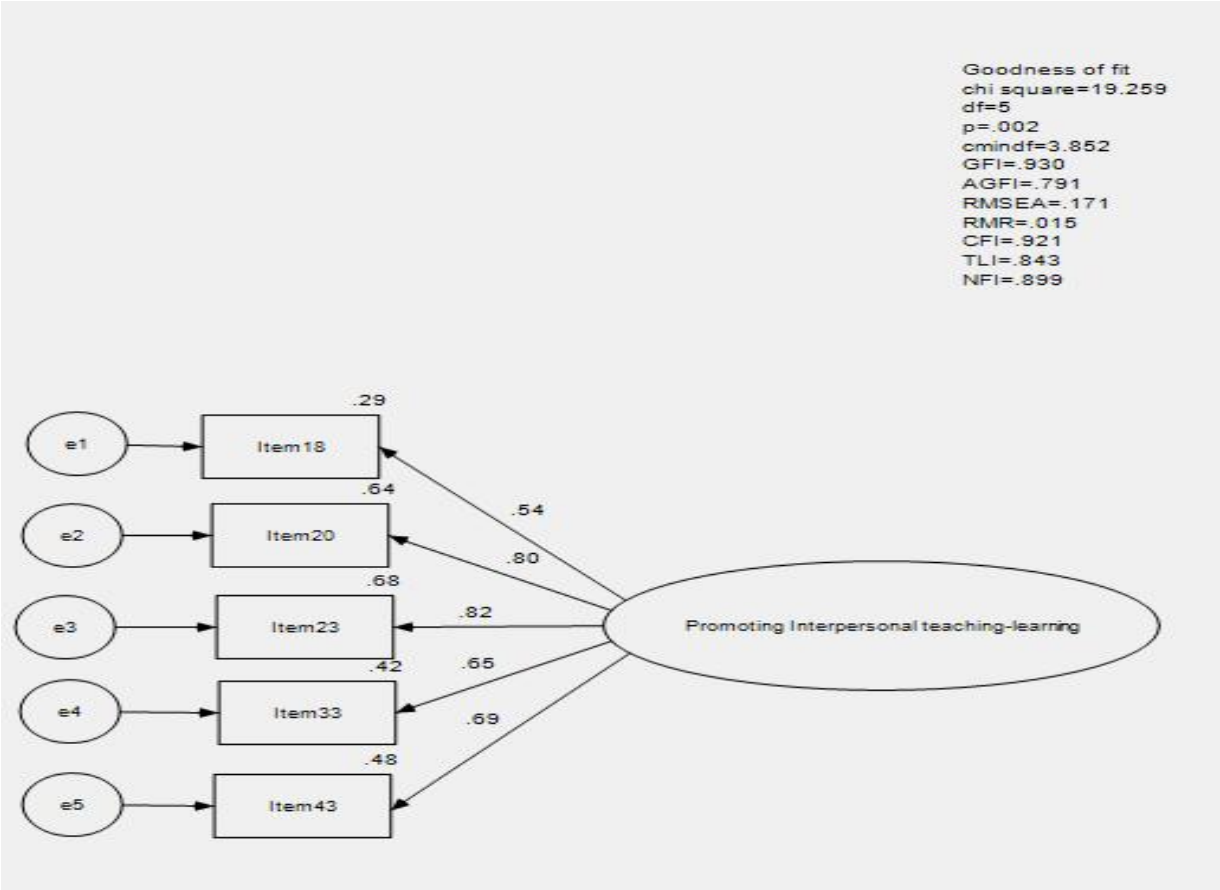

Figure 7. Factor Analysis Promoting interpersonal teaching-learning

The result shows that the value of loading factor at 5 (five) items all have value above 0.3 with p value = 0,002, this number is below p ≤ 0,05 then indicator referred to is valid and mean that indicator is significant in measuring a constraint . Regression weight learning interpersonal teaching can be seen in table 7 below.

Table 7. Regression Weights Learning Interpersonal Teaching

No item *Caratif Factors*	*Estimate*
Item 33 <--- Learning Interpersonal Teaching	*0,651*
Item 23 <--- Learning Interpersonal Teaching	*0,824*
Item 20 <--- Learning Interpersonal Teaching	*0,799*
Item 18 <--- Learning Interpersonal Teaching	*0,538*
Item 43 <--- Learning Interpersonal Teaching	*0,689*

Source: statistical results

The client must know what is possible and what can not be achieved. The nurse must admit it and then provide this information in clear terms to the client and his family (America Nurse Association, 2016). This involves caring relationships as a context for teaching and learning (Watson, 2007).

This shows that nurses are able to improve interpersonal teaching learning in the implementation of nursing services to clients. The nurse creates an environment conducive to the delivery of health education to the needs of the client, explains the complaints rationally and scientifically, assuring the client about the nurse's willingness to provide information (Tomey & Alligood, 2006; Potter & Perry, 2009).

h. Test of caratif factor 8 (Providing for a supportive, protective, and / or corrective mental, social, spiritual sphere)

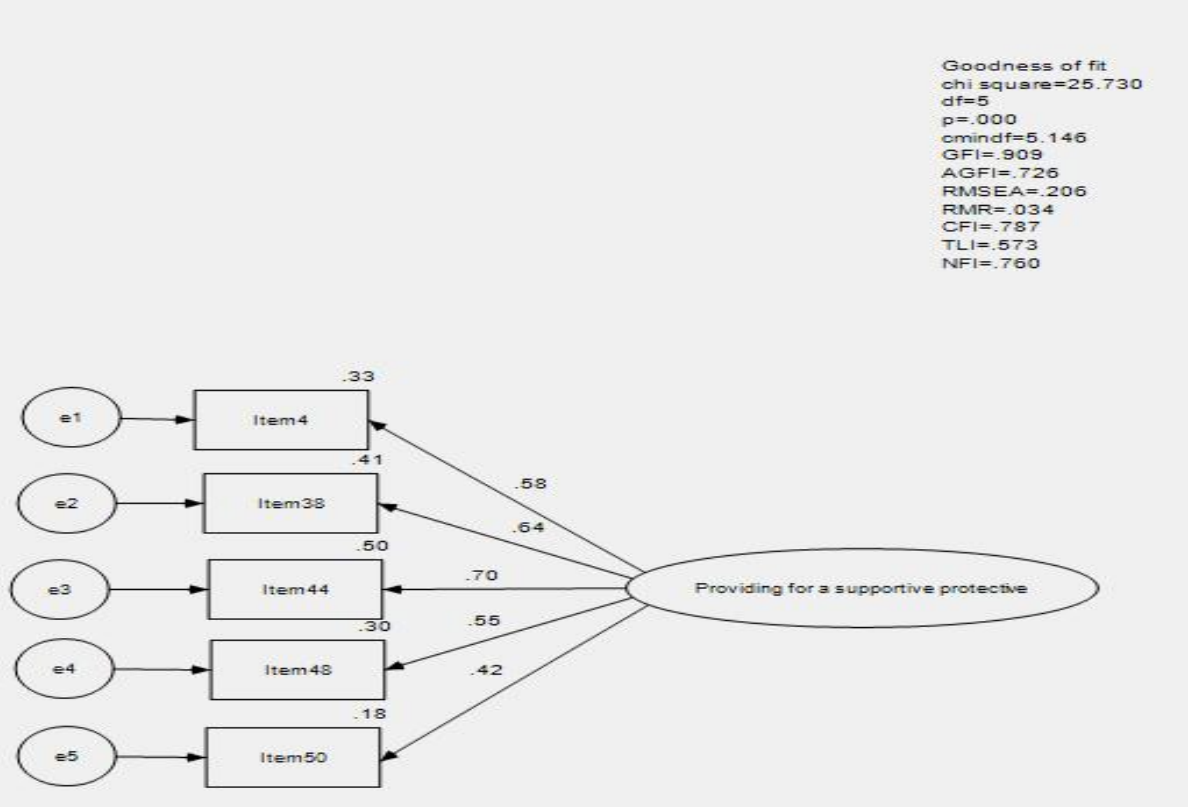

Figure 8. Factor Analysis Providing for a supportive, protective, and/or corrective mental, social, spritual environment

The result shows that the value of loading factor at 5 (five) items all have value above 0.3 with p value = 0.000, this number is below p ≤ 0.05 then the indicator in question is valid and means that the indicator is significant in measuring a const . Table regression weight supportive, protective, corrective environment can be seen in table 8 below.

Table 8. Regression Weights Supportive, Protective, Corrective Environments

No item	*Caratif Factors*	*Estimate*
Item 48	<--- Supportive, Protective, Corrective Environments	*0,551*
Item 44	<--- Supportive, Protective, Corrective Environments	*0,704*
Item 38	<--- Supportive, Protective, Corrective Environments	*0,641*
Item 4	<--- Supportive, Protective, Corrective Environments	*0,577*
Item 50	<--- Supportive, Protective, Corrective Environments	*0,419*

Source: statistical results

The nurse needs to recognize the influence of the client's internal and external environment on the client's health / disease condition. Nurses can create a restoration of the atmosphere at all levels whether physical or non-physical. Nurses can also enhance togetherness, beauty, comfort, trust and peace (Potter & Perry, 2009). This shows that nurses are able to create a supportive, protective and corrective physical, mental, social-cultural and spiritual environment in the implementation of nursing services to clients.

i. Test of caratif factor 9 (Assisting with gratification of human needs)

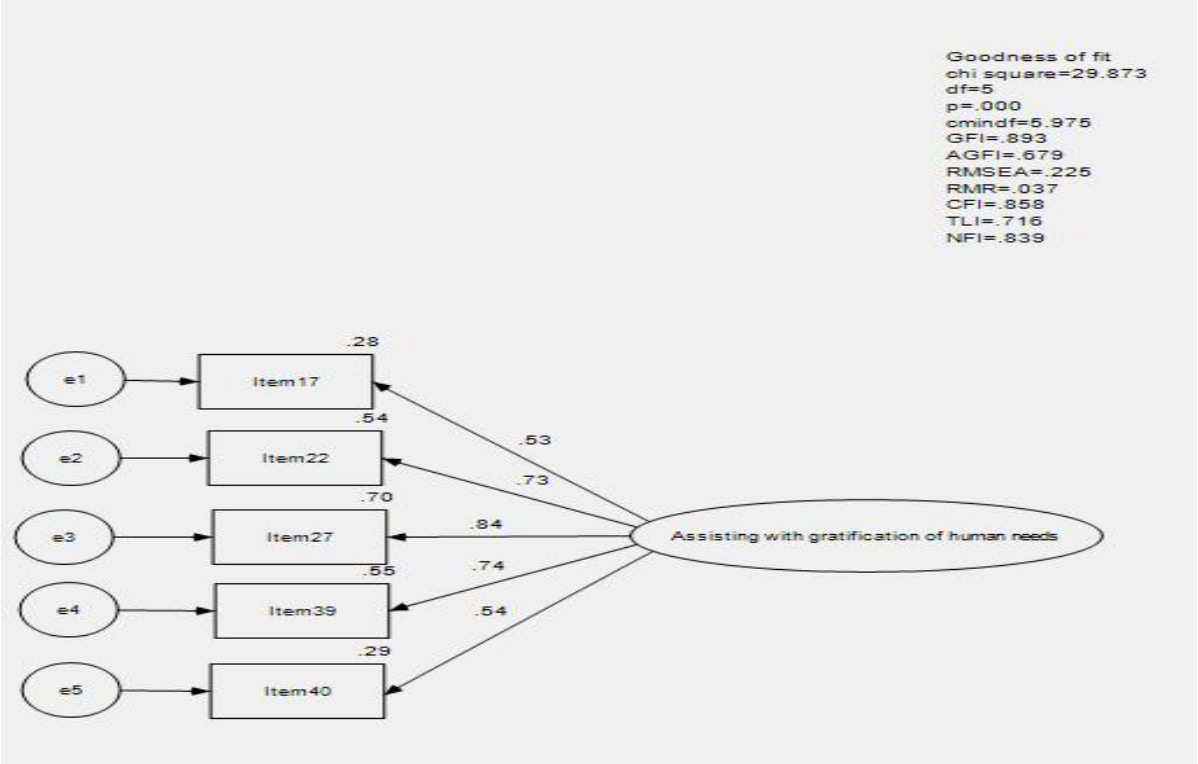

Figure 9. Factor Analysis Assisting with gratification of human needs

The result shows that the value of loading factor at 5 (five) items all have value above 0.3 with p value = 0.000, this number is below p ≤ 0.05 then the indicator in question is valid and means that the indicator is significant in measuring a const . Regression weight of basic human need can be seen in table 9 below.

Table 9. Regression Weights Basic Human Needs

No item	*Caratif Factors*	*Estimate*
Item 39	<--- Basic Human Needs	*0,745*
Item 27	<--- Basic Human Needs	*0,839*
Item 22	<--- Basic Human Needs	*0,732*
Item 17	<--- Basic Human Needs	*0,529*
Item 40	<--- Basic Human Needs	*0,540*

Source: statistical results

Nurses recognize the biophysical, psychophysical, psychosocial, and interpersonal needs of the client and self. Caring nurses are always trying to treat clients as individuals and try to identify patient needs (Marrison & Burnard, 2009). This shows the nurse is able to assist the basic human needs in the implementation of nursing services to clients. Nurses recognize the client's need to build trust in the nurse-client relationship, and encourage the client's active participation in health decisions (Ronnebaum & Schmar, 2015).

j. Test of caratif factor 10 (Allowing forexistential-phenomenological dimensions)

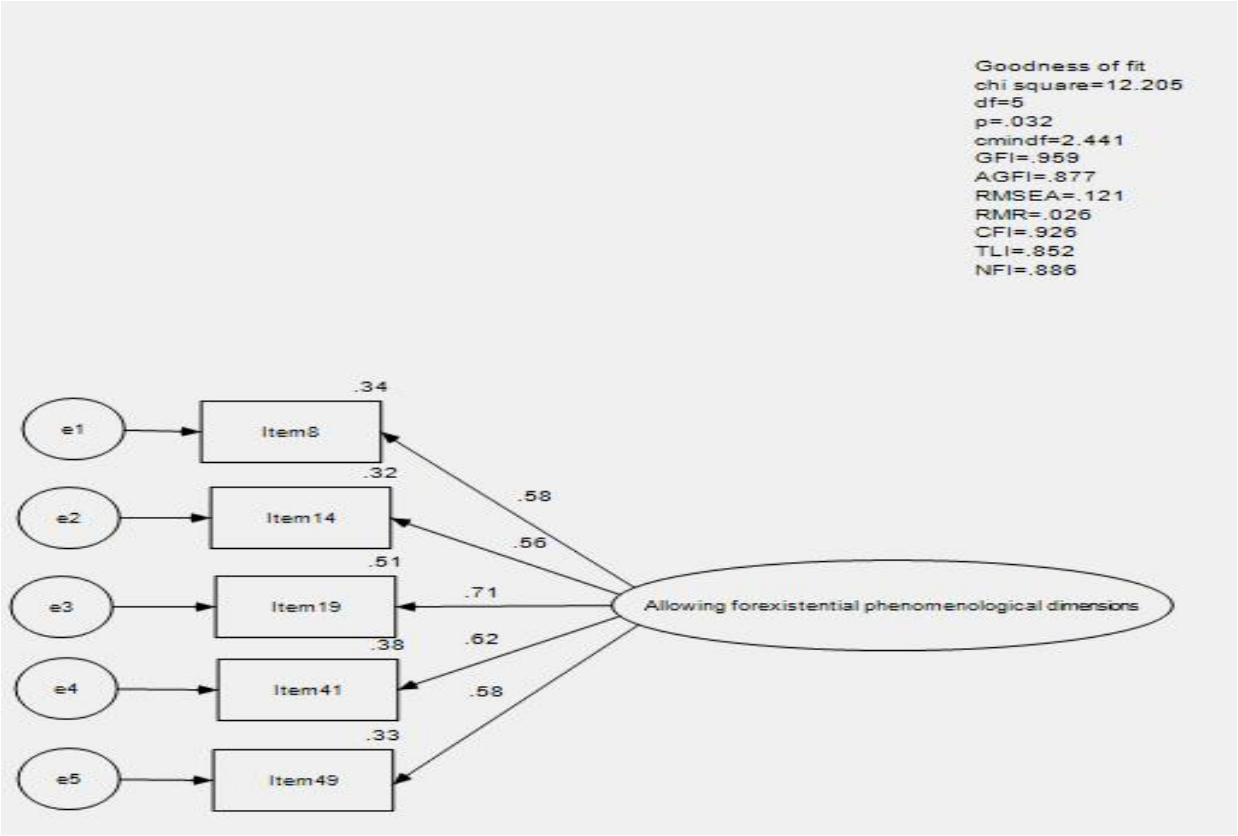

Figure 10. Factor Analysis Allowing forexistential-phenomenological dimensions

The result shows that the value of loading factor at 5 (five) items all have value above 0.3 with p value = 0,032, this number is below p ≤ 0,05 then indicator is valid and mean that indicator is significant in measuring a construct . Table regression weight of spritual phenomena can be seen in table 10 below.

Table 10 Regression Weights Spiritual Phenomena

No item	*Caratif Factors*	*Estimate*
Item 41	<--- Spiritual Phenomena	*0,616*
Item 19	<--- Spiritual Phenomena	*0,713*
Item 14	<--- Spiritual Phenomena	*0,564*
Item 8	<--- Spiritual Phenomena	*0,582*
Item 49	<--- Spiritual Phenomena	*0,577*

Source: statistical results

The nurse understands the growth and maturity of the client's (phenomenological) soul of data and situations that help the client understand the phenomenon. The nurse may, among other things, allow the client to use her spiritual powers to perform alternative therapies at her option, motivating the client in the face of the mourning phase (Potter & Perry, 2009). This shows that nurses are able to appreciate the existence of phenomenal forces that are spiritual in implementing nursing services to clients.

Reliability is determined using construct reliability with a cut-off value of at least 0.7. The test results are listed in table 11 below.

Table 11. Results of Construction Reliability

Caratif Factors	*CR*
Humanistik altruistic	*0,744*
Confidence and expectation	*0,829*
Sensitivity	*0,755*
Trust relationship	*0,781*
Expression of positive and negative feelings	*0,846*
Creative problem solving	*0,831*
Learn interpersonal teaching	*0,874*
Supportive, protective, corrective environment	*0,719*
Basic human needs	*0,814*
Spirtual Phenomena	*0,749*

Source: statistical results

The result shows the reliability value of the construct (CR) of each caratif factor above 0.7 so that the caring instrument performance of the nurse is reliable.

4. Conclusions and Implications

The result of data analysis with Amos showed caring factor of nurse of Puskesmas is altruistic humanistic (p = 0,087), belief and expectation (p = 0,017), sensitivity (p = 0,013), mutual trust (p = 0,011) 0.635), creative problem solving (p = 0,000), interpersonal learning (p = 0.002), creating a supportive, protective, corrective (p = 0,000) environment, helping basic human needs (p = 0,000), recognizing spiritual phenomena (p = 0.032) with the loading factor above 0.03 and the reability of the construct (CR) above 0.7 The implication of this research is the formation of caring instruments that contain the caring factors of professional caring nurses in providing services to clients. Caring instruments can be used to measure caring behavior of nurses and as instruments for further research development.

Acknowledgment

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A Case Report: A-27-years-old female with *ST-Elevation Electrocardiography: STEMI or Pericarditis?*

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Abstract

ST-elevation on electrocardiography is one of the diagnostic guidelines of patients on cardiovascular disease. ST-elevation can occur in ST-Elevation Myocardial Infarction (STEMI) and Pericarditis. A-27-years-old female presented with history of typical chest pain, tightness, and backpain since 5 hours before admission. There was no history of hypertension, diabetes, smoking, and dyslipidemia, but there was history of familial cardiovascular disease. Her physical examination is within normal limit. There was an increasing creatine kinase-MB (*CK-MB*) : 58 u/l. ECG showed a convexST-Elevation in lead II, III and aVF, reciprocal ST changes in lead I and avL, no PR depression. Echo showed normal LV systolic function withregional wall motion abnormality on inferior segment, and minimal pericard effusion on the left lateral.There are some differences between STEMI and pericarditis that can be seen from history, physical examination, investigation, and ECG. Coronary angiography is a gold standard to decide the diagnose.

Keywords: ST-Elevation Myocardial Infarction (STEMI), Pericarditis, Young Age, Coronary Artery Disease, Family History of Cardiovascular Disease, ST-Elevation Electrocardiography.

1. Introduction

Cardiovascular disease is still a health problem in many countries both in developed and developing countries. WHO says cardiovascular disease is the leading cause of death from non-communicable diseases that is about 37% [1].Myocardial infarction (MI) is an uncommon disease in young individuals and its incidence varies between 2% and10%. To date, few studies have focused on acute ST-elevation myocardial infarction (STEMI) in young patients and the clinical characteristics and outcomes of young patients with STEMI have not been reported [2].While, pericarditis is a common disease caused by pericardial inflammation, usually benign and self-limited and may occur as an isolated disease or as a manifestation of systemic disease. The incidence and prevalence of pericarditis is difficult to determine. The Necropsy study shows its prevalence is only about 1%. Pericarditis affects mainly young males (aged between twenty and fifty years) without previous pathologies and represents only 5% of all causes of chest pain in the emergency room [3].

2. Case Report

A-27-years-old female presented with history of typical chest pain, tightness, and backpain since 5 hours before admission. Chest pain on the left is felt like heavy objects are crushed to the left arm to the back and left jaw. Chest pain that is felt arising since ± 1 week ago but worsening 5 hours ago. Chest pain felt disappeared, appeared 2 times a day with duration ± 30 minutes. Patient felt better if resting and chest pain will appear if the activity. Currently the patient complains of nausea but not vomiting, the patient also did not feel fever. Defecation and urination are also within normal limits. Patient admitted the first time complained about it and there was no history of smoking, hypertension, diabetes, and dyslipidemia but there was history of familial cardiovascular disease.

Her blood pressure : 103/69 mmHg, pulse : 76 t/min regular, and respiratory rate : 20 t/min.Her physical examination is within normal limit. There was an increasing creatine kinase-MB (*CK-MB*) : 58 u/l and white blood cell : 16,25 x 10^3/µL and random blood glucose : 106 mg/dl. Day-1, ECG showed a convex upward ST-segment in lead II, III and aVF, in

which ST-segment more elevated in lead III than lead II, reciprocal ST depression in I and aVL, no PR depression (Figure 1). And D-2, ECG showed ST depression on lead II, III, and aVF (Figure 2). Echo showed normal LV systolic function with regional wall motion abnormality on inferior segment, and minimal pericard effusion on the left lateral.

The patient was treated with Infusion PZ 500 cc / 24 hours, Ranitidine Injection 2x1 ampoule, Betaone 2.5 mg 1x1 / 2 tablets, LoadingAspilet 320 mg, then 1x80 mg, Loading CPG 300 mg, then 1x75 mg, Atorvastatin 20 mg 1x1, and ISDN 5 mg if needed.

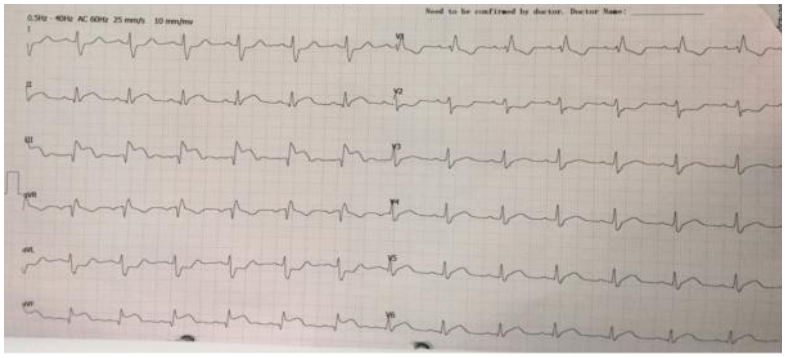


Figure 1. Day-1 ECG. Convex upward ST-segment in lead II, III and aVF, in which ST-segment more elevated in lead III than lead II, reciprocal ST depression in I and aVL, no PR depression

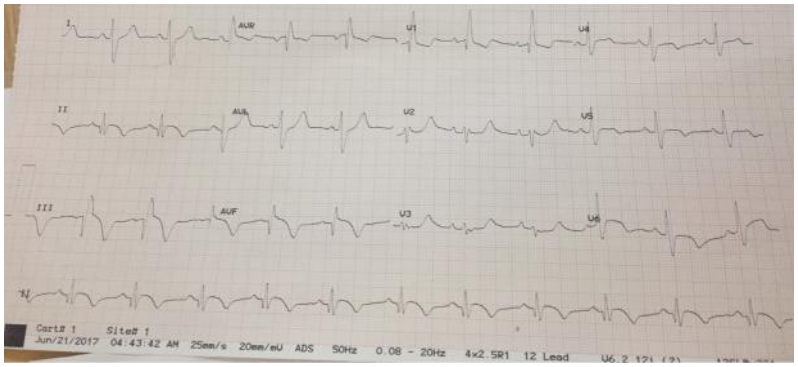


Figure 2. Day-2 ECG. ST depression on lead II, III, and aVF

3. Discussion

The incidence of ACS in women of reproductive age still has low data. Lack of data may be caused by the low incidence in women and it is not a major health problem. Data from a Danish cohort reported an incidence of 25 per 100,000 people/ year while American data reported 57 per 100,000 people/ year.Highly circulating estrogens in young women have traditionally been considered to have protective factors against the heart. However, with the increasing prevalence of certain cardiovascular risk factors, especially obesity, the risk of ACS in young women is expected to increase and become a significant health concern in the future [4].

Myocardial infarction is a rare disease in young individuals and the incidence varies between 2% and 10%. Young patients are more likely to have a history of smoking and dyslipidemia, but less likely to have other comorbidities, such as diabetes mellitus, hypertension, or a history of coronary artery disease. To date, several studies have focused on STEMI at a young age and its clinical characteristics but to date the results have not been reported [2].

Family history of coronary disease is one of the common risk factors that can not be modified in myocardial infarction disease. According to a study that examines the prevalence of CAD risk factors, family history accounts for about 19.3% in CAD events. Of all the CAD risk factors, family history of the disease was ranked 7th which may affect the occurrence of CAD. The top ranking according to the study was lifestyle (47.1%), central obesity (42.1%), smoking (38.7%), hypertension (35.3%), fat diet (32.8%), alcohol (22.7%), family history (19.3%), diabetes mellitus (15.9%), hypercholesterolemia (12.6%), and history of coronary heart disease (10.9%) [5].

Acute pericarditis is a common disease caused by inflammation of the pericardium, usually benign and self-limited and can occur as an isolated or as a manifestation of a systemic disease entity. Represents 5% of all causes of chest pain in the emergency room. The main etiology are viral infections, although it can also be secondary to systemic diseases and infections. The incidence and prevalence of pericarditis is difficult to determine. The Necropsy study shows its prevalence is only about 1%. Pericarditis is more common in young men (between twenty and fifty years) without prior pathology and represents only 5% of all causes of chest pain in the emergency room. In developed countries, about 80-90% of cases are idiopathic, assuming that the main etiology is viral infection, although it can also be secondary to systemic disease and infection [3].Based on the above prevalence, ACS and myocardial infarction may be more common than pericarditis.

There are some differences between STEMI and Pericarditis seen from chest pain complaints, physical examination, laboratory findings (Table 1) and ECG. Radhakrishnan and Granato in Millis (2012) explains the difference between STEMI and Pericarditis based on ST-segment change, Q-waves, Reciprocal ST changes, Location of ST elevation, ST / T ratio in lead V6, Loss of R wave voltage, and PR segment depression (Figure 3) [3,6,7].

Table 1. Difference between STEMI and Pericarditis

	STEMI	PERICARDITIS
Chest Pain	Typical chest pain, tightness, radiating to the left arm, neck, jaw, interscapular area, shoulders, or epigastrium. Those complaints may be intermitten/several minutes or persistent (>20 minutes)	Chest pain with pleuritic characteristic, sudden onset, high intensity, which worsens with deep inspiration and radiate to the neck and upper limb
Physical Examination	Acute mitral valve regurgitation, three heart sounds (S3), fine wet ronchi, and hypotention should always be examined to identify ischemic complication. The present of signs of regurgitation of acute mitral valve, hypotention, dhiaporosis, fine wet ronchi or pulmonary edema increases suspicion of ACS	The physical examination may reveal a febrile patient with toxemia, tachycardia and lung assessment suggestive of pleural effusion. Pericardial friction is present in 85% of cases and is characterized by rough, irregular sounds heard best at the left sternal border
Laboratory Finding	Creatinine kinase-MB (CK-MB) or troponin I/T is a marker of myocardial necrosis of the heart and a marker for the diagnosis of myocardial infarction	Laboratory testing for acute pericarditis is nonspecific and provides limited guidance in determining a cause. White blood cell count, erythrocyte sedimentation rate, and serum C-reactive protein level are modestly elevated in acute pericarditis regardless of the etiology. A significant number of patients with pericarditis, with or without myocarditis or myocardial infarction have elevated creatinine kinase MB fraction and or troponin I values.

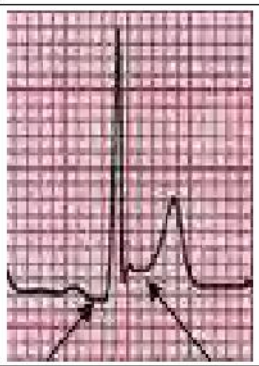
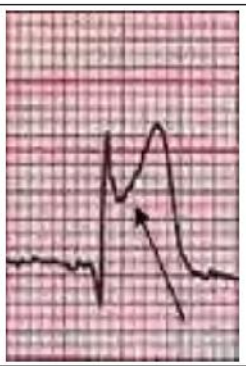
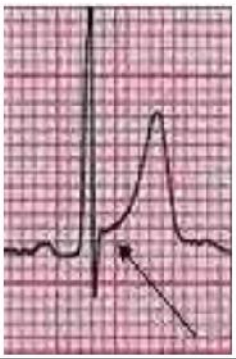
ECG Findings	Acute Pericarditis	Myocardial Infarction	Early Repolarization
ST Segment Change	Concave upward	Convex upward	Concave upward
Q waves	Absent	Present	Absent
Reciprocal ST changes	Absent	Present	Absent
Location of ST elevation	Limb and precordial leads	Area of involved artery	Precordial Leads
ST/T ratio in lead V6	>0.25	N/A	<0.25
Loss of R wave voltage	Absent	Present	Absent
PR segment depression	Present	Absent	Absent
Illustrative Example			

Figure 3. Difference between STEMI and Pericarditis based on ECG

4. Conclusion

STEMI and Pericarditis have similar presentation. It is very important to determine the diagnose of STEMI immediately and properly to reduce mortality. Coronary angiography remains as a gold standard.

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Developing of Rechargeable Allumuium-Ion (Al-ion) Battery with Basic Material Activated Coconut Shell Charcoal

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Abstract

This study aims to know the tecnique of making of rechargeable Al-ion battery with basic material activated coconut shell charcoal and to know the best composition of materials to produce optimum potential (V) and current (mA). The working principle of battery using electrochemical process to produce potential (V) and electric current (mA). In wich principle is indeed involves only the transport of elecrtons beetween two electodes separated by a conductive medium (electrolyte). There are two electrodes used in which aluminum as anode undergoes oxidation reaction and graphite as cathode undergoes reduction reaction. The optimum composition in the production of Al-ion batteries with basic marerial activated coconut shell charcoal is 7,5 grams activated coconut shell charcoal, 2,5 grams polypyrol catalyst (MnO2), and NaCl 4,5 %. This composition produce 2,05 mA at the first hours as optimum current capacity the first hour of 45 mA because the remaining wet condition of electrolyte at this point allows the electrons to move easily. For the value of the optimum voltage in the last hours is a discharge voltage of 2,05 volts and superfast charging time is only one minute.

Keywords: rechargeable aluminum-ion battery, activated coconut shell charcoal, potential, electric current

1. Introduction

Energy have important role in every aspec of life. Supply demand energy always rice make the decrease of fossil energi source. In 2012 the demand of electricity in Indonesia up to 174 Twh, increase 10,1 % compare the needs of last years demand. In one side, Indonesia is a country that have a lot of natural resaurce, but unfortunetely that source have not explort much as renewable energy source (Ministry of Energy and Mineral Resources, 2013).

Long time scientist try to develop renewable energy source, one of them is battery. Therefore in reality conventional battery that we usw this time contain of hazarous material like mercury, nitrat, cadmium, and nickel that can effect environtmen contamination. Furthermore the development of battery technology is continue to produce for better quality product. Li-ion battery that many use on phone battery only give power about 2 until 4 hours on laptop. This situation uncompareable to advances of technology that develop so fast. Beside of that Li-ion less save because flammeable or end explode.

To overcome that problems researche is needed to develop nature friendly battery, savety, and fast charging. So this research we try to develop an rechargeable Al-ion battery with basic material coconut shell charcoal. The speciality of Al-ion battery is on superfast charging, low flammability, and for a new inovation we use the coconut shell as base material because it natural friendly and Indonesia having the most coconut plantation in the world with about 2.920.665 ton in 2015 (Directorate General Estate Corps, 2016).

Al-ion battery are composed of two electrodes (anode and cathode) connected by an ionically conductive material called an electrolyte (Armand, 2008). The working principle using electrochemical process to produce electrical energy. The aluminum metal in this battery system will experience anoxidizing reaction by generating $Al_2Cl_7^-$ and electron. The movement of electrons to the cathode will produce electrical energy (Modesto &Julie, 2007). In this research aluminum metal serve as anode on this battery, so this battery is name as an alumninum ion battery. Teoritically, voltage value outcome by each kind of battery will be defferent according to the type of metal used as anode. This different is based on the standart potential energy value of each metal (Vicenzo &

Benedetto, 2014). Rechargeable batteries based on aluminum are attractive alternatives to those based on conventioal chemistries because of the high charge storage capacity, relatively relatively low cost of aluminum, and Al is the most abundant metal in the earth's crust (Hudak, 2013).

In this research composed to develop Al-ion battery is aluminum as anode, graphite as cathode, and mixing activated coconut shell charcoal with polypyrrole catalyst (MnO2) and salt solution (NaCl) as electrolyte pasted. The testing of electrical energy from rechargeable Al-ion battery is potential (V) and electric current for 5 hours in a row. The result is the best composition Al-ion battery is 7.5 grams activated coconut shell charcoal, 2.5 grams polypyrole catalyst (MnO2), and NaCl 4.5 %. This composition produce 45 mA at the first hours as optimum because the remaining wet condition of electrolyte at this point allows the electrons to move easily. For the value of optimum voltage is a discharge voltage of 2.05 V and superfast charging time is only one minute.

2. Materials and Methods

2. 1. Materials

Material is used in this research is aluminum foil, graphite, activated coconut shell charcoal, polypyrrole catalyst (MnO2), Natrium Clorida (NaCl), aquadest, LED light, cable, electric switch, tissu, pipe, box acrylic.

The research title depeloving rechargeable of Al-ion battery with basic material coconut shell charcoal using electrochemical process to produce potential (V) and electric current (mA), used to electrodes include aluminum as anoode undergoes oxidation reaction and graphite as cathode undergoes a reduction reaction. The methode used in this research begins with preparing materials and equipments which will be used in this research. The research use activated coconut shell as basic material to make Al-ion battery. Activated coconut shell pounded until smoot, than do to making rechargeable Al-ion battery.

2. 1. Designing Battery

This step contais all procedures in designing rechargeable aluminum-ion battery based activated coconut shell charcoal which are as follow :

1. Making salt solution (NaCl) with composition 2,5 grams, 3,5 grams and 4,5 grams in 0,1 L aquadest, then they are dissolved to form 2,5 %, 3,5 % and 4,5 % of NaCl
2. Making electrolyte for battery use activated coconut shell charcoal with composition:
   a. 7,5 grams activated coconut shell charcoal, 2,5 grams polypyrrole catalyst (MnO2), and NaCl with concentration 2,5 %
   b. 7,5 grams activated coconut shell charcoal, 2,5 grams polypyrrole catalyst (MnO2), and NaCl with concentration 3,5 %
   c. 7,5 grams activated coconut shell charcoal, 2,5 grams polypyrrole catalyst (MnO2), and NaCl with concentration 4,5 %
3. Each composition of the above electrolyte mixture is then mixed becoming homogeneous to a concentration of 25%.
4. After all tools and materials have been prepared, the next step is designing rechargarbe aluminium batteries in which aluminium foil as anode and graphite as cathode with tissue as separator of both electrodes.

2. 2. Technique for Making Rechargeable Al-ion Battery

Figure 1. Making the electolyte of battery

Figure 2. Put electrolyte and positive electrode (graphite) on separator (tissue)

Figure 3. Rolled up to form cylinder

Figure 4. Aluminum foil coating

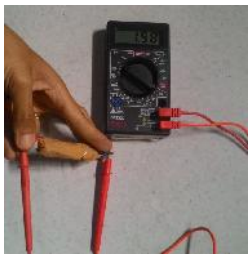

Figure 5. Measuring potential (V)

Figure 6. Measuring current (mA)

Figure 7. Perform test of battery

Figure 8. Final product of battery applying for LED light

2. 3. Function Test

Function test is testing stage using digital multimeter to know potentian (V) and current electricity (mA) at rechargeable Al-ion battery with basic material coconut shell charcoal.

2. 4. Performance Test and Collecting Data

Performance test is testing stage using loads with adjustable voltage and current to determine whether the reahargeable Al-ion battery is capable of working or not. Performance test used LED light which loads 3 V. An Al-ion prototype battery have potencial 1,52-2,05 V bigger than an AA conventional battery that we use. Two pieces of Al-ion batteries assembly as series to light up an LED lamp. Furthermore to produce brighter light 6 alluminioum ion batteries assembly as series to light up 6 LED lamp wich pararelly assmbly. Next phase Al-ion battery charge. The gattering potential data and current Al-ion battery must be done for every electrolite variation and potencial test and current generated for 5 hours in row.

2. 5. Data Analysis

The step for data is to analyze the data from examination and measurement in making this product. The data in the nexy step is connected to literature study and theories related to the phenomenon in the potential and current chart that the produced by rechargeable Al-ion battery.

3. Results and Discussion

The research of developing rechargeable Al-ion battery with basic material activated coconut shell charcoal is use three electrolyte sample were use where the first electrolyte consisted of mixture of 7.5 grams activated coconut shell charcoal, 2.5 grams polypyrrole catalyst (MnO2), and 2.5 % NaCl. The second electrolyte comprises a mixture of 7,5 grams activated coconut shell charcoal, 2.5 grams polypyrrole catalyst (MnO2), and 3,5 % NaCl consentration. The third electrolyte a mixture of 7,5 grams activated coconut shell charcoal, 2.5 grams polypyrrole catalyst (MnO2), and 4,5 % NaCl consentration. The best composition to produce optimum potential and current was obtained in third electrolyte sample as shown in Table 1.

Table 1. The avarege value for potential and current at rechargeable Al-ion battery

Electrolyte	Potential (V)	Current (mA)	Optimum value	
			Potential (V)	Current (mA)
I	1.72	25	2.05	45
II	1.98	32		
III	2.05	45		

In third elecrolyte sample, the optimum potential value reaches 2,05 V with a current is 45 mA. The main condition to produce voltage is on potential difference on both electroda. According Armand et,all (2008) The storage energy content of a battery be maximize by having a large chemical potential difference between the two electrodes. Potential differences happen because the differences number of electron produce from electrochemistry proscess. Electric current from the number of capacity caused by electron movement which produce from electrochemistry proscess.

The results of potential data and current Al-ion battery must be done for every electrolite variation and potencial test and current generated for 5 hours in row shows in table 2.

Table 2. Characteristic of potential and current from Al-ion battery

Electrolyte	Potential (V)				
	1st hour	2nd hour	3rd hour	4th hour	5th hour
I	1,52	1,59	1,63	1,69	1,72
II	1,67	1,75	1,79	1,87	1,90
III	1,89	1,95	1,97	1,99	2,05
Electrolyte	Current (mA)				
	1st hour	2nd hour	3rd hour	4th hour	5th hour
I	25	24	22	22	20
II	32	30	30	27	25
III	45	44	41	40	40

For more details the data presented in chart form as shown in figure 9 and figure 10.

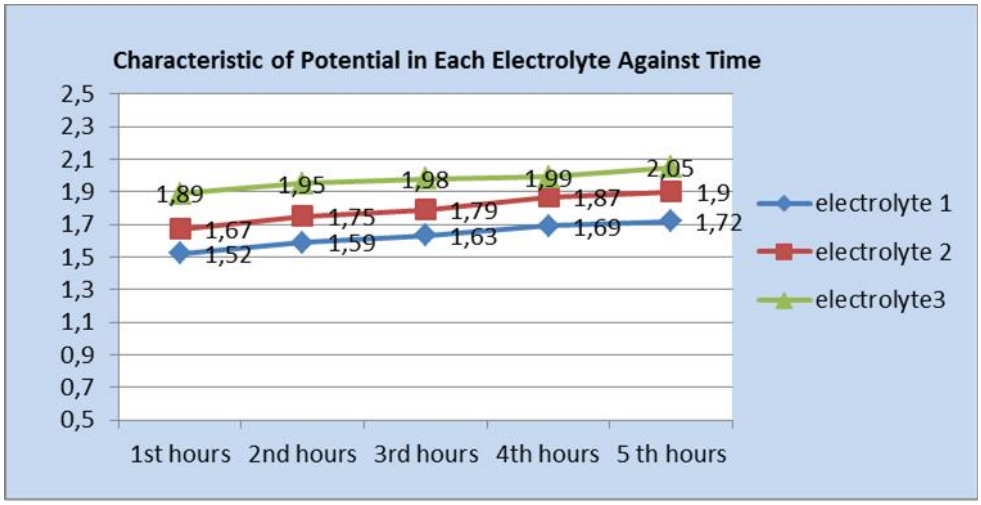

Figure 9. Chart Characteristic of Potential in Each Electrolyte Againts Time

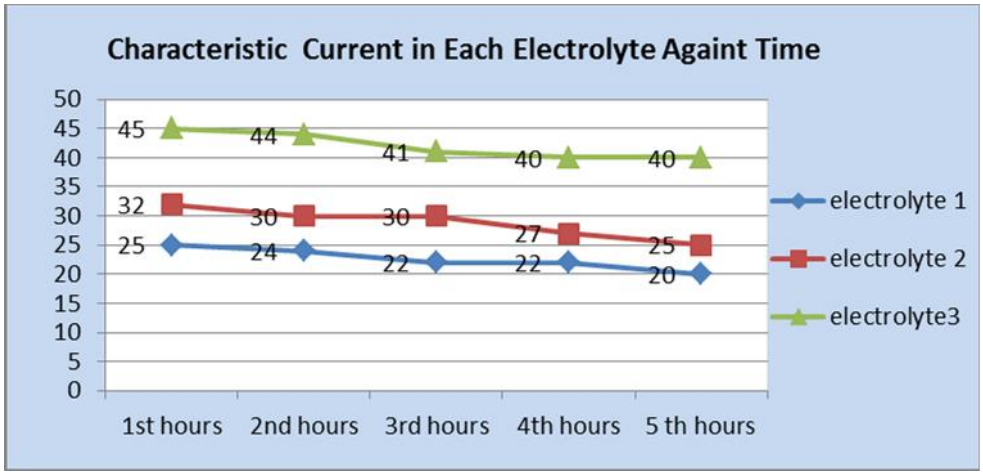

Figure 10. Chart Characteristic of Current in Each Electrolyte Againts Time

From the result of potential and current data Al-ion battery (see figure 9 and 10) it is found the optimum average is volt is last hours , while the average current in the first hour of

the third electrolyte sampel with composition 7,5 grams activated coconut shell charcoal, 2.5 grams polypyrrole catalyst (MnO_2), and 4,5 % NaCl consentration. Generally voltage phenomenon that happened every hour tend increase, but current value that produce tend to decrease because to produce stable voltage need some time in order electrochemistry balance work properly. Meanwhile the reason the decrease of current value tend to decrease cause by corrotion on anoda with electolyte so the ion production to produce electron decrease every huor. The other problem is the decrease of liquid electric composition used because already consumed to produce current on early proscess electrochemistry.

Electrolyte is important part in electrochemistry cell, but aluminum foil as anode is corroded by reaction between the electrolyte and the surface of the A-ion battery, and will also form a metal hydroxide coating. This causes the process of migration of metal ions to the catide will be inhibited and this causes decrease energy density battery life to be short (Mohammad, 2008, Gelman et all., 2015, Vicenzo et all., 2014).

To solve above the problem can use pure aluminum (99.99 %0 as anode material with a combination of metal Mg, Sn, In,and Ga. This metal can prevent corrosion and can also break the passive hydroxide layer aluminum. However, considering that pure aluminum is relatively expensive then the alternative that can be used is to add inhibitor or direct additive to the electrolyte or alternative solvents such as alcohol and ionic liquids (Egan et all, 2013)

4. Conclusion

Based on the result of the research and the description of the discussion that have been presented, it can be concluded that the best composition of materials to produce optimum potential and current of Al-ion rechargeable battery with basic material activated coconut shell charcoal is 7,5 grams activated coconut shell, 2,5 grams catalys (MnO2) and NaCl 4,5 % with the optimum current capacity in the first hour of 45 mA. This is mainly because at this point the electrolyte is still wet which allows the electrons to move. While the value of the optimum voltage in the last hours with a discharge voltage is 2,05 volts, and superfast charging time is only one minute.

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Simulation of Monthly Rainfall Data of Dodokan Watersheed Using Nonparametric Statistical Downscaling Model

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Abstract

The prediction of river water discharge is needed as refference in developing water resource management plan. The prediction of river water discharge can be determined by developing a river water discharge model based on climate information, especially rainfall information. This research aims to obtain a simulation of rainfall data that will be used to river water discharge modeling based on rainfall information. The simulation of rainfall data is obtain using statistical downscaling model which develop the functional model between global climate data, that is monthly precipitation of General Circulation Model (GCM), and local climate data, that is monthly rainfall of Dodokan watersheed. In order to reduce dimension of GCM global data GCM data projection is specified by classification and regression tree (CART) algorithm. Then, it is determined the model of GCM projection data with local rainfall data using Kernel nonparametric regression. Monthly rainfall data of Dodokan watersheed is simulated based on the model obtained.

Keywords**:** simulation, rainfall data, statistical downscaling, CART, kernel nonparametric regression

1. Introduction

The prediction of river water discharge is needed in water resource management planning as an effort to adapt and mitigate the impact of flood and drought. In order to get accurate prediction, it is needed river water discharge modeling with high accuracy. The modeling of river water discharge can be done based on influence factors, one of them is rainfall.

Many river water discharge models have been developed based on local/regional scale climate variables. In order to improve the quality of river water discharge prediction, it have been developed river water discharge model using General Circulation Model (GCM) output data which is global scale (Gagnon et al., 2005; Samadi et al., 2012; Sachindra et al., 2015). GCM is computer based model that consists of various numerical and deterministic equations which are integrated and follow the rules of physics. GCM is the main predictor of weather and climate numerically and the primary information source for assessing the effects of climate chage. (Wigena, 2006). However, the GCM model information is still global, so it less appropriate for local/regional forecasting and necessary to do regionalization using downscaling technique.The one of downscaling technique is statistical downscaling (SD), where it will be arranged functional relation model between GCM output information with local/regional climate information.In the use of SD method, it is necessary to consider the characteristics of GCM output as predictor variables and the characteristics of local/regional climate data as response variables (Wigena, 2006).

GCM output data is curse of dimensionality, it is also spatial and temporal data where there may be spatial correlation between data on different grids in one domain (multicollinearity).Therefore, it is necessary to do pre-processing GCM data in SD modeling by reducing GCM data dimension.GCM data is generally nonnormal, so that the data pre-processing method used is a method that does not require the assumption of datanormality, the method isClassification and Regression Tree (CART) algorithm (Zorita and Storch, 1999; Kannan and Ghosh, 2013; Hadijati et al., 2015). By CART algorithm, GCM data is projected

on to some independent dominant variables that will be the predictor variables in statistical downscaling model.

GCM output data and local climate data are generally spatial, temporal, nonlinear, nonstationery, and nonnormal distributed. The appropriate SD method for these characteristics is noparametric regression (Kannan and Ghosh, 2013; Hadijati et al., 2015; Singh et al., 2016). This method can explain the temporal diversity and extreme value of climate data (Kannan and Ghosh (2013).

2. Materials and Methods

This research use two kind of data. The first are monthly rainfall data at Pengga and Kediri observation stations in the Dodokan watersheed. The second is monthly precipitation GCM data from CMAP (CPC Merged Analysis of Precipitation) data. The domain of GCM data is 8X8 domain on the Dodokan watersheed in Lombok Island. The data collected is data of five years.

In this research, simulation of rainfall data of Dodokan watersheed is based on statistical downscaling model with nonparametric regression approach. As response variables are monthly rainfall data at Pengga and Kediri station, and the predictor variables are monthly precipitation of GCM data at 8X8 location of grids. Before modeling, pre-processing of GCM data is done in order to reduce the dimension of data. The method used is CART algorithm. By CART, the dominant GCM variables are determined as a projection of GCM data. The dominant variables will be used in statistical downscaling modeling by Kernel nonparametric regression.

Methods used in each step of research will be explained as follows.

2. 1. Statistical Downscaling

Downscaling is a transformation process of data. Data with high scale unit is tranformed to data with lower scale unit. There are two approach of downscaling, one of these is statistical downscaling (SD).

SD is a static downscaling process where data on high scale grids in certain period of time are used to determine data on lower scale grid (Wigena, 2006). SD use global data to get fungsional relation between local scale and GCM global scale (Lembang et.al., 2009).
Generally, the fungsional form is formulated by

$$\mathbf{Y} = f(\mathbf{Z}) + \boldsymbol{\varepsilon} \quad (1)$$

where $\mathbf{Y}$: response variable
$\mathbf{Z}$: predictor variables that are a union of spasial reduction result of GCV variable
$\boldsymbol{\varepsilon}$: residual/error
Several SD method have been developed and can be classified into three categories:transfer function, weather typing, and weather generator (Wilby et al., 2004) .

2. 2. Classification and Regression Tree (CART) Algorithm

Classification and Regression Tree (CART) is classification method that uses history data called learning sample to costruct decision tree. The decision tree is described as a set of questions that devide learning sample become smaller parts. The decision tree is used to classify new data (Timofeev, 2004).

CART idea is appeared when there is observation sample measures *n* on Y variable that have value 1,2,…,k, and p predictor variable that have many fiture that interact each other. The interaction is nonlinear and complex.It causes difficulty to make fungsional model between response variable Y and predictor X. Then developed a nonparametric method that divides data into smaller space in order to simplify the interactions. Partitioning is done recursively until get the value of new predictor variable. This procedure is known as CART

method which aims to get a model to predict Y based on value of new predictor variable (Loh, 2011).

There are three part of CART algorithm (Timofeev, 2004), those are

1. To construct maximum tree based on certain splitting rule that form division of learning sample become smaller parts.

Every data is divided to two parts with maximum homogenity. The maximum homogenity of child nodes are defined by *impurity function i(t)*. The maximum homogenity of left and right child node will equivalen with maximize the change of impurity function $\Delta i(t)$, because *impurityparent* node is constant every possible parts $x_j \le x_j^R$. $\Delta i(t)$ is formulated as $\Delta i(t) = i(t_p) - E(i(t_c))$, where $E(i(t_c)) = P_l i(t_l) + P_r i(t_r)$, with $P_l i(t_l)$ *and* $P_r i(t_r)$ are probability of left node and right node. Therefore, on the every CART node solve maximization problem

$$\arg\max_{x_j \le x_j^R,\, j=1,2,...,M} \left(i(t_p) - P_l i(t_l) - P_r i(t_r) \right) \quad (2)$$

Based on Gini index, impurity function is difined as follow

$$i(t) = \sum_{k \ne 1} p(k|t) p(l|t) \quad (3)$$

where *k,l* = 1,2,…,*K* = *class* index; $p(k|t)$ =probability of *class k* if in node *t*.And the change of *impurity function* can be derived as

$$\Delta i(t) = -\sum_{k=1}^{K} p^2(k|t_p) + P_l \sum_{k=1}^{K} p^2(k|t_l) + P_r \sum_{k=1}^{K} p^2(k|t_r) \quad (4)$$

And Gini algorithm will solve the following problem

$$\arg\max_{x_j \le x_j^R,\, j=1,2,...,M} \left(-\sum_{k=1}^{K} p^2(k|t_p) + P_l \sum_{k=1}^{K} p^2(k|t_l) + P_r \sum_{k=1}^{K} p^2(k|t_r) \right) \quad (5)$$

2. To choose appropriate tree size

   Maximum tree maybe has very high complexity and consists of hundred levels. So, it is necessary to optimize before used to classify new data. The optimization tree is the selection of optimal tree size. There are some optimizaton tree methods, the one is cross validation method that based on proportion of tree complexity and misclassification error. Based on this method, it will be obtained optimal proportion between tree complexity and misclassification error by minimizing cost complexity function, that is

$$R_{\sim}(T) = R(T) + \sim(\tilde{T}) \quad (6)$$

   where *R(T) = misclassification error* of tree *T*, $\sim(\tilde{T})$ = complexity size that depend on $\tilde{T}$ (total of terminal node number on tree).

3. To classify new data using tree that has been constructed

2. 3. Multivariate Kernel Nonparametric Regression

Multivariate nonparametric regression model can be formulated as follows:

$$Y_t = m(\mathbf{X}) + u_t, \quad t = 1, 2, ..., T \quad (7)$$

with error u_t and $E(u_t) = 0$. Function $m(.)$ is assumed to be unknown but smooth. $\mathbf{X} = (X_1, X_{2,}..., X_k)$ are some random predictor variable, and Y_t is response variable.

The curve $m(\mathbf{x})$ is estimated using multivariate Kernel nonparametric regression. Kernel estimator used is Nadaraya-Watson estimator that is often used for random predictor variable cases (Eubank, 1988). Nadaraya-Watson estimator of multivariate Kernel nonparametric can be formulated as follows (Hardle and Muller, 1997):

$$\hat{m}_{\mathbf{H}}(x) = \frac{\sum_{t=1}^{T} K_{\mathbf{H}}(X_t - x) Y_t}{\sum_{t=1}^{T} K_{\mathbf{H}}(X_t - x)} \quad (8)$$

with K(.) is Kernel function and H is vector of bandwidth. In this research, the Kernel function used is Quartic Kernel function that is formulated as

$$K(u) = \frac{15}{16}(1-u^2)^2,\ I(|u| \leq 1) \quad (9)$$

The curve of Kernel estimator is influenced by bandwidth value. If bandwidth is too small then the curve will beundersmoothed.If bandwidth is too high then the curve will be oversmoothed. So, it is necessary to select bandwidth optimum in order to get the best Kernel estimator that provide smooth regression curve (Sarda and Vieu, 2000). In this research, the selection of bandwidth is done based on generalized cross-validation (GCV) criteria, that is

$$GCV = \frac{n^{-1}\sum_{i=1}^{n}\left(Y_i - \hat{m}_{\mathbf{H}}(X_i)\right)^2}{\left(n^{-1} trace\left(\mathbf{I} - \mathbf{H}(h_0)\right)\right)^2} \quad (10)$$

3. Results and Discussion

CART analysis on rainfall data at Pengga station and Kediri stationbased on GCM precipitation data produces classification trees as shown in Figure 1 and Figure 2.

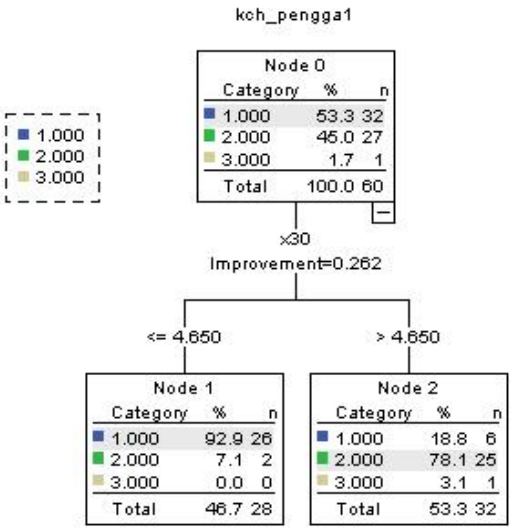

Figure 1. Classification Tree of Rainfall Data atPenggaStation based on GCM Precipitation Data

The classification tree in Figure 1 describe that there are three nodes with two terminal nodes. Also, there are one variable in the model, that is variable X_{30} (GCM precipitation on grid -8.75° N and 118.75° E). It is a variable that affect the classification of rainfall at Pengga station.

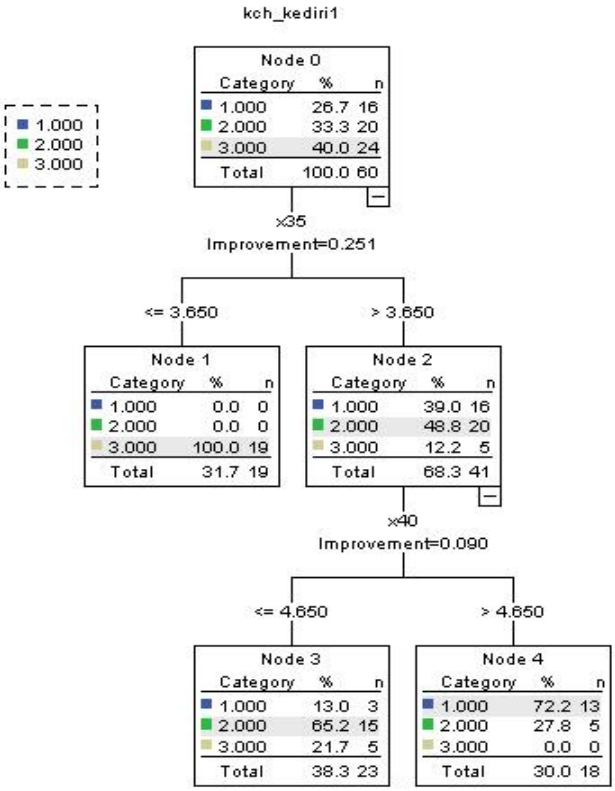

Figure 2. Classification Tree of Rainfall Data at Station Kediri based on GCM Precipitation Data

The classification tree in Figure 2 describe that there are five nodes with three terminal nodes. Also, there are two variables in the model, that are variable X_{35} (GCM precipitation on grid -11.25^o N and 111.25^o E) and variable X_{40} (GCM precipitation on grid -11.25^o N and 123.75^o E). The summary of the CART analysis results is shown in Table 1.

Table 1. The summary of CART analysis on rainfall data at Pengga and Kediri stations

Station	Number of Node	Number of Terminal Node	Accuration	Variable Model	Normalized Importance
Pengga	3	2	80.4%	X_{30}	100%
Kediri	5	3	78.3%	X_{35}	93.2%
				X_{40}	86.3%

Table 1 show that CART analysis produce classification with high accuracy (more than 75%). The accuration at Pengga station is 80.4%, it means that 80.4% of the clasification resultby CART are appropriate with the actual classification.At Kediri station, thereare 78.3% of classification result by CART that appropriate with the actual classification.

In table 1, it can be shown that variables model have high level of normalized importance (more than 85%). It means that those variables are greatly influence rainfall classification at each station. So, those variables are used as predictor variables in rainfall modeling.

Rainfall models are determined using multivariate Kernel nonparametric regression. At Pengga station, local rainfall is influenced by movement ofGCM precipitation on grid -8.75^o N and 118.75^o E. At Kediri station, local rainfall is influenced by movement of GCM

precipitation on grid -11.25° N and 111.25° E and GCM precipitation on grid -11.25° N and 123.75°.Rainfall model at each station are used as the basis of rainfall data simulation.
The comparison of actual and simulation rainfall data at Pengga and Kediri stations are shown in Figure 3 and 4.

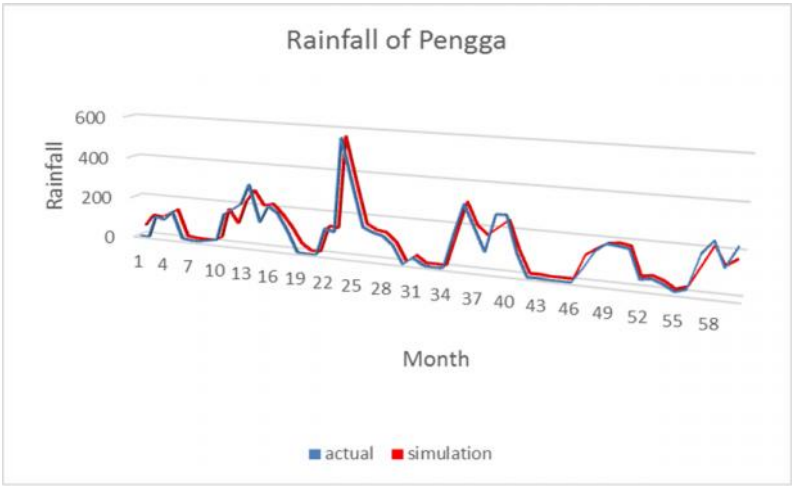

Figure 3. The patern of actual and simulationrainfall dataatPengga Station

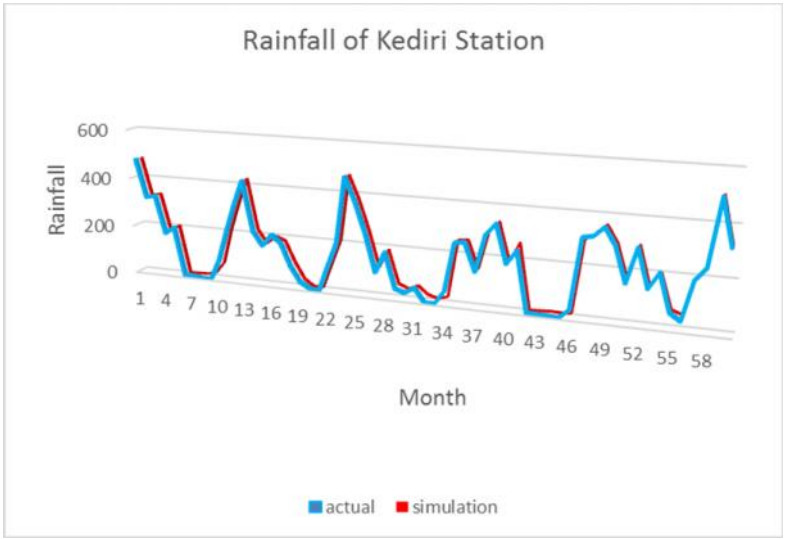

Figure 4. The patern of actual and simulationrainfall data at Kediri Station

Figure 3 and 4 show that the patern of rainfall simulation data at Pengga and Kediri station are relatively similar with the patern of their actual rainfall data. The accuracy of data simulation can be seen from root mean square error of prediction (RMSEP) value. Table 2 shows the value of RMSEP of simulation data at Pengga and Kediri station.

Table 2. RMSEP of simulation data

Station	RMSEP
Pengga	29.05
Kediri	8.92

Based on table 2, it can be seen that RMSEP values of simulation data at Pengga and Kediri stations are relatively small. It means that the simulation rainfall data at Pengga and

Kediri stations in Dodokan watersheed are accurate. So, those data can be used in river discharge modeling of Dodokan watersheed.

4. Conclusion

Rainfall at Pengga station is influenced by the movement of GCM precipitation on grid -8.75^o N and 118.75^o E. It provides simulation rainfall data with RMSE 29.05. Rainfall at Kediri station is influenced by the movement of GCM precipitation on grid -11.25^o N and 111.25^o E and GCM precipitation on grid -11.25^o N and 123.75^o. It provides simulation rainfall data with RMSE 8.92.

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Integrated Remote Sensing and Geographic Information System Based RUSLE Model for Spasial Prediction of Soil Loss in Catchment of SelorejoReservoir, East Java

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Abstract

Soil loss is one of the major indicators of environmental degradation. Numerous human activitieslead to result soil loss, namely agricultural activities, disturb land, mining, construction, etc. It can cause significant disaster to downstream areas, due to soil loss deposited in lakes, reservoirs, rivers, drainage and sea. Linking RUSLE, remote sensing, GIS within raster GIS, an prediction of soil loss risk from Catchment of Selorejo Reservoir has been presented in this paper. RUSLE comprises of six model components on RKLSCP, each of which is represented by empirical algorithms. The R factor was estimated from daily rainfall data. The K factor was estimated using characteristicsof soil sample. The LS factor was calculated from DEM. The C factor was generated from the remote sensing data by using NDVI method and field survey validation and P factor was generated based on landsatand slope map. The average soil loss was moderate (103 ton $ha^{-1}year^{-1}$), due to the slope of the study area is under 30% about 48.2 % and most of the area (30.2 %) was occupied by dryland forest. Almost one third of its area was located in the very low and low class of soil loss risk.

Keywords: Catchment of Selorejo Reservoir, soil loss, RUSLE, remote sensing, GIS

1. Introduction

Soil loss is defined as the amount of material that is actually removed from a particular slope, and is one of the major indicators of environmental degradation(Renard et al., 1997). The negative effects caused by soil loss on soil degradation, hydrological systems, water quality,agriculture and the environment in general, have long been established as severe problems for human sustainability (Lal, 2001). Numerous human activitieslead to result soil loss, namely agricultural activities, disturb land surfaces, mining, construction, etc(Kouliet al., 2009). In terms of civil engineering, soil loss is a disaster that can cause significant disaster to downstream areas(Chen & Li, 2011), due to soil loss deposited in lakes, reservoirs, rivers, drainage channels and sea. According to the Dam Operational Improvement and Safety Project (DOISP) report in 2014, based on 37 reservoir data collected, it was reported that most of them, has begun disturbed in their functions related with reservoir sedimentation, approximately range reduction were 0.70-97.36%.Reservoir sedimentation is one of the direct impacts of soil loss that exacerbates water management problems in Indonesia.

A large number of empirical soil loss models are based on the The Universal Soil Loss Equation-USLE (e.g., AGNPS, ANSWERS, EPIC, SWAT, SLEMSA, INDEROSI,SOILOSS, etc(Merritt et al., 2003). Thus, although the USLE, an empirical model or RUSLE model (Renard et al., 1997) are widely used to predict potential soil loss, because USLE/RUSLE have several benefits: easy to implement and familiar from a functional perspective, compatible with geographic information system (GIS) framework; the data required to apply within the model are not overlay complex and are accessible. Moreover, the approach makes soil loss estimation and observation of its spatial patterns feasible at a reasonable cost (Farhan & Nawaiseh, 2015). It provides better accuracy for catchment and regional scales (Prasannakumar et al., 2011).Several models of soil loss are available, and can be linked to spatial data management systems, such as remote sensing (RS), geographic information systems (GIS), and some spatial technologies have provided new ways to study soil loss dynamics (Devatha et al., 2015). Most efforts linking RS, RUSLE and GIS have been carried

out within raster GIS (grid-by-grid basis) (Pandey et al., 2009). In practice, both the estimation model and values for each of the variables are incorporated into the GIS. The models can then solved to provide soil loss estimates for each spatial unit of interest.

The objectives of this research were to map soil loss prone areas in catchment of Selorejo Reservoir by using RS and GIS for the discretization of the catchment into small grid cells by extracting the values of RUSLE factors using spatial data of physical characteristics such as rainfall, soil characteristics, slope, and land use, all of which affect the processes of soil loss in the different subareas of a catchment. Further GIS methods are also used to estimate the soil loss in individual grid.

2. Materials and Methods

2.1. Study Site

Catchment of Selorejo Reservoir is located in Malang in East Java whichand lies between -7˚45.933′S to -7˚56.872′S and 112˚19.351′E to 112˚29.924′E (Figure 1). It is surrounded by three mountain namely Anjasmoro Mountain, Butak Mountain and Kawi Mountain.Total area of catchment reservoir is 235 km^2, with elevations range607 m - 2663 m asl (above sea-level) and basin length of 15,3 km. Annual precipitation is about 1499–4297 mm, whichconcentrates in November–April mainly in a form of erosive storms.The soil is mainly loam type and the average land slope varied between 0 and 267 %. The dominant crop in the study area is dryland forest, shrub land and paddy field. Soil loss problem is prevalent in the study area due to rolling topography and improper agricultural management practices.

2.2. Data

Each factors within the RUSLE equation was calculated by using GIS, which can be obtained from rainfall data stations,soil samples and soil maps, topographic maps andLandsate TM (path 118, row 65, dated 17.09.2014). In this study, all factors of the RUSLE equation were represented by raster models with a 30 × 30 m^2 grid size in GIS framework, which is consistent with the Landsat TMand it is closest to the typical RUSLE resolution (~22.13 m). DEM (digital elevation model) map was constructed for the catchment as the base for other topographic-related analyses. Generation of the DEM for the catchment involved digitizing 12.5 m contour lines from 1:25.000 topographic maps (from http://tanahair.indonesia.go.id).Rainfall data (daily amounts of precipitation) were collected over many years (2000–2014) from 4 rainfall station gauge (e.g. Sekar, Kedungrejo, Pujon and Jombok) to calculate the rainfall erosivity factor. The soil erodibility factor was extracted fromsoil types map (The Center for Agricultural Land Resources Research and Development) and 10 soil samples were collected from the field representing the different soil types over the catchment. Location of these samples was controlled by GPS. Normalized Difference Vegetation Index (NDVI) and LULC were derived from Landsat 8 TM for determining the Cfactor Pfactor values.Prior to that, the Landsate TM were geometriccorrection using topographic map of indonesia and radiometriccorrection using FLAASH atmospheric correction module. Supervised classification of LULC with maximum likelihood algorithm of ENVI 5.3 was used for digital classification of Landsate image. Classification results were then assessed for accuracy using ground control-points determined in the study area collected through hand-held Garmin Global Positioning System (GPS) and Google Earth. The classified map categorized the study area into 7 class e.g. shrub land, dryland forest, build-up land, plantation, ricefield, dryland farming and water bodies.

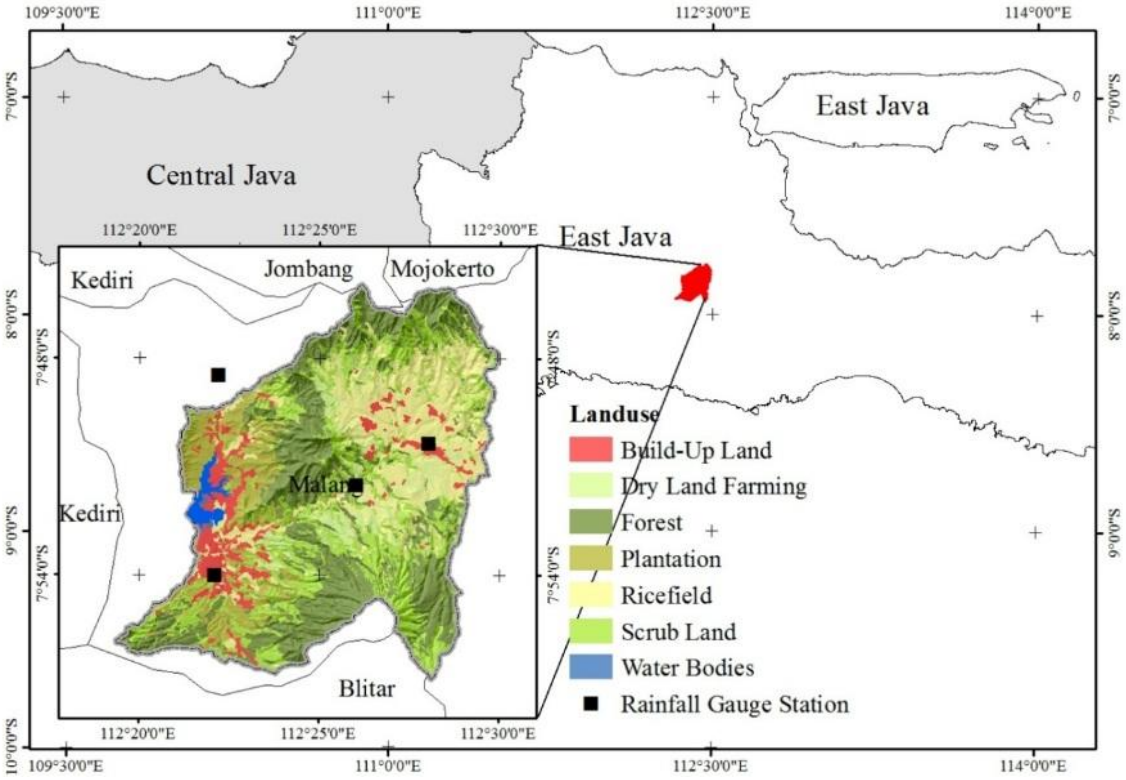

Figure 1.The study area

2.3. Methodology

Soil loss prediction by Revised Universal Soil Loss Equation (RUSLE)(Renard et al., 1997) is an empirically based model founded on the Universal Soil Loss Equation, USLE(Wischmeier & Smith, 1978). RUSLE model enables prediction of an average annual rate of soil loss for a site of interest for any number of scenarios involving cropping systems, management techniques, and soil loss control practices(Renard et al., 1997). In the application of RUSLE on GIS environment, soil loss is estimated within the raster/grid GIS. Raster models are grid-based representations of map features, which offer analytical capabilities for continuous data and allow fast processing of map layer overlay operations(Fernandez et al.,2003). RUSLE comprises of six model components on rainfall characteristics, soil properties, topography, crop system, and management practices, each of which is represented by empirical algorithms. The equation is expressed as:

$$A_i = R_i K_i L_i S_i C_i P_i \quad (1)$$

where*i*is *i*-th grid;*A*is the computed soil loss per unit area (ton $ha^{-1}year^{-1}$);*R* is the rainfall erosivity factor (MJ mm $ha^{-1}h^{-1}year^{-1}$);*K*is the soil erodibility factor (ton ha h $ha^{-1}MJ^{-1}mm^{-1}$);*L*is the length factor (dimensionless);*S*is the steepness factor (dimensionless);*C*is the cover and management factor (dimensionless); and *P*is the support practice factor (dimensionless).

The rainfall erosivity factor (*R*), in RUSLE models, is an index of rainfall erosivity which is the potential ability of the rain to cause soil loss. A storm's maximum 30-min precipitation intensity must be known to compute the storm's erosivity index. Numerous countries in the world still do not have 30-min rainfall data availabe. To solve this problem, several researchers have been performed to estimate the *R* factor based on available rainfall data. As an approximation of *R* for Java-Madura, Indonesia, Bols (1978) and Institute of Soil Research (Bogor-Indonesia) developed an index on the basis of daily rain(Vis, 1987). From

daily rain volumes one can easily derive the monthly rainfall and the number of raindays per month. *R* can be estimated based on the following formula:

$$R = \frac{EI_{30}}{100} = \frac{6.119\left(Pm\right)^{1.21}\left(N\right)^{-0.47}\left(P\max\right)^{0.53}}{100} \quad (2)$$

where*R*is the mean monthly rainfall erosivity index unit (MJ mm $ha^{-1}h^{-1}year^{-1}$);*Pm*is the monthly rainfall (mm), *N* is the number of rainfall-days in a month; and*Pmax* is the maximum-daily-rainfall in a month (mm).

The soil erodibility (*K*) is the rate of soil loss per rainfall erosivity index unit asmeasured on a standard plot and often determined using inherent soil properties (Wischmeier & Smith, 1978). The main soil properties affecting *K* are soil texture, organic matter, structure, and permeability of the soil profile. The *K* values are represented as a ratio ranging in value from 0 to 1, where 0 refers to soils with the least susceptibility to soil loss and and 1 refers to soils which are highly susceptible to soil loss by water. The factor was computed using the following equation(Renard et al., 1997).

$$K = 0.0034 + 0.00405\exp\left(-\frac{1}{2}\left(\frac{\log\left(\exp\left(0.01\sum f_i \ln m_i\right)\right)}{0.1701}\right)^2\right) \quad (3)$$

where$f_i$is the particle size fraction in percent of class *i*; and m_i is the arithmetic mean of the particle size limits of that size. Applying the Eq. (3) to generate GIS layer, it was important to generate digital maps of soil properties used in the equation. This relation is very useful with soils for which data are limited and/or the textural composition is given in a particular classification system.

The slope length factor (*LS*) is defined as a ratio of soil loss under given conditions to that at a site with the ‘‘standard’’ slope steepness of 9% and slope length of 22.13 m (Renard et al., 1997). As slope length increases, the total soil loss per unit increases, as a result of progressive accumulation of runoff in downslope. As the slope steepness increases, the soil loss also increases as a result of increasing the velocity and erosivity of runoff (Wischmeier & Smith, 1978). To calculate the *L* factor was followed (Eq. 4)(McCool et al., 1987).

$$L = \left(\frac{\mathrm{a}}{22.13}\right)^m \quad (4)$$

$$m = \left(\left(\sin^{-}/0.0896\right)\Big/\left(2.96\left(\sin^{-}\right)^{0.79} + 0.56\right)\right)\Big/\left(1 + \left(\sin^{-}/0.0896\right)\Big/\left(2.96\left(\sin^{-}\right)^{0.79} + 0.56\right)\right) \quad (5)$$

where*m* is a variable slope length exponent; λ is the slope length (m); θ is the slope angle (^{o}); and m is the slope length exponent.

This approach chose the flow direction of steepest descent among the eight permitted choices (Fig. 2). Once the flow direction in each grid was identified, a grid-to-grid flow path was determined to the nearest stream channel and thus finally to the catchment outlet. According to the definition of slope length in Eq. (4), slope length of a grid refers to the distance from the origin of overland flow along its flow path to the location of either concentrated flow or deposition. Therefore, flow direction codes of concentrated flow grids were changed to 255 which was treated as flow sink(Yang et al., 2012), thus flow path ended once it reached a concentrated flow grid (Fig. 2). Once the flow path in each grid was identified, distance along a flow path was calculate the longest upslope distance along the flow path, from each cell to the top of the drainage divide.

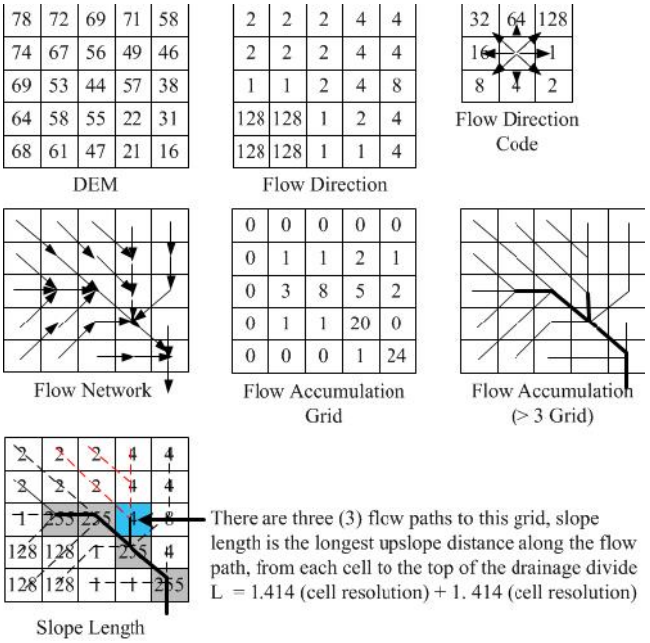

Figure 2. Graphic representation of the approach to calculate slope length

The effect of slope steepness is greater impact on soil loss compared to slope length. Steeper the slope, the greater is the soil loss. The worst soil loss occurring between 10 and 25% slope. *S* factor is the slope steepness and estimated by taking McCool et al., (1987)methods.

$S = 10.8\sin^{-} + 0.03$ for slope percent < 9% or $S = 16.8\sin^{-} + 0.50$ for slope percent ≥ 9%(6)

where θ is the slope angle (^{o}).

The crop management factor (*C*) expresses the effect of cropping and management practices on the soil loss rate(Wischmeier & Smith, 1978). The traditional method for spatial estimation of *C* factor is assigning values to land cover classes using classified remotely sensed images of study areas. It causesthe *C* factoris relatively constantata relativelywidearea, anddo notreflectthe variationof vegetation(Sulistyo et al., 2010).De Jong et al., (1999)provide a solutionby utilizing Normalized Difference Vegetation Index (NDVI) in mapping*C* factor by remotes sensing (RS).The NDVI calculation can be derived as.

$$NDVI = (NIR - RED)/(NIR + RED) \quad (7)$$

Using the above quoted formula an NDVI (Eq. 7) was created. *C* factor for good vegetation cover (0) and bad vegetation cover (1) where derived from literature (Morgan, 2005). In a next step NDVI values for good vegetation (forest and mixed plantation with good cover) cover and bad vegetation cover (street, build-up area and bare land) were taken from each image. These sample points were used for a linear regression analysis. As a result a linear model was inverted. Using this model a *C* factor image was calculated. Grids with values > 1 were classified as 1 and grids with values < 0 were classified as 0 (Fig. 3).

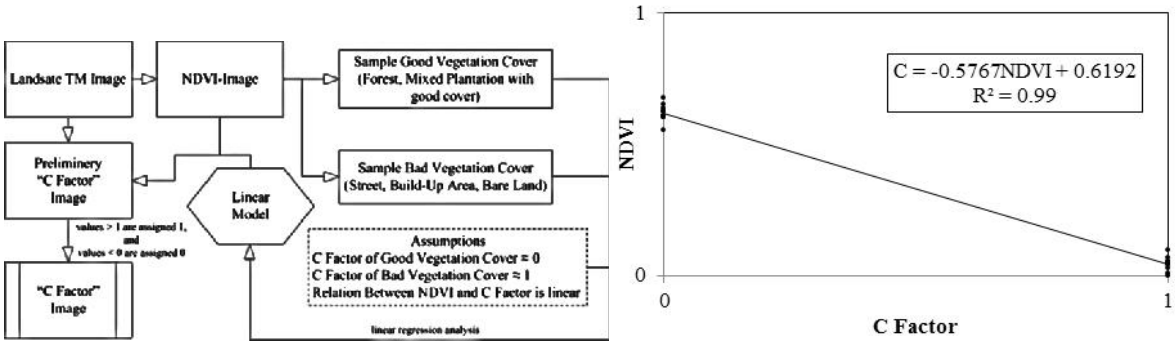

Figure 3.Flowchart outlining the procedure of C factor mapping using NDVI(Erencin, 2000) and linear regression of NDVI and C-Factor

P is a supporting practice factor that reflects the effects of practices that will reduce the amount and rate of the water runoff and thus reduces the amount of erosion, the higher the supporting practice, the lower the value of the *P* factor(Wischmeier & Smith 1978). It includes different types of agricultural management practices e.g. contouring, strip cropping, terracing and subsurface drainage. In this research, *P* factor are related to the land use identified by landuse types (agriculture and non-agriculture) and slope (Farhan et al., 2013).

3. Results and Discussion

3.1. RUSLE Factor

The*R* factor for the years 2000–2014 were found to be in the range of 137–404 MJ mm $ha^{-1}h^{-1}year^{-1}$, respectively. The average *R* factor was observed to be 245 MJ mm $ha^{-1}h^{-1}year^{-1}$ and the standard deviation is 19.52 MJ mm $ha^{-1}h^{-1}year^{-1}$ which implies that the erosivity in the study area was unstable and obviously fluctuated. The figure of *R* factor exhibits obvious spatial difference. High values gather at the downstream of catchment, while the low values are mainly clustered at the east and the middle part of the region.

The *K* factor varies as a function of the mean geometric particle diameter *Dg*, with the highest values in correspondence of median values of *Dg*. From the soil erodibility map derived using a IDW method. The spatial distribution of soil erodibility is given in Fig. 4. Soil erodibility factor ranged from 0.015 to 0.043 ton ha h $ha^{-1}MJ^{-1}mm^{-1}$ and and the mean value was 0.04 ton ha h $ha^{-1}MJ^{-1}mm^{-1}$, in which soil erodibility values closer to 0 are less prone to soil loss.

Topographic factor represents the influence of slope length and slope steepness on soil loss process. *LS* factor was calculated by considering the slope length (m) and slope in degree as an input in ArcGIS. From the analysis, it is observed that the value of *LS* factor increases in a range of 0-122 as the slope length to nearest flow accumulation and slope increases. The spatial distribution of *LS* factor was presented in Fig. 5*LS* values are directly related to surface relief. The lowest values for the *LS* factor occurred along rivers, which is largely because of the low slopes. The higher values for LS factor were scattered, especially in the areas with steep slopes (Fig. 4). The average value for this area was 9 with a large standard deviation of 11 which indicates the *LS* values were relatively unevenly distributed.

C values were generated from the remote sensing data by using NDVI method and field survey validation. Figure 3 shows the scatter plot correlations between the *C* factor and the field data from 20 sampling sites. The correlation coefficient (R) between the *C* factor and NDVI value is 0.99. The *C* factor values ranged from 0.17 to 0.62, which were higher in the lowland area, because they can be affected by the human disturbance factor. The highest *C* factor (poor land cover management) almost coincide with the lowest NDVI values, (0-0.1),

since dryland forest protects soils against erosion, while ricefield and dryland farming have a high *C* factor (0.35). Similarly, the plantation areas have a *C* factor of 0.31. The model showed logical results after applying the assumed *C* values for each landuse class, with a trend of increasing soil loss with low vegetation cover.

Considering the lack of data is in this study on a supporting practice factor, the *P* factor was determined base on two types of landuse (agricultural and non-agricultural) and slopes. Thus, the agricultural lands were classified into six classes and assigned *P* factor, while all non-agricultural lands were assigned a *P* factor of 1. *P* factor values increased towards the lower catchment, where steepness are greater (*P* factor ranges 0-1, see Fig. 4). The higher values in steepness areas with no conservation practices (dryland forest, scrub land and plantation). *P* factor decrease towards the downstram of catchment, where in flat area and slope length decreases. This explained lower *P* factor in the ricefield compared to dryland farming, since ricefield mainly occupy flat/surging lands.

3.2. Average Annual Soil Loss

Using Eq. 1, the average annual soil loss in the catchment of Selorejo Reservoir was computed by overlaying the five factor grids into a result grid in ArcGIS, with a uniform spatial resolution of 30 x 30 m. According to the soil loss rate standard, technical procedures for forest rehabilitation plan and catchment regulation, issued by the Ministry of Forestry of Indonesia, the quantitative output of predicted soil loss was divided into five ordinal classes as shown in Table 1 and Table 2. Annual average soil loss rate for the study area was estimated at 103 t ha^{-1} $year^{-1}$, and annual soil loss 551 x 10^3 t $year^{-1}$. The statistical result of annual soil loss rate by class (Table 2) indicates that 59.2% of the study area was under a very low soil loss class, 27.2 % under a low soil loss class, and 12.6% under a moderate class of soil loss. The high to very high soil loss class accounted for 0.6% of the total area.

The soil loss based on different land use types were also assessed (Table 1). Dryland forest was the type of landuse that dominated the study area approximately 30.2%, from which the quantity of soil loss made up a half of the total soil loss (51.6%). Dryland forest is forests that grow and thrive in habitats in the form of upland plains, hills, mountains, or the tropical highland forests. Dryland forest have a highest soil loss in this study, in addition catchment is dominated by dryland forests, caused also by the high rainfall in mountainous areas, erodibilitas high value, in general located in areas with a steep slope and it was considered no conservation practice. Another reason is the average value of C factor for dryland forest based NDVI is 0.29, while the *C* factor based on Morgan(2005)is 0001-0005.Shrub land was the second largest contributor due to its large area and caused the soil loss rate of 31 t ha^{-1} $year^{-1}$ was high. As regards to soil loss on different landuse types, most of the soil loss occurred in dryland forest and shrub land, accounting for about 83.7% of the total soil loss. It should be noted that nearly all of very low to high classes were from dryland forest and shrub land (Table 2). The key work of conservation practices should put emphasis on these two land use types taking into consideration their large areas and mass soil loss. And it indicates that dryland forest and shrub land play an important role in soil conservation, especially shrub land because dryland forest was considered no conservation practice. In other hand, the analysis shows that the agriculture land (dry land farming and ricefield) contributed 25,6 % of total soil loss owing to its large soil loss rate. The mean soil loss rate of cropland was 13 t ha^{-1} $year^{-1}$ and two thirds of the agriculture land were under very low to moderate soil loss class. Comparatively, the plantation areas had a high soil loss rate of 19 t ha^{-1} $year^{-1}$. Fortunately, this type has only 11.2% of total area and the soil loss accounted for merely 9.1 %.

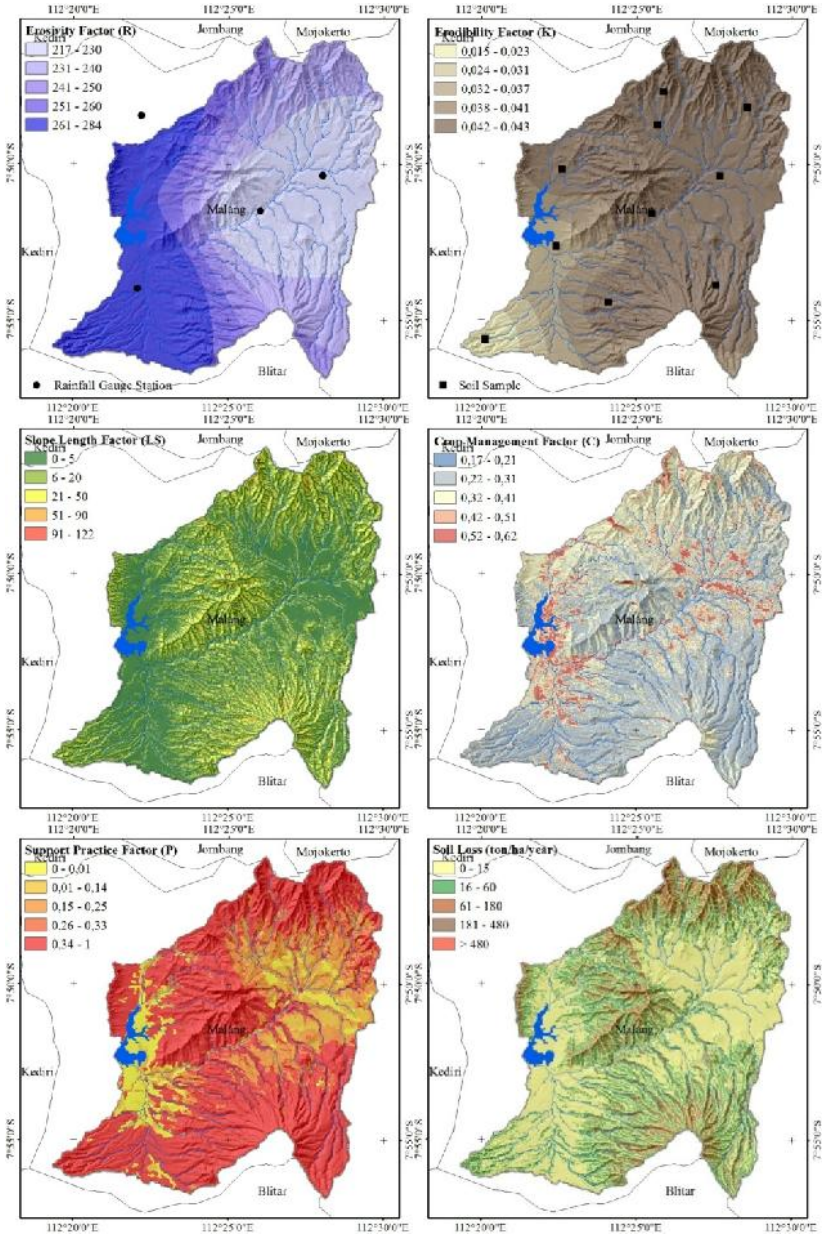

Figure 4.RUSLE factor maps and soil loss map

4. Conclusions

The catchment of Selorejo Reservoir is very important to East Java as it supplies water need and electricity of the city especially Malang and neighborhood contains very large fertile agricultural lands covering 25.6 % of the entire catchment. Excessive soil loss means reducing not only water storage and electricity capacity of the Selorejo reservoir, but also productivity of agricultural lands in upstream of the catchment. This study aimed at understanding the soil loss risk in the catchment of Selorejo Reservoir by using RS-RUSLE method in a GIS framework.

The average soil loss for catchment of Selorejo Reservoir is moderate (103 ton $ha^{-1}year^{-1}$) based on the Ministry of Forestry classification, due to the slope of the study area is under 30% about 48.2 % and most of the area (30.2 %) is occupied by dryland forest. Almost one third of its area is located in the very low.

Table 1.Soil loss on different landuse types

Landuse Type	Area (Ha)	Area (%)	Ave. Soil Loss (tonha^{-1} year^{-1})	Ann. Soil Loss (ton year^{-1})	Ann. Soil Loss (%)
DrylandForest	7,071	30.2	40	284.146	51.6
Shrub Land	5,751	24.6	31	177.155	32.2
Ricefield	4,940	21.1	7	32.966	6.0
Dry Land Farming	1,047	4.5	6	6.633	1.2
Plantation	2,614	11.2	19	50.124	9.1
No Erosion	1,979	8.5	0	0	0.0
Total	**23,401**	**100**	**103**	**551.024**	**100**

Table 2.Soil loss classes on different landuse types (% of area)

Landuse Type	Very Low	Low	Moderate	High	Very High	Total
DrylandForest	11.5	11.0	7.3	0.4	0.0	30.2
Shrub Land	10.8	9.4	4.1	0.1	0.0	24.6
Ricefield	18.3	2.5	0.3	0.0	0.0	21.1
Dry Land Farming	4.0	0.4	0.1	0.0	0.0	4.5
Plantation	6.3	4.1	0.8	0.0	0.0	11.2
No Erosion	8.3	0.1	0.0	0.0	0.0	8.5
Total	**59.2**	**27.7**	**12.6**	**0.6**	**0.0**	**100**

The application of RUSLE and RS in GIS framework can be cost-time saving to estimate soil loss over a large area effectively, even though there are some limitations in determining the RUSLE-factors due to the spatial heterogeneity in the catchment.This methods and results described in this study are valuable for understanding the situation of and relationship between soil loss and environmental characteristics, which are useful to formulate and implement conservation practice that will decrease soil loss accurately.

Acknowledgements

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Enhancement Flexural Strength of Brick Masonry Wall with Polypropylene Bands

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Abstract

A simple way to retrofit brick masonry walls is by installing polypropylene (PP)-band mesh on the wall surface. PP-bands are affordable for ordinary people and are easy to find and install. Prestressed PP-bands were used to increase the wall flexural strength and deformation capacity. In order to find the best way to increase the interaction effect of the prestressed PP-bands with the wall, flexural tests were carried out using 11 specimens of masonry wall blocks with PP-bands, covered with mortar plaster. Each group of specimens consisted of three blocks. The blocks were 135 cm long × 25 cm wide × 14 cm thick. The specimens varied in terms of the distance between PP-bands (45, 60, 120 mm), the prestressed PP-band technique (twisted and initial stress), and the PP-band width (5, 7, 14 mm). Flexural tests were carried out by applying the line load perpendicular to the wall surface. These tests followed the ASTM E72 guideline. The result of the tests showed that the masonry block with the initially stressed PP-bands had higher flexural strength. The blocks with 7-mm-wide PP-bands had highest flexural strength.

Keywords: masonry, polypropylene-band, pre-stressed, flexural test, ultimate strength

1. Introduction

Indonesia is located between the Australian, Pacific, and Eurasian plates, causing many earthquakes. The earthquakes that hit Indonesia between 2000 and 2010 can be seen in Figure 1. Between 2000 and 2010, a total of 875,322 houses were heavily damaged by earthquakes in Indonesia (OCHA, 2010). These houses were usually made from unreinforced brick masonry and owned by poor people. To reduce fatalities, a simple and easy retrofitting method should be developed. Meguro (2008) has developed a polypropylene (PP)-band mesh method to improve the seismic performance of the buildings. PP-bands are affordable for ordinary people and easy to find and install. According to Mayorca and Meguro (2007), the most important parameter for good seismic performance is the structural strength immediately after cracking. To obtain the maximum strength immediately after cracking, the PP-band was set as a prestressed PP-band.

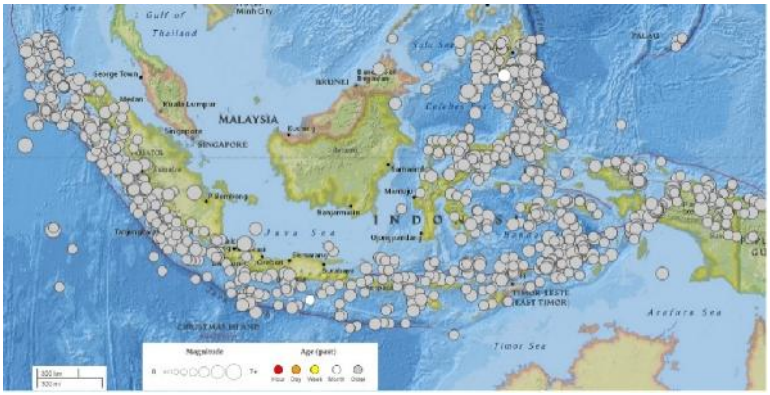


Figure 1. Earthquakes in Indonesia between 2000-2010 (USGS, 2017)

The goal of this research was to investigate the best flexural strength of wall blocks with PP-band by comparing wall blocks with PP-band mesh, twisted PP-band mesh, and prestressed PP-band mesh. In this research, the PP-bands were placed directly on the wall blocks. Many variables influenced the wall characteristics, namely the different qualities of

the bricks, the workmanship, and the variations of bed thickness. The test followed ASTM E72 procedure. The results showed that prestressed PP-bands increased the capacity for wall deflection and flexural strength.

2. Materials and Methods

The masonry wall blocks were 135 cm long × 25 cm wide × 14 cm thick. The specimens varied in terms of distance between PP-bands in the vertical direction (50, 60, 80, 120 mm), the prestressed PP-band technique used (twisted and initial stress), and the PP-band width (5, 7, 14 mm). The distance between PP-bands in the horizontal direction was 10 cm, except for L14-05, where the spacing was 1.5 cm. The variety of specimens can be seen in Table 1. A picture of some specimens can be seen in Figure 2.

Table 1. Variation of specimen

N.	Code	PP-band width (mm)	PP-band distance (cm)	Pre-stressed technique	Plaster
1	TTP	No PP-band	-	-	No
2.	TDP	No PP-band	-	-	Yes
3.	L14-12	14	12	No pre-stressed	Yes
4.	T14-12	14	12	Strain 2.31%	Yes
5.	P14-12	14	12	Twisted	Yes
6.	P14-08	14	8	Twisted	Yes
7.	L14-06	14	6	No pre-stressed	Yes
8.	P14-06	14	6	Twisted	Yes
9.	L14-05	14	5	No pre-stressed	Yes
10.	L07-12	7	12	No pre-stressed	Yes
11.	L05-12	5	12	No pre-stressed	Yes

(a) Wall without PP-band (b) Prestressed PP-band
(c) Twisted PP-band (d) PP-band without prestressing

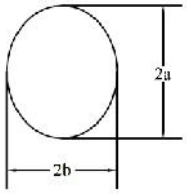
Figure 2. Variations of specimens

3. Tests

The tests were conducted 60–90 days after the wall blocks were made. Wall blocks were made from ordinary bricks and mortar with a cement : sand ratio of 1:8 and water cement ratio of 1.2. PP-bands were woven directly on the wall in order to ensure that they were properly tightened. The PP-band mesh on both sides of the wall was tied together every 30 cm using annealed wire. After the PP-bands had been set up, mortar plaster was put on both sides of the wall. Prestressed PP-bands were set by slipping a piece of bamboo between PP-bands and the wall in order to apply initial strain (see Figure 3). Bamboo was chosen because its skin is not sharp enough to damage the PP-bands. Bamboo is not easy to deform so it could apply a uniform strain on the PP-bands. The bamboo was cut uniformly. The height of the bamboo was 6 cm. The calculation of the strain used the circumference of an ellipse as follows.

$$K = 2\pi b + 4(a - b)$$

with K : circumference of an ellipse
a : half of the longer axis
b : half of the shorter axis



The elongation of the PP-band was half of the circumference of an ellipse. In this case, 2a was the thickness of the wall, that is, 14.5 cm, and b was 6 cm. So, half of the circumference of the ellipse was $\pi b + 2(a - b)$ = 21.4 cm. The elongation of the PP-band was 21.4 cm – 14.5 cm = 6.9 cm. The strain was 6.9/{2 × (135+14.5)} = 2.31%. The PP-band's modulus of elasticity was 582 MPa, so the initial strain applied to the PP-band was 2.31% × 582 MPa = 13.4 MPa.

Figure 3. Slipping the bamboo under the PP-band mesh

The test was conducted using a Wykeham Farrance machine following the ASTM E72*Standard Test Methods of Conducting Strength Tests of Panels for Building Construction* (ASTM International, 1998). The test used two-point loading for transverse load tests. The distance between the two loads was 40 cm, and the distance between supports was 120 cm. Three LVDTs (Linear Variable Differential Transformer) were installed to obtain the deflection data in the middle and under each load. The force and deflection were recorded using a Tokyo Sokki Kenkyujo TDS-303 data logger. The setup can be seen in Figure 4 and the flexural test in Figure 5.

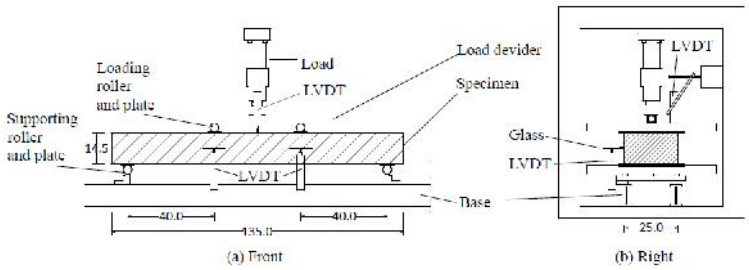


Figure 4. Test Setup

Figure 5. Flexural test using Wykeham Farrance Machine

4. Results and Discussion

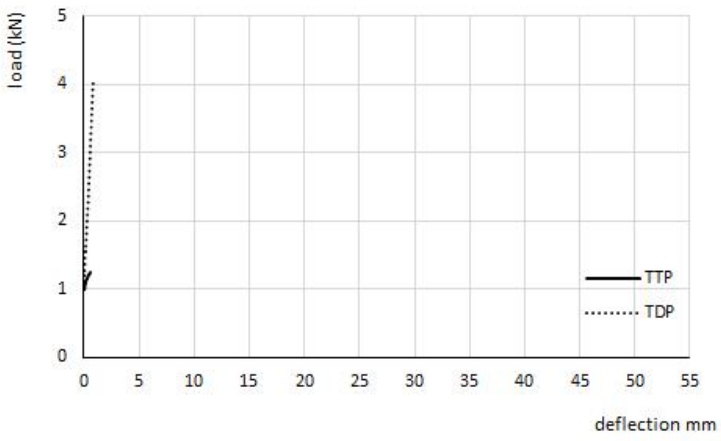
The average flexural strength and maximum deflection of the specimen can be seen in Table 2.Mortar plaster would significantly increase the flexural strength up to three times. The flexural strength of the block without mortar plaster (TTP) was 1.29 kN while that of the block with mortar plaster (TDP) was 3.89 kN. The blocks with PP-bands had lower flexural strength compared to blocks without PP-bands, except those with 5-mm-wide PP-bands and 7-mm-wide PP-bands. When 14-mm-wide PP-bands were placed on the wall, the mortar plaster did not stick entirely to the brick, which caused a decrease in flexural strength. This condition was proven by the specimen L14-05 which had the lowest flexural strength. This block consisted of many PP-bands, because the distance between PP-bands was 5 cm.

Table 2.Flexural strength and maximum deflection of the specimen

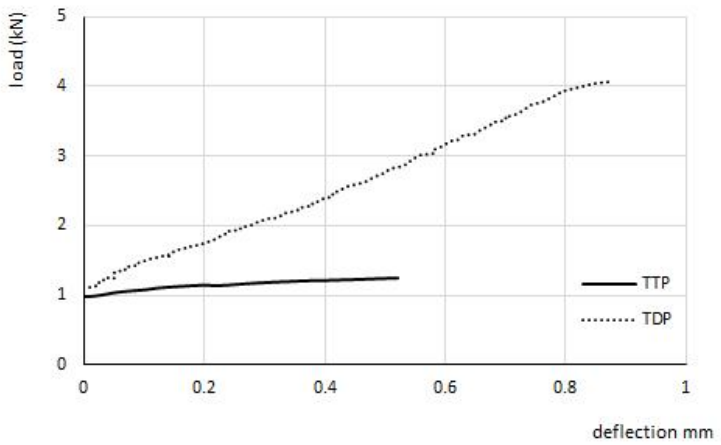
N.	Code	Flexural strength (kN)	Maximum deflection (mm)
1	TTP	1.29	0.52
2	TDP	3.89	0.58
3	L14-12	2.84	27.79
4	T14-12	3.46	40.40
5	P14-12	3.06	36.46
6	L14-06	2.67	33.43
7	P14-06	2.83	25.08
8	L14-05	2.33	36.63
9	P14-08	3.16	28.04
10	L07-12	4.17	39.11
11	L05-12	4.47	34.81

The blocks with PP-bands with initial strain (T14-12) had 22% higher flexural strength than those with PP-bands without initial strain (L14-12) and 13% higher flexural strength than those with twisted PP-bands (P14-12). The blocks with twisted PP-bands (P14-12) had 8% higher flexural strength than those with PP-bands without initial strain (L14-12). The data were consistent with P14-06, which had 6% higher flexural strength than L14-06. The data showed that prestressed PP-bands increased the flexural strength of the wall.The prestressed PP-bands reacted immediately toward the load, while the non-prestressed PP-bands needed more time to react. The twisted PP-bands were placed on the wall somewhat loosely in order not to crack the PP-bands, so they needed more time to react too.

The PP-bands sustained the wall block after the first crack. The wall materials did not fall apart even when the deflection reached 50 mm. The test was stopped when the specimen touched the base so there were no data on the maximum deflection. Table 2 shows that the block without mortar (TTP) failed when the deflection reached 0.52 mm ($\frac{L}{2300}$), while the block with mortar only (TDP) failed when it reached 0.58 mm($\frac{L}{2000}$). Mortar plaster increased the block deflection capacity. The load–deflection curves of TTP and TDP can be seen in Figure 6. The blocks with PP-bands were still able to sustain load and deflection after the first crack, as can be seen in Figures 7 to 9. The blocks with initial strain (T14-12) could sustain 40.40 mm ($\frac{L}{30}$) greater deflection than the others.



(a) Load-deflection curve



(b) Detail of initial curve

Figure 6. Load-deflection curve of wall block with and without mortar plaster

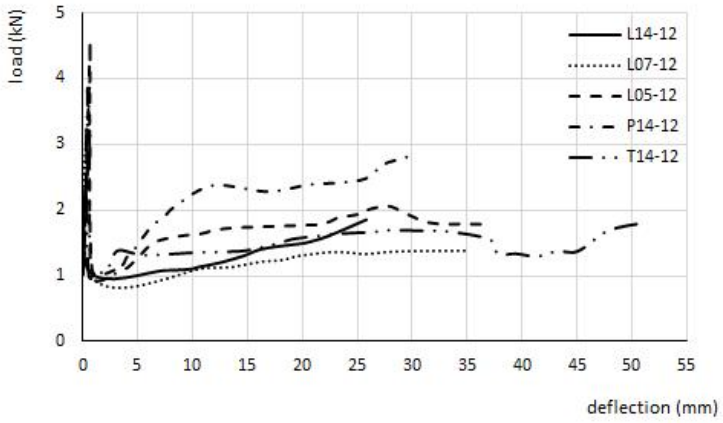


Figure 7. Load-deflection curve of wallblocks with PP-band spaced 12 cm

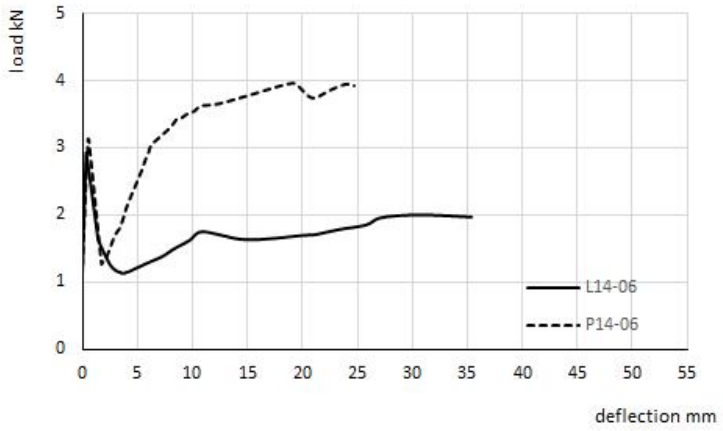


Figure 8.Load-feflection curveof wall blocks with 14-mm-wide PP-bands spaced 6 cm apart

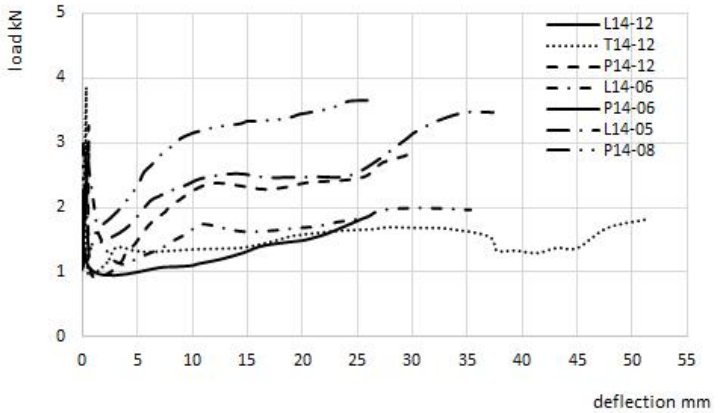


Figure 9.Load–deflection curves of various wall blocks with 14-mm-wide PP-bands

Examples of wall blocks that cracked and did not fall apart can be seen in Figure 10.

Figure 10.Specimen that cracked but did not fall apart

5. Conclusion

PP-band mesh was used to improve the flexural strength of wall blocks, and the tests showed that PP-bands with initial tension could increase the flexural strength. The 5-mm-wide PP-band is better than the 14-mm-wide PP-band for increasing the flexural strength of the wall block. Prestressed PP-bands with initial strain gave the blocks more capacity for flexural strength. The blocks with initial strain (T14-12) could also sustain higher deflection than the others.

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Utilization of NanoChitosan as Biomordant of Natural Indigo Dye on Cotton Fabrics

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Abstract

Natural dyeing requires the use of metallic mordants as a binder of dye molecules for better color fixation. In this study, chitosan was applied as a biomordant. Cotton fabrics were treated with two different particle size of chitosan solution (bulk chitosan and nano-chitosan), various concentration of crosslinker agent and then dyed with natural indigo. Nano-chitosan was synthesized by complexationof sodium tripolyphosphate and chitosan, and then characterized by particle size analyzer (PSA). Crosslinker agent is prepared by citric acid solution with various concentration 2% ; 5% ; and 8% respectively. The cotton fabrics were coated by pad-dry-cure technique. Effect of particle size of chitosan and crosslinker agent concentration on cotton fabrics were examined through dye ability using natural indigo in terms of color strength (K/S) and color fastness. Intermolecular interactions of cellulose, nano-chitosan/citric acid, and natural indigo were analyzed by FT-IR. The experimental results showed that the addition of nano-chitosan and citric acid tend to increase dye ability of natural indigo. The highest color strength value was achieved by nano-chitosan/citric acid with 5% citric acid concentration. Those results revealed that the particle size of chitosan and concentration of agent crosslinker might enhanced dye ability.

Keywords: biomordant, chitosan, crosslinker, natural indigo, dye ablility

1. Introduction

Batik industry based on natural dyes is a potential market along with the increasing public demand for environmentally friendly products.Natural indigo dye has been widely used in batik industry which is non-toxic and eco-friendly (Handayani et al., 2013; Maharani, 2016). Indigo dye that contain indigotin is found as the glucosideindican in the plant of *Indigoferatinctoria*(Samanta, 2009). Indigo is a vat dye being water insoluble that requires reduction agent (sodium dithionite, sodium hydrosulfite, glucose) into water soluble form or leuco indigo in alkaline condition (Fig. 1) (Lestari, 2000; Vuorema et al., 2006; Ticha 2013). The application of indigo to cotton fabrics requires a specific dyeing process to achieve deep color (Ticha, et al., 2013).

Dye ability such as color strength and color fastness of natural indigo dye can be increased by the use of metal salts (alum, ferrous sulphate, potassium dichromate) or tannic acid as a mordant on cotton fabrics. Mordanting is the treatment of textile fabric with metallic salts or other complex forming agents as a binder of dye molecules (Samanta et al., 2009; Visalakshi et al., 2013). However, the wastewater containing residual toxic metal ions from metal salt mordants which have negative impact on the environment and public health (Shahid et al., 2013). On the other hand, to improve the dye uptake of indigo, the surface of cotton fabrics was modified by several cationizing agents such as Sera Fast GMX and Croscolor DRT (Ticha et al., 2013). Recently, the pretreatment of cotton with chitosan which is containing amino groups (Fig. 2) has been investigated as an alternative way to introduce cationic sites on cotton (Rattanaphani et al., 2005).

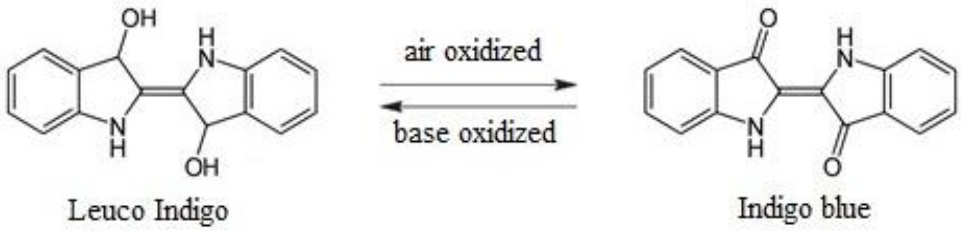

Figure 1. Redox reaction of indigo

Chitosan which ispolycationic biopolymer has an extremely high affinity for many classes of dyes such as disperse, direct, reactive, acid, vat, sulfur and naphthol dyes (Al-Sagheer et al., 2014). Chitosan contains the primary amino groups that protonated at acidic condition, producing positive charges which enhances further absorption of dyes (Chattopadhyay et al., 2012; Hao et al., 2016). Chitosan is a natural linear polysaccharide produced commercially by deacetylation of chitin from crustaceans such as crabs, shrimp, and fungi.Chitosan is non-toxic, biodegradable, biocompatible, and chemically modified (Kasiri et al., 2013). In textiles processing, chitosan was commonly used such as dye fixing agent, to improve the color fastness, antimicrobial agent and as a binder in pigment printing (Chattopadhyay et al., 2012).Chitosan can be applied to the textile fabrics by spray and foam, coating, exhaust, pad-dry-cure techniques. On the other hand, chitosan nanoparticles have unique pshyco-chemical properties such as large surface area that contain more cationic sites and high reactivity(Zhang et al., 2010; Vellingiri et al., 2013).

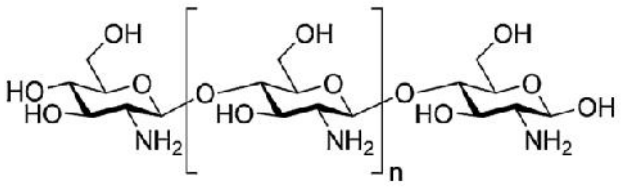

Figure 2. Chemical structure of chitosan

Chitosan has low affinity in alkaline/basic condition. To improve dye ability, chitosan has been crosslinked to cotton using chemicals such as glutaraldehide, silica, *dimethyloldihydroxy ethylene urea* (DMDHEU), and polycarboxylic acid (Chao et al., 2003; Junaidi, 2008; Vellingiri et al., 2013). In this study, the effects of the particle size of chitosan and crosslinker agent (citric acid) concentration on cotton fabrics on the quality of indigo dyeing process to impart dye ability were studied.

2. Materials and Methods

2.1. Materials

Chitosan with degree of deacetylation (DD) >90% was obtained from PT. Biotek Surindo, Cirebon, West Java. Natural Indigo dye was purchased from Prawoto Batik, Yogyakarta. 100% cotton fabric of Primisima was used. A sample size of 15 cm x 10 cm was used for each application. Sodium tri poly phosphate (STPP), acetic acid 98% and citric acid were purchased from Merck. Brown sugar was used as reductor agent and aquadest.

2.2 Methods

2.2.1. Synthesis of Chitosan Nanoparticles

Chitosan nanoparticles were obtained by ionic gel method preparation. Chitosan (0.2% w/v) was dissolved in 1% acetic acid for 2 hours under magnetic strirring. Then, 0.84 g/L of

STPP solution was added to the chitosan solution at a volume ratio of 5:2 (chitosan: STPP) while strirring (Tsai, et al., 2011).

2.2.2. Characterization of Chitosan Nanoparticles

The size distribution of chitosan nanoparticles was measured by Particle Size Analyzer (PSA)with dynamic light scattering (DLS) method, using PSA Horiba SZ-100.

2.2.3. Coating of Chitosan Nanoparticles on Cotton Fabrics

The cotton fabrics were kept immersed in the solution containing bulk chitosan and chitosan nanoparticles solutions (0,2% w/v) and citric acid solution at different concentration of 0-8% as a crosslinker, material to liquor ratio (MLR) 1:40 for 30 minutes at 50 ^{o}C. Then, the cotton fabrics were dried at 80 ^{o}C for 5 minutes and cured at 120 ^{o}C for 2 minutes to fix the chitosan.

2.2.4. Indigo Dyeing Process

Indigo dye solution was prepared by dissolving indigo dye, brown sugar and aquadest with MLR 1:1:10 for 30 minutes under magnetic stirring, then kept for 24 hours. Bulk chitosan and chitosan nanoparticles treated cotton fabric samples were dyed with indigo dye at a liquor ratio 1:40 (fabric weight (g): dyeing bath volume (mL)) at ambient temperature for 15 minutes, then, fabrics were oxidized for 5 minutes.

2.2.5.Characterization of Cotton Fabrics Treated Chitosan Nanoparticles

The presence of functional groups and molecular interaction between components in cotton fabrics treated were analyzed with Fourier-Transform Infrared (FTIR). The recorded spectra were ranging from 4000-400 cm^{-1}.

2.2.6. Measurement of Color Strength (K/S)

The color strength (K/S value) was obatained from the reflectance measurment on the samples by UV-vis spectrophotometer at wavelength 380-780 nm. Then, K/S value was calculated from the Kubelka-Munk equation (equation 1):

$$K/S = \frac{(1-R)^2}{2R} \quad (1)$$

Where K and S are the absorbance and scattering coefficient, R is the reflectance ratio measured at the maximum absorbance using a reflective spectrophotometer.

2.2.7. Color Fastness

The washing fastness was evaluated in accordance to the standard SNI ISO 105-C06 2010 method. The washing of samples were conducted at 50 ^{o}C for 30 minutes, rinsed with cold water, dried at ambient temperature and analyzed by grey scales and staining scales.

3. Results and Discussion

3.1 PSA Analysis

The particle size of chitosan nanoparticles dispertions were determined using Particle Size Analyzer (PSA) with dynamic light scattering method. The previous researchers pointed outthat the concentrations and ratio of chitosan and TPP solutions have important effects on chitosan particle size (Yang et al., 2010). Fig 3. Shows that the particle size distribution of chitosan naniparticles tend to be homogeneous. The diameter of chitosan nanoparticles are found to be is in the range of 356.20-402.44 nm with an avarage diameter is 364.20 nm.

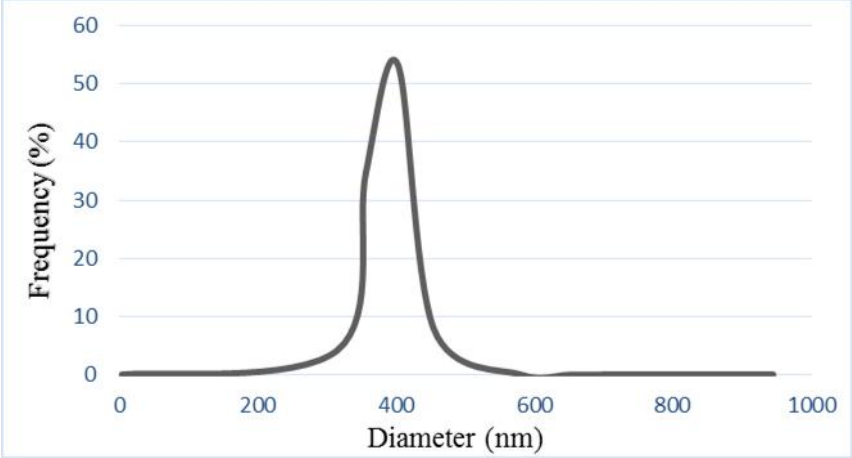

Figure 3. Particle size distribution of chitosan nanoparticles

3.2 FTIR Analysis

Fourier-transform infrared spectra were used to identify the presence of functional groups and intermolecular interactions on the surface of the untreated and treated cotton. FTIR spectra of untreated cotton fabric, treated cotton fabric with nanochitosan-citric acid, treated cotton fabric with nanochitosan-citric acid-indigo were shown in Fig. 4(a), 4(b) and 4(c), respectively. As shown in Fig. 4(a) for untreated cotton, peaks at 3350 cm^{-1} and 2904 cm^{-1}can be assigned to stretching vibration of O-H and C-H groups. Fig 4(b) has shown characteristic peatks at 3344 cm^{-1}assigned to streching vibration of primary amino groups and hydroxyl groups, then at 1640 cm^{-1} associated with C=O of amide 1, at 1282-1237 cm^{-1}related to the C-O streching vibration. The bands at 1725 cm^{-1}confirm the presence of citric acid. It can be observed that the presence of new band at 1639 cm^{-1} in assigned to COO^- and NH_3^+ groups indicate ionic interaction between citric acid and chitosan.

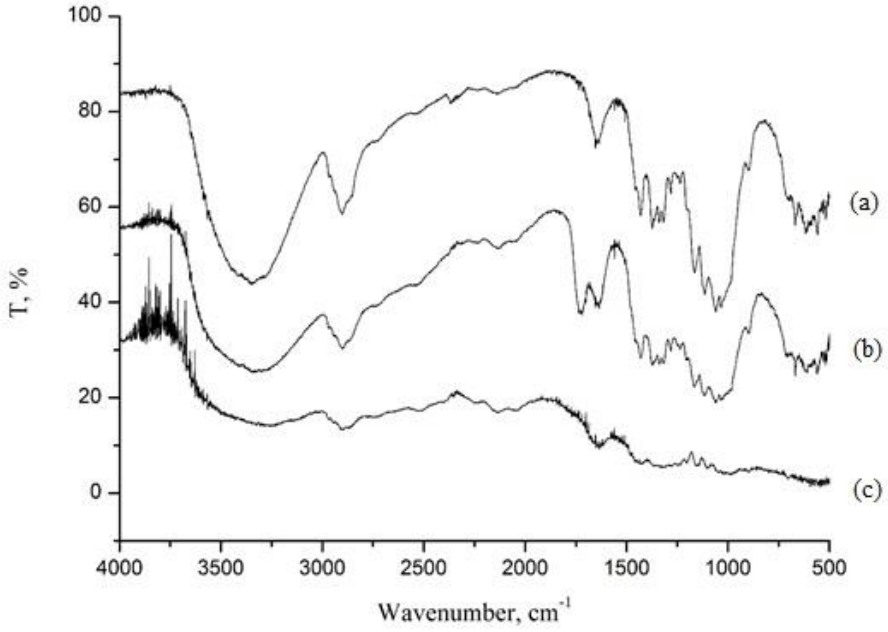

Figure 4. FT-IR spectra of (a) untreated cotton fabric; (b) treated cotton with nanochitosan-citric acid; (c) treated cotton with nanochitosan-citric acid-indigo

3.3 Color Strength (K/S)

Dyeing using natural indigo dye was carried out on cotton fabrics untreated and treated using chitosan/nanochitosan-citric acid. The results obtained are set out in Table 1 and Fig. 5. According to the K/S value,it can be seen that untreated cotton fabric showed a lower dye

uptake compared to the treated cotton fabrics dyed. Fig.5 reveals that chitosan nanoparticles treated cotton fabrics exhibit much higher K/S values than those treated with bulk chitosan. It is also observed that the different concentrations of citric acid effected into color strength values. The optimum concentration of citric acid for color strength is 5%.Thus, the increase of color strength can be explained by thepresence of active primary amino (cation) groups of chitosan which can dissipate the negative surface charge on cotton and drive indigo dye molecules to the fibre (Chattopadhyay et al., 2013). On the other hand, the dye uptake may also been enhanced due to the presence of carboxylic groups from citric acid.

Table 1.The color strength of untreated and treated cotton fabrics dyed with indigo dye

Cotton Substrate	R%	K/S
Untreated	42.61	0.39
Treated with bulk chitosan/citric acid (0%)	39.30	0.47
Treated with bulk chitosan/citric acid (2%)	22.41	1.34
Treated with bulk chitosan/citric acid (5%)	20.00	1.60
Treated with bulk chitosan/citric acid (8%)	22.50	1.33
Treated with nano chitosan/citric acid (0%)	23.22	1.27
Treated with nano chitosan/citric acid (2%)	14.72	2.47
Treated with nano chitosan/citric acid (5%)	11.75	3.31
Treated with nano chitosan/citric acid (8%)	15.71	2.26

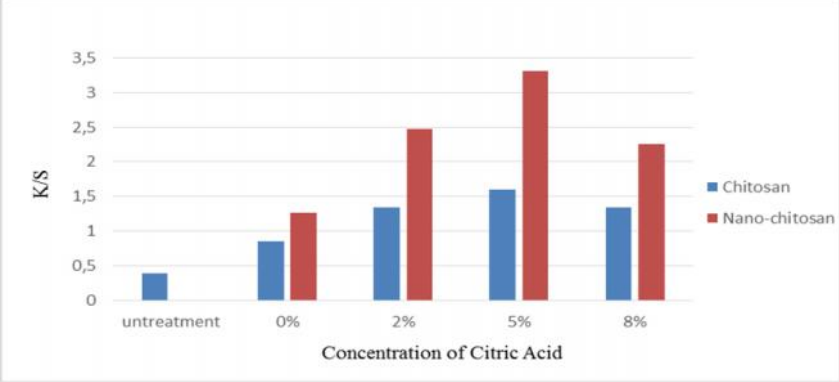

Figure 5. The effect of particle size of chitosan and concentration of citric acid on the color strength of indigo dyed cotton samples.

3.4 Color Fastness

Table 2. presented the wash fastness of indigo dyed cotton fabrics were analyzed. According to the results, the ratings of color fastness by washing for grey and staining scales of treated cotton fabrics are good compared to untreated cotton fabrics. It was found that the studied dyeing fastness were improve when cotton was treated by chitosan/nanochitosan. It should be mentioned that almost no color change was observed at treated cotton cotton (1= most difference, 5= no difference).

Table 2. washing fastness of indigo dyed cotton fabrics

Cotton Substrate	Grey Scales	Staining Scales
Untreated	4	4
Treated with bulk chitosan/citric acid (2%)	4-5	4-5
Treated with bulk chitosan/citric acid (5%)	4-5	4-5
Treated with bulk chitosan/citric acid (8%)	4-5	4-5
Treated with nano chitosan/citric acid (2%)	4-5	4-5
Treated with nano chitosan/citric acid (5%)	4-5	4-5
Treated with nano chitosan/citric acid (8%)	4-5	4-5

4. Conclusion

In this study, the dye ability of natural indigo dye treated with chitosan/nanochitosan-citric acid on cotton fabrics has been investigated. Chitosan nanoparticles due to large surface area might enhanced dye ability of indigo dye.Citric acid addition could improve the dye uptakeof the natural indigo dye on cotton fabric. The highest color strength value was achieved by nano-chitosan/citric acid with 5% citric acid concentration.Use of nano-chitosan as biomordants might enhanced the ability of natural indigo dye and as an alternative method that may help to reduce the reliance on toxic metal salt mordants.

Acknowledgements

This study was supported by Biomaterial Research Group of Chemical Engineering Department, Gadjah Mada University.

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Flexural Properties of Tropical Natural Fibres Reinforced Epoxy Composites Prepared Using Vacuum Bagging Method

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Abstract

This paper discusses the results of experimental investigation on the flexural properties of natural fibre composites prepared using vacuum bagging method. The reinforcement fibres were derived from tropical grown natural fibers which include jute, sisal, hemp and bamboo fibre that reinforced epoxy polymer resin. The flexural properties of each laminate were tested and assessed thoroughly. The results showed that all composite laminates have fairly comparable flexural strength which varied from 47.17 MPa for hemp fibre composite to 62.72 MPa for jute fiber composite. Natural fiber composites based on sisal and bamboo fibre provided almost comparable flexural strength, which was 54.35 MPa and 53.34 MPa, respectively. The flexural modulus properties differs by a significant amount. Jute fibre composite has the highest flexural modulus (3459 MPa), which is approximately 73 percent higher than bamboo fibre composite (2001 MPa), the lowest value reached in this study. Meanwhile, sisal and hemp fibre composite reached a slightly different flexural strength of 2322 MPa and 2489 MPa, respectively. In general, the results are comparable to the results of the previous studies. The stress-strain curves for all the tested laminates presented a linear elastic behaviour up to the final failure. Some specimens showed a slight strengthening beyond the ultimate load, and then collapsed in a sudden motion. Most of the specimens failed due to fracture at the bottom part under the loading point, which is a common failure mechanism of natural fiber composite tested under three point bending load.

Keywords: Natural fiber composites, flexural properties, vacuum bagging method

1. Introduction

Over the past two decades, extensive researches have been conducted to investigate the use of natural fibers as reinforcement in polymeric and cementitious matrices. As reported by Salit (2014), most of the commonly used natural fibers are native in tropical areas including pineapple, banana, sisal, hemp, jute, bamboo, cotton, abaca and many more. The most common fabrication process reported in literatures is a hand lay up method, especially in a preliminary works. In this method, the composite is formed by manually mixing and placing layers of reinforcement fibers and resin matrix onto an open mold surface until the desired thickness is achieved (Kaynak and Akgul, 2001; Akovali, 2001). Today, hand lay up method is still extensively used especially for large components but in lower quantities. The disadvantages of this method is that the quality of products is mostly depended on the skill of the workers. It seems that a similar shortcomings also encountered in laboratory works which causes a large discrepancies of the testing results. Actually, there are a lot choices of fabrication process that can be used in the production of natural fibre composites (NFCs). Among those options, vacuum bagging method may be used as an alternative to meet the quality while maintaining affordable cost. This method combines a manual method using hand-layup or spray-up on the open mold to produce a laminated component with a vacuum process after covering the laminated using polymeric sheet (Kaynak and Akgul, 2001; Akovali, 2001).

As already indicated earlier, there are a large differences in reported literatures about the properties of NFCs including their flexural properties. Few important works dealing with the flexural properties of NFCs are listed in Table 1. A quick impression given by the obtained data in the table is that there has a widely fluctuated data of flexural strength within the reported studies. The flexural strength ranges from 47.82 MPa for gomuti/polyester composite to a maximum of 128.5 MPa for bamboo/polyester composite. The highest value almost two

and half times of the least. While the flexural modulus lies between 2490 MPa for sisal/polyester composite and 5020 MPa for hemp/polyester composite.

Table 1. Flexural properties of natural fibre composites obtained from several literatures

No	Fibre	Matrix	Flexural Properties		References
			Flexural Strength (MPa)	Flexural Modulus (MPa)	
1	Jute	PVC	62.6	3200	Khan et al. (2011)
2	Banana	Polyester	65	-	Pothan et al. (2002)
3	Gomuti	Epoxy	64.71	3150	Sastra et al. (2005)
4	Gomuti	Polyester	47.82	3400	Ticoalu et al. (2010)
5	Jute	Vinylester	128	-	Ray et al. (2001)
6	Sisal	Polyester	99.5	2490	Prasad and Rao (2011)
7	Bamboo	Polyester	128.5	3700	Prasad and Rao (2011)
8	Hemp	Polyester	54	5020	Rouison et al. (2006)

Flexural and tensile properties are the most common mechanical properties examined in developing natural fiber composites. Other mechanical properties such as shear and compressive properties are slightly less attracted the researchers. The results of both tests provide extremely important properties, which are the elastic modulus and the stiffness of the material. The flexural test is commonly used to select a suitable material that support loads without flexing. As the intended used of NFCs is largely for material that supporting flexural loads, examining this property is extremely important during the development process. This paper reports the results of experimental investigation on the flexural properties of natural fibre composites prepared using vacuum bagging method. The reinforcement fibres were derived from tropical grown natural fibers which include jute, sisal, hemp and bamboo fibre that reinforced epoxy polymer resin.

2. Materials and Methods

2.1. Materials and Sample Preparation

The fibres which includes jute, sisal, hemp and bamboo were collected from various sources and also in different form. Jute fibers were in the form of woven with a commercial name of Hessian jute, while sisal fiber was in the form of unidirectional long fibers. The mechanical properties of sisal fiber reinforced epoxy composite were actually reported previously (Fajrin, 2016). In this paper, the flexural properties are presented again to compare with others. Hemp fiber was already in the form of hemp mat, while bamboo were randomly chopped. The natural fiber composites were prepared using a vacuum bagging process as shown in Figure 1.

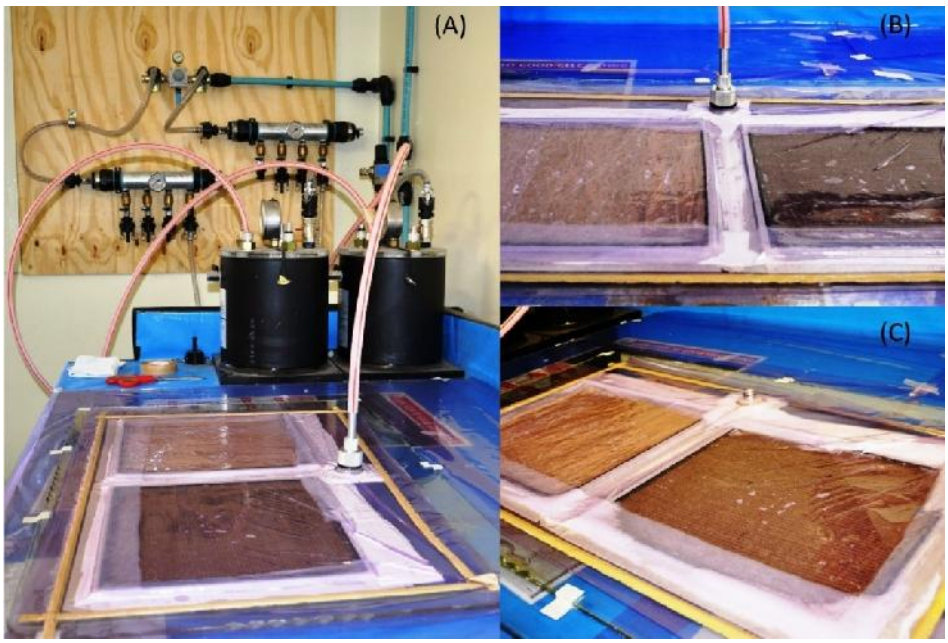

Figure 1. Sample fabrication using vacuum bagging method. (A) Vacuum bagging equipment, (B) Applying the pressure, and (C) Curing the laminates.

2.2. Experimental Procedure

The flexural test was conducted as per ISO standard, which is ISO 14125 (British Standard, 1998); a standard test for the determination of flexural properties of fibre-reinforced plastic composites. A flexural test is typically carried out on simply supported beams where the test specimen is deflected at a constant rate until the specimen fractures or until deformation reached some pre-determined value. The test was carried out using a MTS machine with a maximum load capacity of 10 kN. The testing speed applied was 2 mm/min, as recommended by the standard. Five specimens of recommended dimensions were prepared for each natural fiber composite laminate. The specimen was in a flat rectangular shape and supported close to the ends and centrally loaded in three-point bending. In order to minimize membrane stress, a typical roller and pin support was used allowing the specimen to rotate. The testing program for flexural testing of laminate in this work is presented in Figure 2.

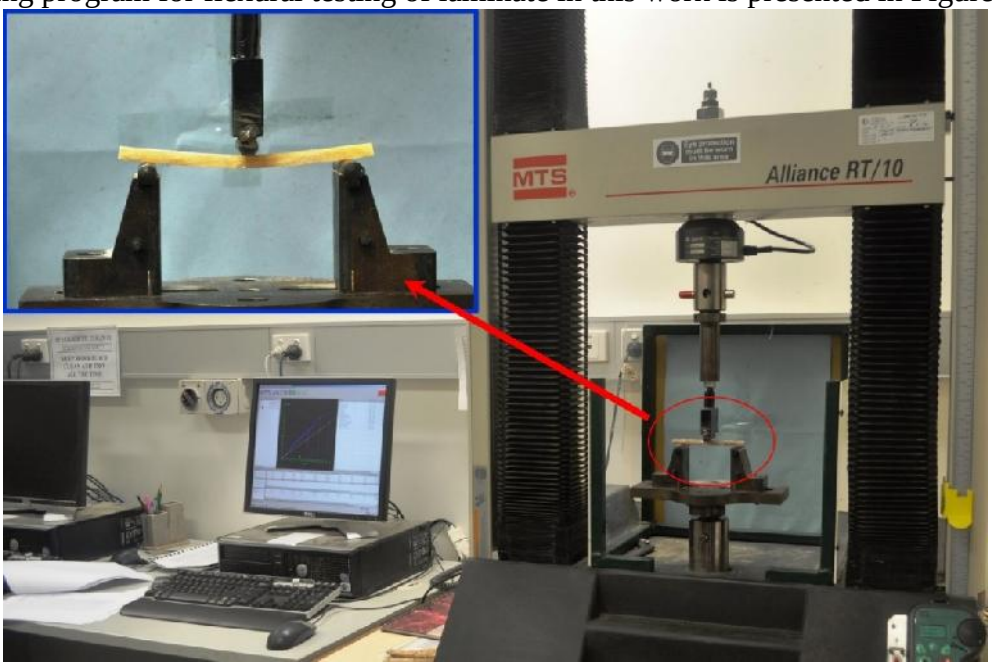

Figure 2. Setting-up testing machine for the flexural test

3. Results and Discussions

As stated in EN ISO 14125 (British Standard, 1998), the referred standard for flexural test in this work, flexural stress is the nominal stress in the outer surface of the test specimen at mid span, while flexural modulus isthe modulus of elasticity in flexure which is the ratio of stress difference divided by correspond strain difference. The results of tensile testing are tabulated in Table 2, which include some important parameters such as flexural strength, flexural modulus and deflection at peak load. In natural fibre composites researches, it is well understood that there has a lot of variations in their properties. It is therefore, checking the consistency of the provided data is very important prior to further analyze them. The distribution of coefficient of variations (CV) might provide some important information relates to the quality of the fabrication or testing process. As it can be seen in Table 2, the CV values ranges from 9.24 to 62.52 percent, which can be considered as high. The high values of CV indicates the inconsistency in the quality of samples.

In more general values, the average of CV values was approximately 15 to 20 percent, with the exception for the CV value of the flexural modulus data of BFC. The CV value for this data was 62.52 percent which may be contributed by one or two peculiar observed data among the specimens. However, the variation of the data which is called as noise is, to some extent, also normal. The noise is usually called as experimental errors that may arise from various factors (Montgomery, 2009).

Table 2. Flexural properties of natural fiber composites

Natural Fibre Composites	Flexural Strength		Flexural Modulus		Deflection at Peak	
	Average (MPa)	CV (%)	Average (MPa)	CV (%)	Average (MPa)	CV (%)
Jute Fiber Composite (JFC)	62.72	16.02	3459	9.24	4.74	15.61
Sisal Fiber Composite (SFC)	54.23	16.96	2322	24.98	6.40	19.69
Hemp Fiber Composite (HFC)	47.17	21.88	2489	19.12	7.41	11.07
Bamboo Fiber Composite (BFC)	53.34	18.12	2001	62.52	4.57	21.23

3.1. Flexural Strength

The flexural strength of various NFCs examined in this study is presented in Figure 3 (A). It is clearly demonstrated in the figure that JFC has the highest value of flexural strength, which is around 62.72 MPa. While in contrast, HFC has the lowest value with the flexural strength of 47.17 MPa; approximately 32.9 percent lower than JFC. In addition, SFC and BFC provided almost comparable flexural strength, which was 54.35 MPa and 53.34 MPa, respectively. The difference between the two NFCs is only about 2 percent. Further, the performance of JFC obtained in this study almost similar to the work reported by Khan et al. (2011), where jute reinforced polyvinyl chloride (PVC) has the flexural strength of 62.6 MPa. The result also parallel to the flexural strength of banana/polyester composite (Pothan et al., 2002) and gomuti/epoxy composite (Sastra et al., 2005), which is 65 MPa and 64.71 MPa, respectively. In addition, sisal fiber composite obtained in this study has a significant lower value (54.35 MPa) compared to the flexural strength of sisal/polyester composite examined by Prassad and Rao (2011) which reached the value of 99.5 MPa. Bamboo/epoxy composite studied in this work also has a pretty lower flexural strength compared to the bamboo/polyester composite reported by Prassad and Rao (2011). The flexural strength of BFC (53.34 MPa) was only approximately half of the previous work, which is and 128.5 MPa. Similarly, the flexural strength of HFC (47.17 MPa) is also lower than hemp/polyester reported by Rouosin et al. (2006), which reached the value of 54 MPa. Although the

difference it is not greatly significant, which is around 15%, the strength of composite using epoxy should be theoretically stronger than composite using polyester matrix. However, the variations in the properties of natural fibre composites have been well understood which may arise from many factors related to the material and manufacturing process.

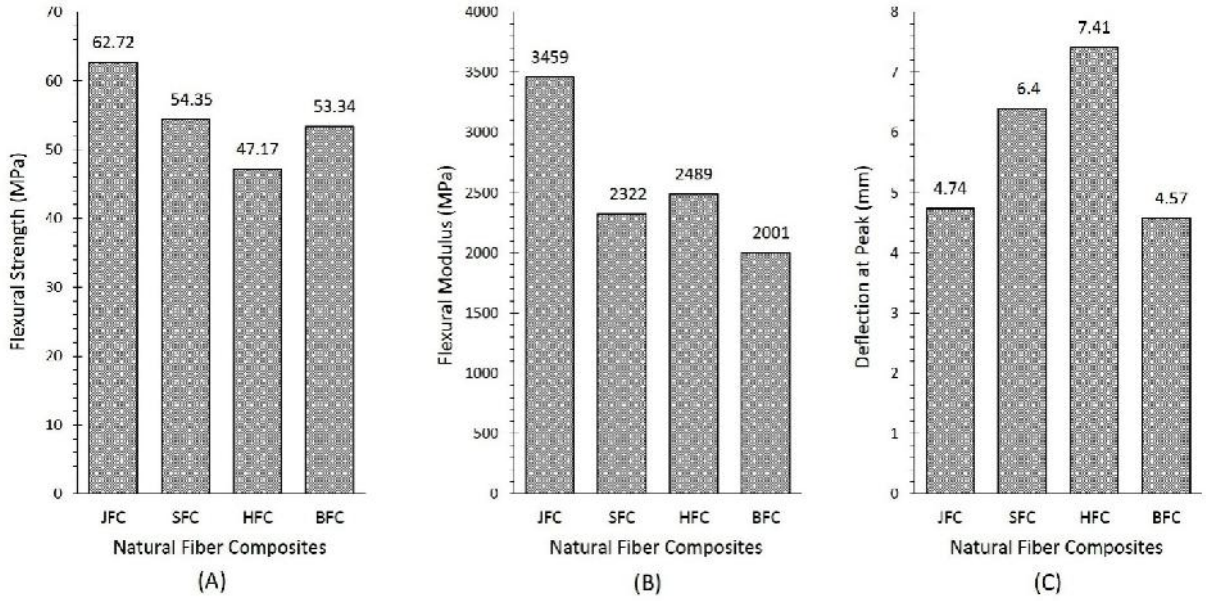

Figure 3. Flexural properties of lignocellulosic composites; (A) Flexural strength, (B) Flexural Modulus, and (C) Deflection at peak load

3.2. Flexural Modulus

Figure 3 (B) shows the flexural modulus of the natural fiber composites obtained in this study. JFC has the highest flexural modulus (3459 MPa), which is approximately 73 percent higher than BFC (2001 MPa), the lowest value reached in this study. Meanwhile, SFC and HFC reached a slightly different flexural strength of 2322 MPa and 2489 MPa, respectively. The difference between the two composites is only around 7 percent, while their differences with JFC is considered as significant which is approximately 50 percent for SFC and 40 percent for HFC. The difference is most likely due to the nature of each fiber used in this study. In general, the values of flexural modulus of composites provided in this works are comparable to the previous reported works as shown in Table 1. As clearly shown in the table, the flexural modulus lies between 2490 MPa to 3700 MPa, except for hemp/polyester composite (5020 MPa). The flexural modulus of Jute/PVC composite (Khan et al., 2011), gomuti epoxy composite (Sastra et al., 2005) and gomuti/polyester composite (Ticoalu et al., 2010) was 3200 MPa, 3150 MPa and 3400 MPa, respectively. While polyester reinforced with sisal fiber (Prassad and Rao, 2011), bamboo fiber (Prassad and Rao, 2011) and hemp fiber (Rouosin et al., 2006) has the flexural modulus of 2490 MPa, 3700 MPa and 5020 MPa, respectively.

3.3. Deflection at Peak

In relation to the stiffness of a material, deflection is also an important parameter that needs to be evaluated. A stiff material only slightly changes under elastic loads. Figure 3 (C) shows the deflection of the natural fiber composites obtained in this study under the peak load. Regarding their deflection at peak load, JFC and BFC may be categorized in the same cluster where they reached almost the same values of 4.74 and 4.57 mm, respectively. While in slightly higher values, SFC and HFC provided a deflection of 6.4 and 7.41 mm,

respectively. It can be assumed that, in regards to the scope of this study, JFC and HFC are much stiffer than SFC and HFC.

3.4. Mode of Failures and Stress-Strain Graphs

The failure pattern of different natural fibre composites investigated in this research is shown in Figure 4. Some specimens collapsed in a sudden motion and displayed a slight strengthening beyond the point of ultimate load. All natural fibre composites examined in this work, regardless of their nature of fibers, failed due to fracture at the bottom part which acted a tension region of the specimen under the loading point. This failure mechanism is commonly observed for specimens tested under a three point bending test. The typical stress-strain graphs of different natural fibre composites tested under flexure in this study are presented in Figure 5. As shown in the figure, the stress-strain curves showed a linear elastic behaviour up to a final failure.

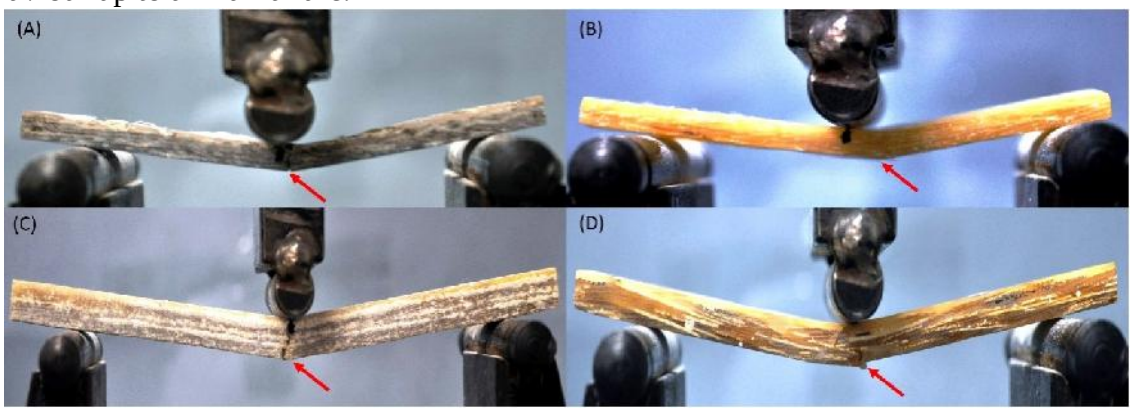

Figure 4. Failure mode of natural fiber composites under flexural load; (A) Jute fiber composite, (B) Sisal fiber composite, (C) Hemp fiber composite, and (D) Bamboo fiber composite

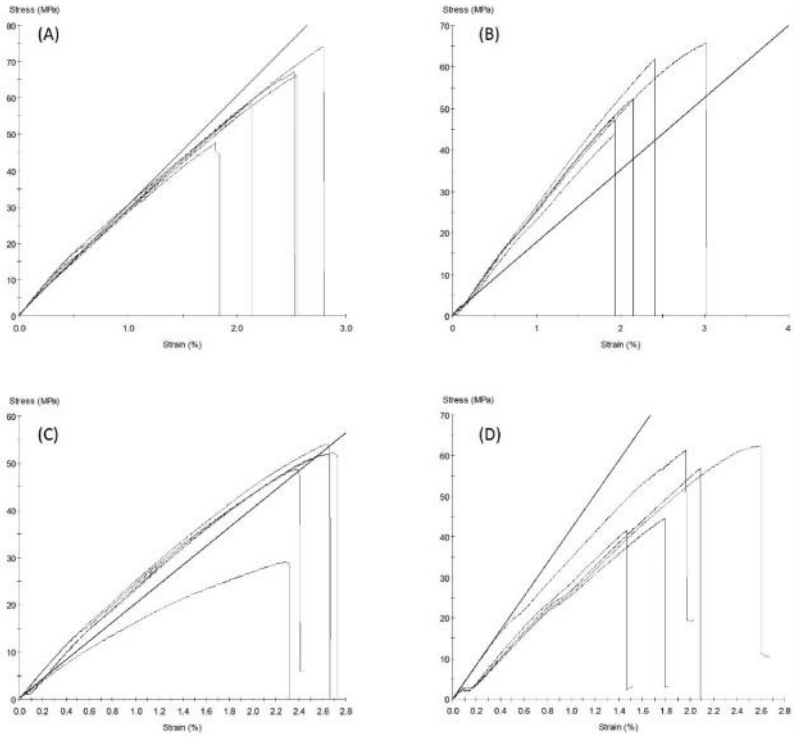

Figure 5. Stress-strain graphs of natural fiber composites under flexural load; (A) Jute fiber composite, (B) Sisal fiber composite, (C) Hemp fiber composite, and (D) Bamboo fiber composite

4. Conclusion

A comparison study on the flexural properties of natural fiber composites derived from tropical grown natural fibres and prepared using vacuum bagging method has been investigated comprehensively. The results show that the flexural properties of the composites are comparable to the previousstudies. More specific findings are as follow:

1) All composite laminates have fairly comparable flexural strength which varied from 47.17 MPa for hemp fibre composite to 62.72 MPa for jute fiber composite. Natural fiber composites based on sisal and bamboo fibre provided almost comparable flexural strength, which was 54.35 MPa and 53.34 MPa, respectively.
2) The flexural modulus properties differs by a significant amount. Jute fibre composite has the highest flexural modulus (3459 MPa), which is approximately 73 percent higher than bamboo fibre composite (2001 MPa), the lowest value reached in this study. Meanwhile, Sisal and hemp fibre composite reached a slightly different flexural strength of 2322 MPa and 2489 MPa, respectively.
3) The stress-strain curves for all the tested laminates presented a linear elastic behaviour up to the final failure. Some specimens showed a slight strengthening beyond the ultimate load, and then collapsed in a sudden motion. Most of the specimens failed due to fracture at the bottom part under the loading point, which is a common failure mechanism of natural fiber composite tested under three point bending load.

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The Efficacy of Various Croping Paterns to Utilize a Carry Over Fertilizer Aplication from Tobacco.

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Abstract

The use of chemical fertilizers is constantly increase in agricultural practices in Lombok.Agriculture development in Lombok Island facing a seriousl problem such as land degradation, intensive change of land function, water crisis and climate change. Goverment of NTB concern on improving environmental carrying capacity Lombok famers prefere to grow tobacco following rice. The largest area of tobacco plantation in Lombok are in East Lombok district (17, 862 Ha) and Central Lombok district (11,727 Ha) respectively. Most farmers apply fertilizer above the requirement that cause degradation of soil quality, However that can benefit the following crops. The aim of this research was to to evaluate the efficacy of various croping paterns to utilize a carry over fertilizer aplication from tobacco. The cropping patterns that were applied: 1) rice - tobacco – intercropping of chilli and tomato, 2) rice - tobacco – intercropping of corn and soybean. The crops after tobacco were only fertilize by organic fertilizers at 5 tonnes/Ha. Results showed that nitrogen (N) residues from first cropping pattern were 0.10%, 0.13% and 0.12% after rice, tobacco, and intercropping of chilli and tomato respectively. Phosphorus (P) residues were 107.51, 133.04, and 87.94 ppm respectively, while Potassium (K) residues were 35.40, 33.47, and 33.54 ppm respectively. For the second cropping pattern, N residues were 0.11%, 0.13%, and 0.15% after rice, tobacco, and intercropping of corn and soybean respectively. P residues were 26.59, 42.66, and 39.32 ppm respectively. While K residues were 33.20, 25.20, and 24.81 ppm respectively.

Keywords: chemical fertilizers, cropping patterns

I. Introduction

Agricultural land plays important role to the livelihood of human beings. Therefore, it has to used in a sustainable way and managed in the best way. In line with rapid grow of population and increasing necessity of human beings, demand for basic needs like agricultural products is increasing too. However, the allocation of land used for agriculture is limited. Unless, the land use considers the efforts to conserve the land's function and its capacity, it will create damage and threaten the preservation of the land source. (Juhadi, 2007)

Degraded land is the reduction of land quality that will affect the rate of land productivity (Blumm, 1988 in Agustinus Yohannes, 2013). The excessive fertilizers to a land will cause the low efficiency and environmental pollution (Nurdia,2007). Most of the destruction are caused by the mismanagement to the agricultural system, in both sub-system and sophisticated agriculture with mechanic use. (Hurni, 2000).

Based on experts' research, generally crops cannot absorb 100 % of chemical fertilizer. There will be some Residue. The Residue of chemical fertilizer left on the ground, if it mixed by water will tie land like glue or cement (Charisma R., 2014).

After drying, land will be tighted with others (or it is no longer fertile) and it becomes strong. Beside, the land will be acid. This condition will cause death to the nutrient components (organisms which fertile land) or at least decrease its population. If it happens, land can no longer provide its own food, and eventually will be too much dependent on the additional fertilizers, especially the chemical fertilizers.

The use of precise and efficient fertilizers will increase the output of agriculture and enhance the farmer's income by minimizing the cost of production per square meter. The income of farmers can be enhanced by increasing the efficiency of production factors which

consist of planting efficiency and the use of fertilizer's Residue in a planting system rotation, other than rationalization of production's factor use like fertilizers and pesticides. (Makarim et al., 2003). The tobacco plantation has been the most favoured in NTB which cover the widest area in the District of East Lombok (17, 862 Ha) and in the District of Central Lombok (11,727 Ha). The result of of the regional map of agricultural commodity interpretation based on the agroecology zone in the District of East Lombok with the scale of 1: 50.000 (Alkusuma, dkk., 2004) known that the class of suitability of tobacco farm in the District of East Lombok is suitable enough (S2) and most of areas spread in the paddy farm that relies on rain in the Sub district of Keruak, Jerowaru, Sakra, West Sakra, East Sakra, Terara, Montong Gading and Sikur. There are also irrigated Paddy farm such as in the Subdistricts of Masbagik, Pringgesela, Selong, Sukamulia, Selong, Pringgabaya, Suela, Wanasaba, and Sambelia (Wisnu W,et al., 2005).

Nowadays, tobacco which becomes the source of livelihood for most of people who live in Central Lombok and East Lombok has been a problem caused of its plantation's effect to the environment, not only for the current time but in the near future as well after the tobacco plantations are finished. One of the cause is the use of land continuously for the tobacco plantation. This will impact to the degrading quality of land cause of input from the excessive use of fertilizer and the effect of chemical fertilizer's Residue to the ground when tobacco plantation was conducted intensively (Nurjihadi M, 2012). This research is aimed at understanding the changing composition of chemical fertilizer to the land by setting the suitable plant to grow so it can preserve the quality of the land in post-tobacco plantation n the Central Lombok and East Lombok. To evaluate the efficacy of various croping paterns to utilize a carry over fertilizer aplication from tobacco.The substance composition of the chemical fertilizer's Residue to the land by setting pattern for cropping. As information for next research, and can be used as an alternative in the agricultural activities.

2. Materials and Methods

This research methodology is conducted with diskriptive analize and participatory approach by involving farmers since the beginning of the planning till the evaluation phase. Farmers are given some choices of commodities, farmers are given freedom to choose by considering farmers choices and the cultivation that consists of (the suitability of land and climate). The co-operator is members of farmers group who ever grew tobacco and the surrounding farmer who have never planted tobacco.

This research is conducted in two locations which are in the District of Central Lombok and the District of East Lombok which are the centre of tobacco plantation. The implementation were scheduled fom January till December 2013.

Data used in this research are taken from Desk Study, survey and action Research by implementing physical activities by technique of example in the land that is used for the tobacco plantation. Then, it is analyzed in descriptive analysis, land analysis, and economic analysis with R/C.

The Exsperiment was conducted in East and Central Lombok Districts, between January and December 2013. Four croping paterns was porpositly alocated in two diferent site. The croping paterns wer in east Lombok, Rice-Tobacco- Corn
Rice-Tobacco- Soybean in Central Lombok Rice-Tobacco- Chilly Rice-Tobacco-Tomatoes Data Collated revenue of Production, profit, N,P, dan K values on soil (ppm), were analysis in Descritive analysis, land analysis and Economic analysis with R/C

3. Results and Discussion

These research activities are conducted on partisipatory approach and deskriptive analize by involving farmers since the beginning of planning till the evaluation phase. As a result of farmers' choices, it can be categorized into some plant grow setting as alternative to

tobacco which are paddy-tobacco-**bera** (the existing plant setting), in Central Lombok the plant setting A paddy-paddy-corn, the second Plan Setting paddy-paddy-soybean, while in East Lombok, the First Plan Setting is paddy-paddy-chilli and the second plant setting is paddy-paddy-tomatoes.

Table 1 The nutrient status before and after the plant setting alternatively to Tobacco in the District of East Lombok and Central Lombok (2013)

No.	Area	Condition	Commodity	N (%)	P (ppm)	K (ppm)
1.	Rarang Village Subdistrict Terara District of East Lombok	Before		0,10	107,51	35,40
		After	Commodity A (Chilli, Tomatoes) Tobacco A	0,12 0,13	87,94 133,04	33,54 33,47
2.	Jango Village Subdistrict Janapria District of Central Lombok	Before		0,11	26,59	33,20
		After	Commodity B (Corn, Soybean) Tobacco B	0,15 0,13	39,32 42,66	24,81 25,20

Source: extracted Primary Data

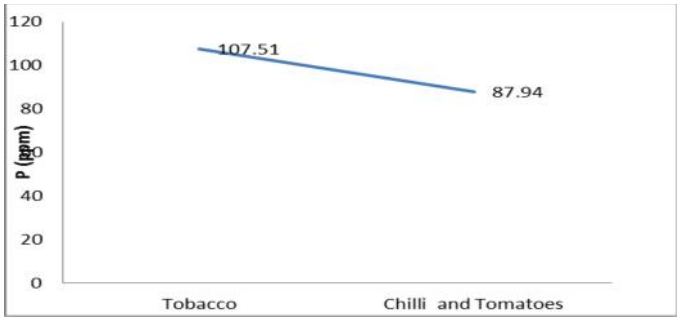

Figure 1. The nutrient P status before and after the plant chilli and tomatoes in to East Lombok

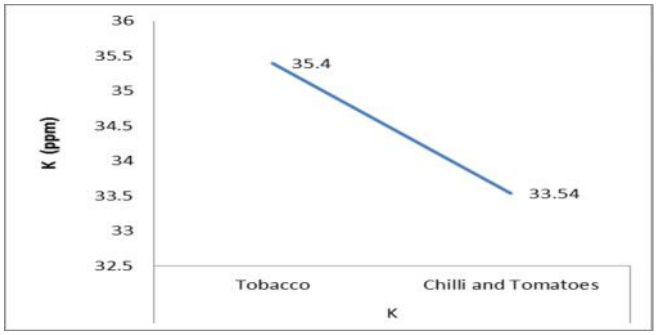

Figure 2. The nutrient K status before and after chilli and tomatoes in to East Lombok

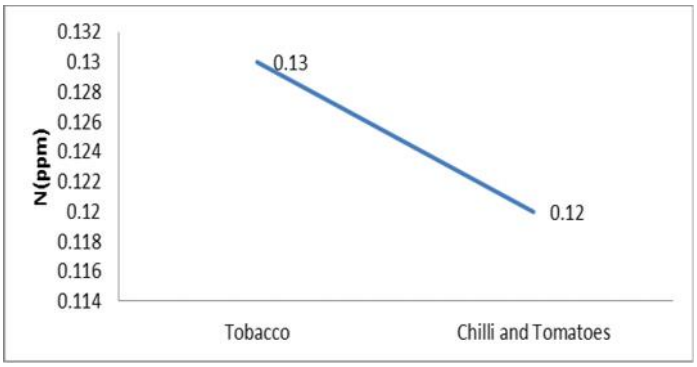

Figure 3. The nutrient N status before and after chilli and tomatoes in to East Lombok

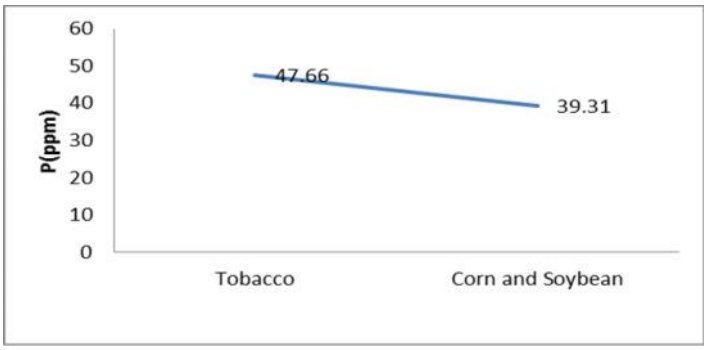

Figure 4. The nutrient P status before and after corn and soybean in to central Lombok

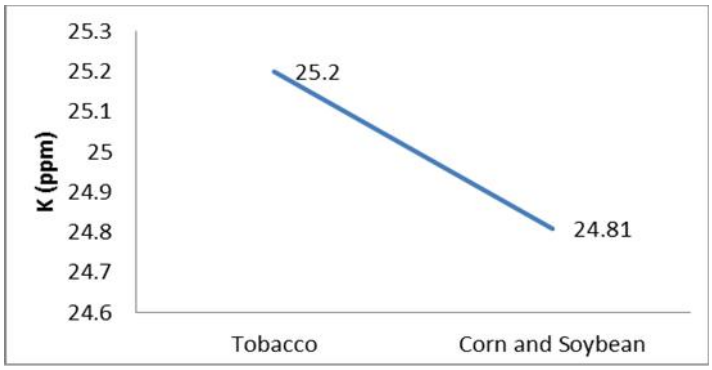

Figure 5. The nutrient K status before and after the plant corn and soybean in to East Lombok

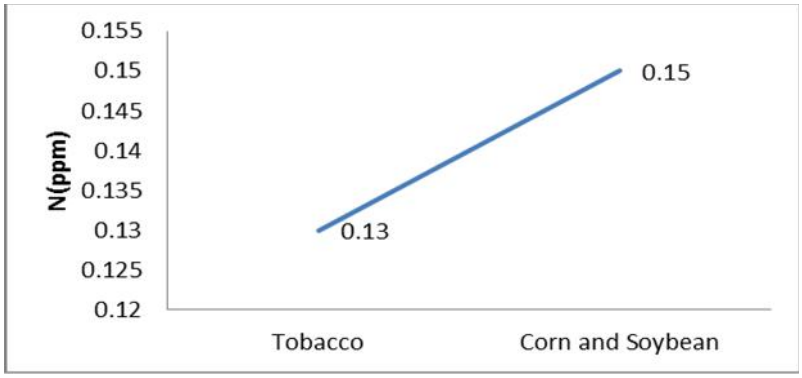

Figure 6 The nutrient N status before and after corn and soybean to Tobacco in to East Lombok

The nutrient status N, P, K of land at the cropping land (0-20 cm) in each location is stipulated through the experiment in the laboratory is presented. It can be seen that the nutrient status of total fertilizer P is at the very high range because it is over 20 (Balittanah, 2008).

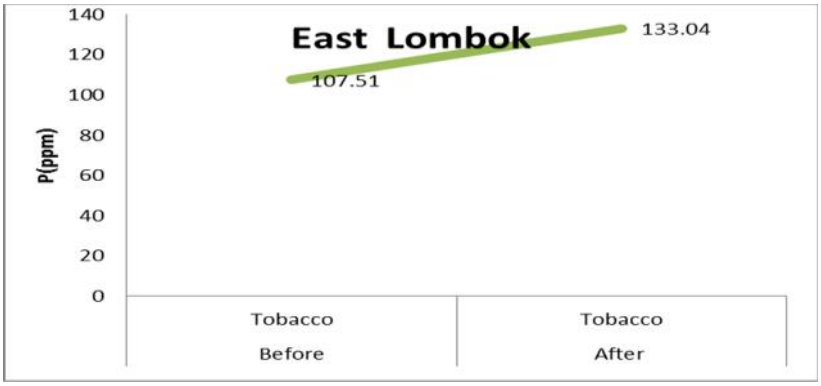

Figure 7. The nutrient status of total fertilizer P in East Lombok

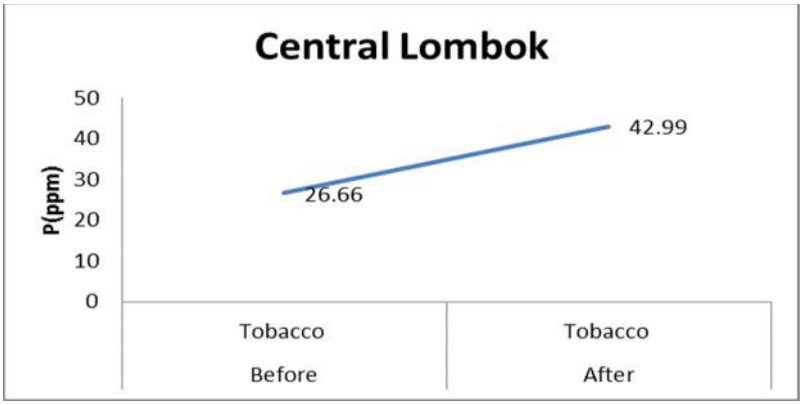

Figure 8. The nutrient status of total fertilizer P in Central Lombok

The same result obtained by setting the plants grow which are initially tobacco to the chilli and tomatoes can change the nutrient status of land by reducing the Residue of chemical fertilizer Residue of P from 133,04 to 87,4, while the Residue of fertilizer N is decreased from 0,13 to 0,12. At the other hand, the plants setting of corn and soybean can lower the Residue of chemical fertilizer P from 42,66 to 39,22 and chemical fertilizer Residue of K from 25,20 to 24,1.

Table 2. the proper study of alternative farming other than tobacco in Central Lombok and East Lombok (2013)

No.	Commodities	Revenue (Rp/ha)	Profit (Rp/ha)	R/C
11	Corn	13.451.416	5.187.416	1,62
22	Soybean	9.240.000	3.180.000	1,52
33.	Chilli	69.139.000	53.899.500	4,43
44.	Tomatoes	48.211.500	33.181.500	3,20
55.	Tobacco	45.666.667	10.912.381	1,31

Source: extracted primary data
Note: RC Ration is bigger than one. It means that this agricultural effort should be tried Rp. 3500/kg.

Based on the research result, the production of corn for average is around 6.114,28 kg/ha. The price of corn is Rp. 2.200/kg. The revenue is around Rp. 13.451.416/ha, while the profit is around Rp. 5.187.416/ha. The Ratio of R/C is about 1, 62.

The production of soybean for a planting season is about 1300 kg/ha. The price is about Rp. 7.000/kg. The obtained revenue is Rp. 9.240.000 and the profit is Rp. 3.180.000/ha. R/C Ratio is around 1,52.

The Production of Chilli for a planting season for average is about 19.754 kg/ha. the price is about Rp. 3.500/kg. The revenue Rp. 69.139.000/ha, and the profit is Rp. 53.899.500/ha. R/C ratio is 4,43.

The Production of tomatoes for a planting season is about 32.141,43 kg/ha. the selling price is about Rp. 1500/kg. The revenue is about Rp. 48.211.500/ha and the profit is about 33.181.500/ha. R/C Ratio is 3,20.

The production of Virginia tobacco for one season of planting is about 2.158 kg/ha. The selling price is Rp. 21.250/kg. The obtained revenue is about Rp. 45.666.667/ha while the profit is about Rp. 10.912.381/ha, with the RC Ratio is around 1,31.

4. Conclusion

A Croping patern padi -tobacco- corn and Maize have a high efikasi to utilize a carry over P (phosphorus) fertilizer from tobacco . The obtained result by setting the plant growing with padi-tobacco- chilli and padi-tobacco -tomatoes can change the nutrient status by reducing the Residue of chemical fertilizer of P from 133,04 to 87,4 on the area in East Lombok. The Residue of fertilizer N is reduced from 0,13 to 0,12. At the other hand, for the corn and soybean plantation can reduce the chemical fertilizer Residue of P from 42,66 to 39,22 and chemical fertilizer residue of K from 25,20 to 24,1.

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El-Nino Characteristics Based On Reservoir Volumetric

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Abstract

Reservoirs are built for various purposes such as storage water during the rainy season. The water fluctuation of the reservoir is strongly influenced by the climate indicating the inflow and outflow of the reservoir. The reservoir inflow is incoming water in the form of river and rain stream, while outflow reservoir is evaporation, seepage and water irrigation requirement. El-Nino is an event of low intensity of rain below the average and occurs over a long period of time. The current El-Nino is can only identified from the high evaporation and the low depth of rain, making it very difficult to predict the occurrence of EL-Nino. The reservoir storage has a measurable volume that can be used to predict the occurrence of El-Nino events very easily and very accurately. This study aims to identify the characteristics of El-Nino based on the volumetric changes of reservoirs in the ZOM region from the reservoir site. Semi-monthly data in the year of El-Nino occur are used in this investigation. The results showed that strong, moderate and weak El-Nino indicated by decreasing reservoirs volumetric of ≥50 %, 30-50%, and ≤ 30%, respectively.

Keywords: El-Nino, reservoir, volumetric

1. Introduction

The history of extreme droughts has occurred simultaneously with the phenomenon of anomaly rising sea surface temperatures in the tropical Pacific known as El Nino - Southern Oscillation (ENSO) in 1982/1983, 1986/1987, 1991/1992, 1997/1998, 2002 / 2003, and 2009/2010.El-Nino is a climate change phenomenon that caused various disasters in the Indonesian territory. The impact of drought affects various sectors especially agriculture, plantation, forestry, water resources, and environment. Drought monitoring and prediction is a very important activity to do, so that the impact of drought can be anticipated and minimized (Erna, 2014). Climate change events in the form of El-Nino are frequent but monitoring is only done based on low rainfall intensity and the rate of evaporation. The monitoring has a very weak accuracy because of the many influencing factors such as area factors, measuring tools and human resources. Drought is one type of natural disaster that occurs slowly (slow-onset disaster), has a very wide and cross-sectorial impact including economic, social, health, education, etc.

Drought is a natural phenomenon that cannot be avoided and is a normal variation of the weather. Greenhouse effect, deforestation and industrial development cause extreme climate change especially for Australia, Indonesia, India and Africa. El-Nino occurs globally and repeatedly affecting various aspects of agriculture, social and economic (Philander, 1989).

The global average temperature on the earth's surface has increased by 0.78 + 0.18 ^{o}C (1.33 + 0.32 ^{o}F) over the past hundred years, resulting in climate change .This is due to global warming on earth that significantly affect climate change and result in changes in temperature, air humidity, solar irradiance, wind speed, wind direction and rainfall. According to Las et.al (1999), the influence of El Nino is stronger against the rain in the dry season than in the rainy season. On average, the decrease in rainfall from normal due to the occurrence of El Nino can reach 80 mm per month while the increase of rain from normal due to the occurrence of La Nina less than 40 mm.

Reservoirs have several functions such as to accommodate water during the rainy season, flood control, domestic and non-domestic water sources, irrigation water supply and electrical energy sources. The reservoir is built in a watershed that has a maximum pool so that it can

provide water for a long period of time. In the future, the reservoir function can be expanded as an indicator of regional drought. This is because the facilities and infrastructure of measuring instruments in the reservoir is completely available such as inflow measuring instrument and outflow reservoir, changes in water level, seepage of reservoir.

Changes in the water level of the reservoir are very dynamic depending of inflow and outflow. The decrease in water level of the reservoir will not always be the same in every period. The water condition of the reservoir will provide an overview of the climatic events and water availability of the area as indicated by the change in water volume of the reservoir. Analysis of water level reduction of the reservoir in a certain period can identify the occurrence of El-Nino event.

2.2 Materials dan Methods

2.1 Materials

The data used in this research is water volume data of daily reservoir at several period of El-Nino event. The research location is Batujai reservoir located in Central Lombok Regency of West Nusa Tenggara Province, Indonesia.

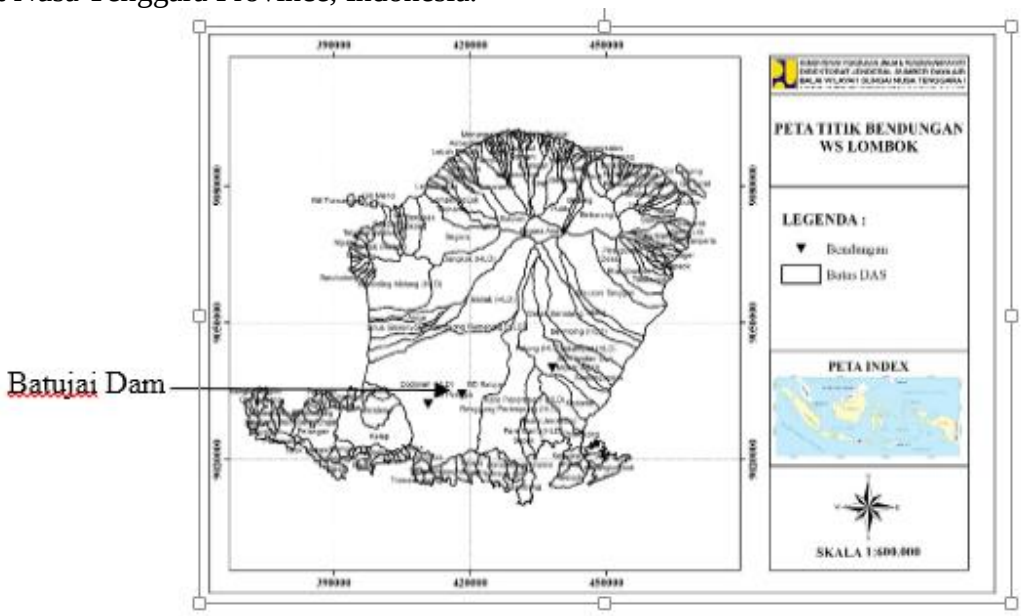

Figure 1. Map of Batujai reservoir location

2.2 Methods

Analysis of El-Nino characteristics using fixed threshold method is 50% reservoir volume condition of effective volume of reservoir. El-Nino is characterized in three categories i.e. weak, moderate and strong. The range used for El-Nino weak if the reservoir volume deficit is smaller than 30%, moderate volume deficit reservoir volume between 30% - 50%, while El-Nino strong reservoir deficit volume is greater than 50%. Statistical analysis is used to determine the parameters such as:

1. Threshold (Xo), is a limit value determined based on analytical requirements in accordance with the selected distribution.
2. Xo is Q50 because it is a normal Q with a probability of 0.5. or is a median.

The magnitude of the reliable value of a hydrological even can be determined using the following equation:

$$P = \frac{m}{n+1} \quad (1)$$

Where:

P : probability

n : amount of data.

m : serial number of data

In determining the El-Nino characteristics of the reservoir volumetric data, the frequency analysis is performed by grouping the data. The steps of frequency analysis performed are as follows:

a) Determining the maximum and minimum values of the reservoir volume data
b) Determining the number of classes using the Sturgerss equation:
   $k = 1 + 3{,}3 \log n$ (2)
c) Determining the interval of data classes
d) Determining the lower class limit
e) Determine the middle value of the class in each class

3. Results and Discussion

Based on the results of volumetric analysis of reservoirs indicate the occurrence of El-Nino phenomenon in the Batujaiby the reservoir volume deficit. The data used are reservoir volume at the time of El-Nino. The occurrence of El-Nino is shown in Table 1.

Table 1. The occurrence of El-Nino

El-Nino			
Weak	Moderat	Strong	Very Strong
1951-1951	1963-1964	1957-1958	1982-1983
1952-1953	1986-1987	1965-1966	1997-1998
1953-1954	1987-1988	1972-1973	2015-1016
1958-1959	1991-1992		
1968-1969	2002-2003		
1969-1970	2009-2010		
1976-1977			
1977-1978			
1-79-1980			
1994-1995			
2004-2005			
2006-2007			

Source : ggweather.com/enso/oni/htm

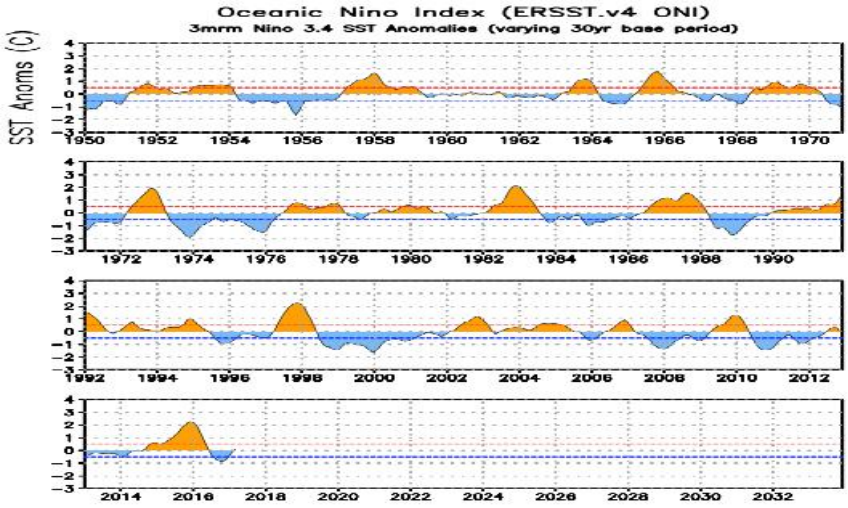

Figure 2. El-Nino and La-Nina Years
Source: National Weather Service, 2017

3.1. Weak El-Nino's characteristics

Since the construction of the Batujai dam, the weak El-Nino incident occurred in 1977-1978, 1979-1980, 1994-1995, 2004-2005 and 2006-2007. The decrease in reservoir volume ranges from 1x106 m3 to 3x106 m3 or an average of less than 30%. The time of El-Nino is weak for almost a year and will return to normal the following year unless El-Nino continues. The water volume of the reservoir at the time of weak El-Nino never reaches the reservoir's effective volume but always above the average volume. Indication of El-Nino weak is denoted if the maximum volume deficit from the reservoir is 30%. The average decrease in volumetric reservoirs during this period is shown in Figure 3.

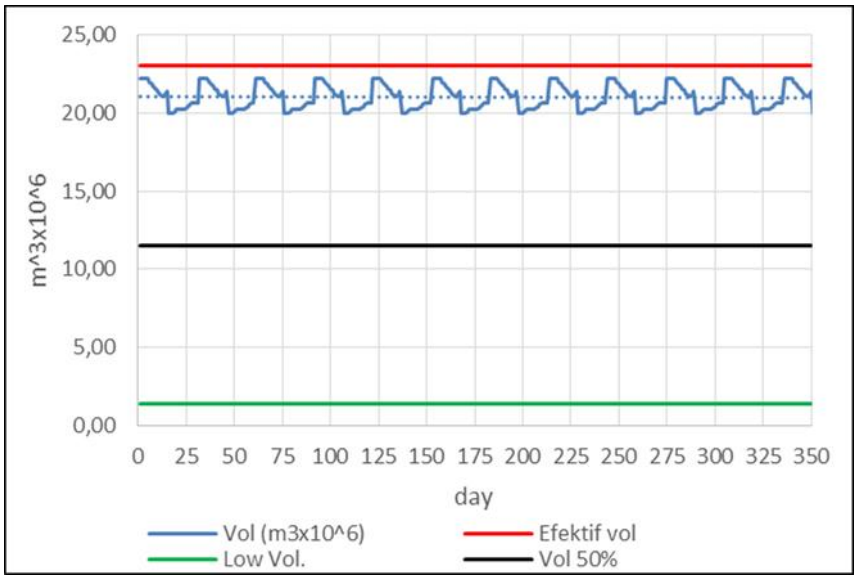

Figure 3. Graph of volumetric fluctuation of the reservoir at the time of weak El-Nino

3.2. Moderat El-Nino's characteristics

The moderate El-Nino events occurred in the years between 1986-1987, 1987-1988, 1991-1992, 2002-2003,2009-2010. In the moderate El-Nino period the volumetric drop pattern of the reservoir is very different from the weak El-Nino. In this period the decline began to occur in April and the most extreme in August. The reservoir's volumetric deficit in this period is not up to 50%. The pattern of decreasing the water volume of the reservoir occurs slowly and in certain periods the decrease is very extreme. The moderate El-Nino events will greatly influence the pattern of reservoir operations especially in times of extreme decline. The characteristic of moderate El-Nino is indicated by volumetric retention of reservoirs ranging from 30% - 50%.

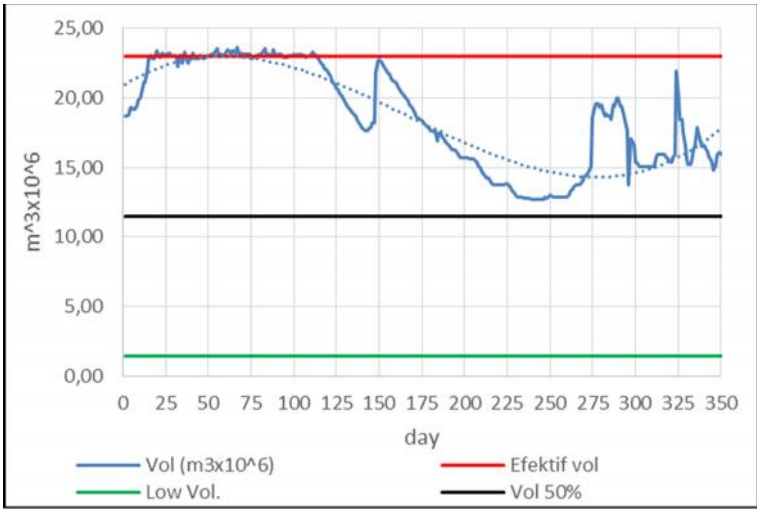

Figure 4. Graph of volumetric fluctuation of the reservoir at the time of moderate El-Nino

3.3. Very strong El-Nino characteristics

The very strong El-Nino phenomenon occurred in 1982-1983, 1997-1998 and 2015-2016. Strong El-Nino has caused a very extreme drought in a very long period of time. Surface water sources are becoming shrinking and inflow reservoirs are very small. The decrease in reservoir volume is under the average volume of the normal reservoir and almost reaches the volume of the dead reservoir. The decrease in reservoir volume reaching 50% indicates that El-Nino has been very strong.

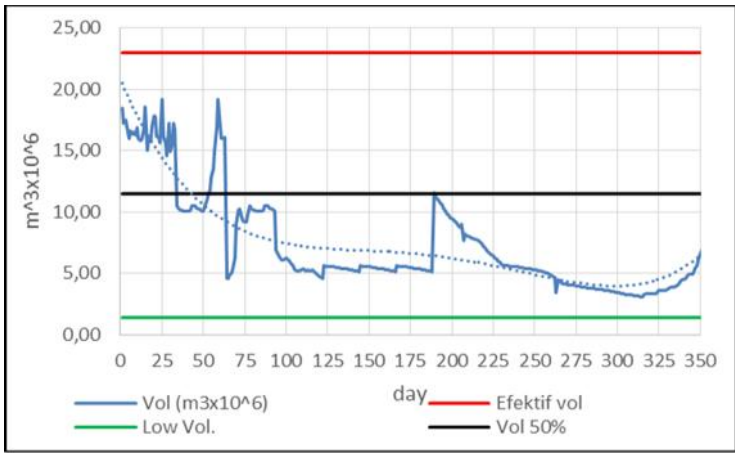

Figure 5. Graph of volumetric fluctuation of the reservoir at the time of very strong El-Nino

4. Conclusion

Based on the results of the analysis, several points can be concluded in the following:

1) Long-term volumetric fluctuations in reservoirs can provide an accurate prediction of potential regional water resources and regional climate change.
2) Prediction of El-Nino event characteristics can be observed from the volumetric decrease of the reservoir. The decrease in water volume of the reservoir reaches 30% indicating weak El-Nino, 30% - 50% decrease is moderate El-Nino and a decrease above 50% indicates is very strong El-Nino

Acknowledgments

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Finite Element Modelling of Creep Glued-Laminated Bamboo

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Abstract

Glued-laminated bamboo is classified as a viscoelastic material because it possesses properties that are common to both perfect solids and liquids. Under long term constant loading the glued-laminated bamboo will causing creep deformation. Creep behaviour is well known as one of the primary structural behaviours to be understood for the development analysis and design of glued-laminated bamboo structures. There are three methods can be used to describe the creep behaviours of viscoelastic material. One method of predicting the creep response of some viscoelastic materials is by mechanical model, where the long term creep deformation represented by a set of springs and dashpots. The well accepted mechanical model to predict creep of glued-laminated bamboo is the four solid elements, usually called Burger model. In this manuscript, the constitutive equation Burger model is converted into relaxation shear modulus of prony series in ABAQUS finite element software

Keywords: glued-laminated bamboo, creep, finite element, burger model, prony series

1. Introduction

In recent years, bamboo has been widely used to replace timber as building material. The bamboo can typically be harvested in less than 3 - 4 years, renewable and sustainable material, mechanical properties similiar with timber (Sharma et al., 2015; Ni et al., 2016). The originally bamboo cross section is hollow and has limited dimension. By using laminated technology, the rectangular elements of bamboo glued together will product new material called glued-laminated bamboo. Its have been applicatedto many members of building structures such as beam, column and truss.

Glued-laminated bamboo is classified as a viscoelastic material because it possesses properties that are common to both perfect solid and liquid. Under long term constant loading the glued-laminated bamboo will causing creep deformation. Creep behaviour is well known as one of the primary structural behaviours to be understood for the development analysis and design of glued-laminated bamboo structures (Holzer et al., 1989; Gottron et al., 2014). Usually, three methods can be used to describe the creep behaviours of viscoelastic material. One method of predicting the creep response of some viscoelastic materials is by mechanical model, where the long term creep deformation represented by a set of springs and dashpots (Findley et al., 1976). The well accepted mechanical model to predict creep of glued-laminated bamboo is the four solid elements, usually called Burger model. This model has been proved in many creep tests, it not only can be applied to describe the creep phenomenon but also can be used in the program of finite element method conveniently. In this manuscript, the constitutive equation Burger model is converted into relaxation shear modulus of prony series in ABAQUS finite element software.

2. Burger Model of Creep

Burger model is derived by assembling Kelvin and Maxwell bodies in parallel configuration (Fig. 1). The model capable to predict both primary and secondary creep.

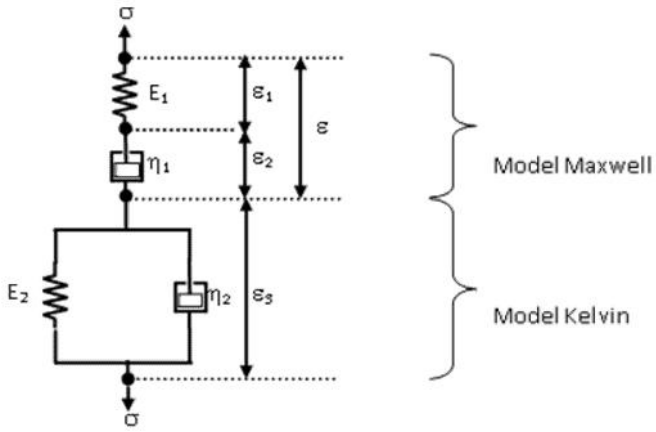

Figure 5. Mechanical Element of Burger Model (Findley et al., 1976)

Kon and Yuan (2010) have been converted Burger model to prony series. Constitutive equation of Burger modelcan be expressed as

$$\pm + p_1\pm + p_2\pm = q_1£ + q_2£ \quad (1)$$

p_1, p_2, q_1, $q_2$expressed by elastic modulus then

$$p_1 = \frac{\dagger_M E_M + \dagger_M E_K + \dagger_K E_M}{E_M E_K}, p_2 = \frac{\dagger_M \dagger_K}{E_M E_K}, q_1 = \dagger_M, q_2 = \frac{\dagger_M \dagger_K}{E_K} \quad (2)$$

If $E_M = 2G_M, E_K = 2G_K, \dagger_M = 2\dagger'_M, \dagger_K = 2\dagger'_K$, so

$$p_1 = \frac{\dagger'_M G_M + \dagger'_M G_K + \dagger'_K G_M}{G_M G_K}, p_2 = \frac{\dagger'_M \dagger'_K}{G_M G_K}, q_1 = 2\dagger'_M, q_2 = 2\frac{\dagger'_M \dagger'_K}{G_K} \quad (3)$$

where,

$$G_M = \frac{E_M}{2(1+«_M)}, G_K = \frac{E_K}{2(1+«_K)}$$

$$\dagger'_M = \frac{\dagger_M}{2(1+«'_M)}, \dagger'_K = \frac{\dagger_K}{2(1+«'_K)} \quad (4)$$

If the deformation of viscoelastic bulk ignored, where $«_K = «'_M = «'_K = 0{,}5$

Convert Burger model into Laplace transform

$$\overline{Y}(s) = \frac{q_1 s + q_2 s^2}{s(1 + p_1 s + p_2 s^2)} = \frac{1}{p_2}\left\{\left[\frac{q_1}{(s+\sim)(\quad-\sim)} + \frac{q_1}{(s+\quad)(\sim-\quad)}\right]\right.$$

$$\left. + \left[\frac{q_1 \sim}{(s+\sim)(\sim-\quad)} + \frac{q_1}{(s+\quad)(\quad-\sim)}\right]\right\} \quad (5)$$

$$\sim, \quad = \frac{p_1 \pm \sqrt{p_1^{\,2} - 4p_2}}{2p_2}$$

Then Laplace inverse transform is applied to the last expression, so

$$Y(t) = \frac{G_M}{(\sim-\quad)}\left[(\sim - \frac{q_1}{q_2})e^{-\sim t} + (\frac{q_1}{q_2} - \quad)e^{-\quad t}\right] \quad (6)$$

Relaxation shearmodulus is requested in ABAQUS, substitution Eqs (2 - 3) into (5).

$$G(t) = \frac{G_M}{(\sim - \quad)}\left[(\frac{G_K}{\quad_K} - \quad)e^{- \quad t} + (\sim - \frac{G_K}{\quad_K})e^{-\sim t}\right] \tag{7}$$

In prony series form,

$$G(t) = G_\infty + \left(\sum_{i=1}^{n} G_i G_0 e^{(-t/\quad_i)}\right) \tag{8}$$

Eqs (8) the series can be expanded into two items (n = 2),

$$G(t) = G_\infty + G_1 e^{(-t/\quad_i)} + G_2 e^{(-t/\quad_2)} \tag{9}$$

where

$$G_\infty = 0, G_1 = \frac{G_M}{(\sim - \quad)}\left(\frac{G_K}{\quad'_K} - \quad\right), G_2 = \frac{G_M}{(\sim - \quad)}\left(\sim - \frac{G_K}{\quad'_K}\right), \quad_1 = \frac{1}{\quad}, \quad_2 = \frac{1}{\sim}$$

If,

$$g(t) = \frac{G(t)}{G_0}$$

$$G(t) = G_\infty + G_0(g_1 e^{(-t/\quad_i)} + g_2 e^{(-t/\quad_2)}) \tag{10}$$

where

$$G_0 = G_M, g_1 = \frac{1}{(\sim - \quad)}\left(\frac{G_K}{\quad'_K} - \quad\right), g_2 = \frac{1}{(\sim - \quad)}\left(\sim - \frac{G_K}{\quad'_K}\right)$$

$E_M, «_M, g_1, g_2, \quad_1, \quad_2$ areparameters of Burger model which can be used in ABAQUS software.

2. Finite Element Modelling Creep

The 3D model of the glued-laminated bamboo beam was created and analysed with finiteelement software ABAQUS.Properties creep data that used for modelling in this manuscript was provided by Li and Xiao (2015). They were measured compression and tension creep of glued-laminated bamboo under normal indoor condition at Hunan University, located in Changshaduringone year (365 days). According to the Burger model, data creep test then evaluated resulting some parameters viscoelastic material of glued-laminated bamboosuch as $E_1 = E_M$, $E_2 = E_K$, $\eta_1 = \eta_M$, $\eta_2 = \eta_K$ showed in Table 1 and conversed in prony series showed in Table 2. The model glued-laminated bamboo beamaccording Eratodi (2014), showed in Fig 1, with different load level P = 10 kN, 20 kN, 30 kN respectively

The procedures are modelling creep of glued-laminated bamboo as follow (i) creategeometry of glued-laminated bamboo; (ii) input the material properties and creep parameters; (iii) use element type C3D20R (20-node quadratic brick, reduced integration), the mesh consist of 2280 elements; (iii) apply the constant loadingunder various applied load level and boundary condition;(iv) use visco analyse type with time periode 365 days, increment 1 and error tolerance 1 x 10^{-6}. The geometry, meshing, apply constant load and boundary condition showed in Fig. 2.

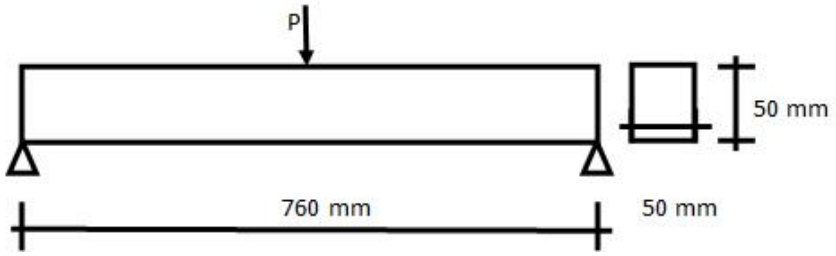

Figure 1. Glued-Laminated Bamboo Beam (Eratodi, 2014)

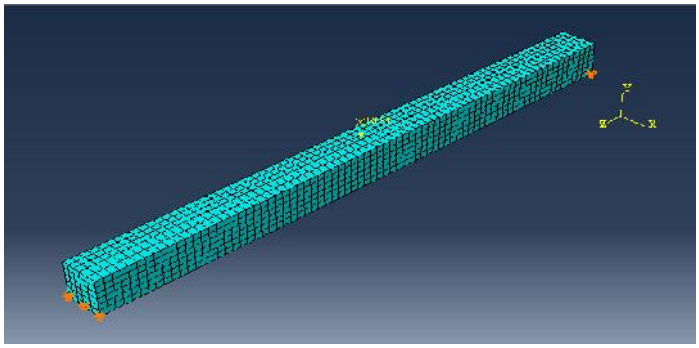

Figure 2. The geometry, meshing, apply constant load and boundary condition glued-laminated bamboo beam

Table1.Creep properties compression and tension of glued-laminated bamboo (Li and Xiao, 2015)

Parameter	Unit	Compression	Tension
$E_1 = E_M$	MPa	4490	5970
$E_2 = E_K$	MPa	3440	1330
$\eta_1 = \eta_M$	MPa/day	27600000	15100000
$\eta_2 = \eta_K$	MPa/day	651300	102400

Table2.Creep properties compression and tension of glued-laminated bamboo in prony series

Parameter	Compression	Tension
g_1	0,88	0,18
τ_1	6951,51	13945,73
g_2	0,11	0,81
τ_2	16,74	13,96

4. Results and Discussion

The results numerical simulation creep displacement behavior of glued-laminated bamboo beam under different load level P = 10 kN, 20 kN and 30 kN showed in Fig. 3 and the maximum diplacement in mid span U_2 showed in Fig. 4, 5, 6 repectively.

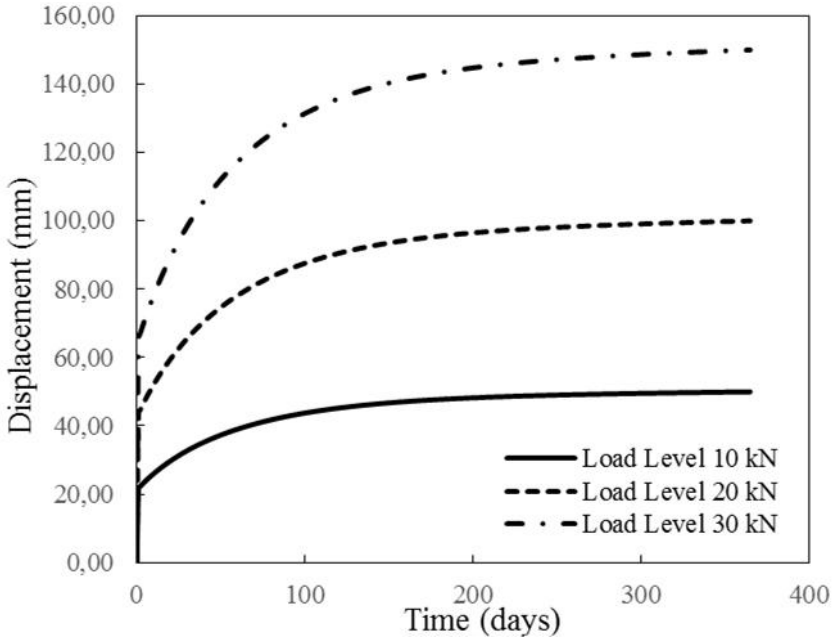

Figure3. Creep displacement U_2 under constant load

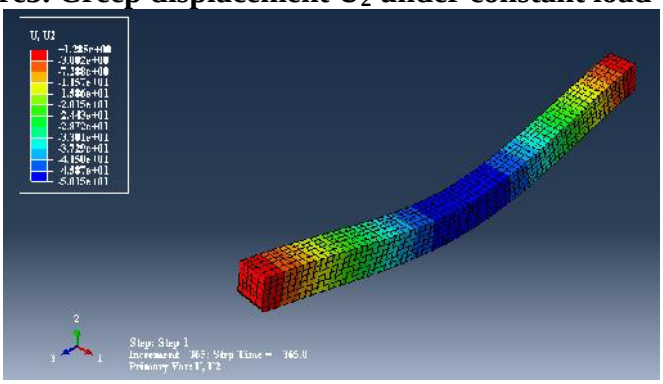

Figure 4. Creep displacement U_2 apply constant load level 10 kN

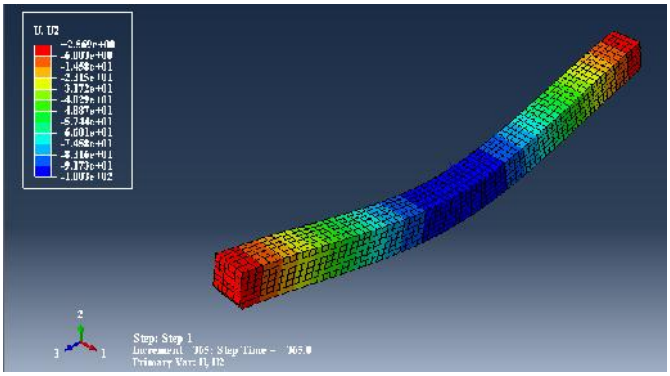

Figure 5. Creep displacement U_2 apply constant load level 20 kN

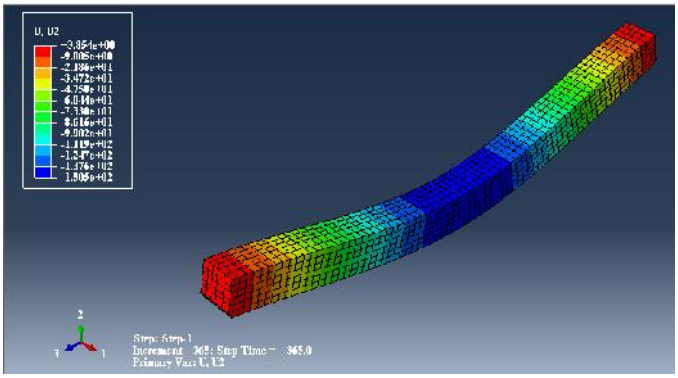

Figure 6. Creep displacement U_2 apply constant load level 30 kN

According to the Fig 3., the initial elastic and creep diplacement of the beam increases in proportion tothe load level. The initial elastic diplacement for load level 10 kN, 20 kN, 30 kN are 21.83 mm, 43.65 mm, 65.48 mm respectively.Here the authors also can evaluate quicklyinitial elastic diplacement based to theelastic theory, displacement of the beam under one unit point load in mid span $\Delta_e = PL^3/48EI$ are 29.41 mm, 58.82 mm, 88.24 mm respectively.In comparison, we can see that the magnitude elastic diplacement theoryare more greater than numerical analysis. The graphic also show primary and secondary creep behaviour of the beam.

The Fig. 4- 6 ilustrate distribution of creep diplacement at time 365 days in the span length. The maximum creep diplacement in various load level 10 kN, 20 kN, 30 kN are 50.15 mm, 100.30 mm, 150.50 mm respectively.

4. Conclusion

Some conclusions according numerical analysis above can be drawn as follows: (1) Burger Model can be used as input parameter properties in ABAQUS with conversed in prony series; (2) The finite element analysisis satisfy method for prediction creep diplacement behaviour of viscoelastic material glued laminated bamboo under constant loading.

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Physicochemical and Sensory Properties of Chicken Stock Powder Added with Carrots Extract (*Daucus carota,* L.)

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Abstract

This research aimed to find out the effects of the comparison levels between chicken feet stocks and carrots extract (Daucus carota, L.) towards the characteristics of instant powder stocks and to get the best formulation of the comparison levels between chicken feet stocks and carrots extract (Daucus carota, L.) towards the characteristics of the instant powder stocks that had been produced. This research used Complete Randomized Design (CRD) that consists of 5 treatments and 3 repetitions. The data were analyzed statistically by using ANOVA test and continued by using Duncan's New Multiple Range Test (DNMRT) on the real standard 5%. The treatments on this research were the comparison levels between chicken feet stocks and carrots extract that were treatment A (chicken feet stocks 95% : carrots extract 5%), treatment B (chicken feet stocks 85% : carrots extract 15%), treatment C (chicken feet stocks 75% : carrots extract 25%), treatment D (chicken feet stocks 65% : carrots extract 35%), and treatment E (chicken feet stocks 55% : carrots extract 45%). The best product of the instant stocks that had been produced was on treatment E (chicken feet stocks 55% : carrots extract 45%) with the chemical characteristics were water content 6.53%, ash content 3.85%, total nitrogen content 1.15%, protein content 7.20%, nitrogen amino content 0.29%, fat content 2.43%, sodium chloride content 1.56%, total carotene 1.51 g/100g. The physical characteristics were yield 35.50%, soluble time 2.15 minutes and colour with value ^{0}hue 5.92 (red-purple) and based on sensory test, the colour 4.23, aroma 3.57, taste 3.50 and texture 3.23.

Keywords: characteristics, instant powder stocks, chicken feet, carrot

1. Introduction

Chicken feet are a part of the chicken that is cooked after an outer layer of thin skin is removed, most of the edible tissue on the feet consists of skin and tendons, with no muscle. This gives the feet a distinct texture different from the rest of the chicken's meat. Being mostly skin, chicken feet are very gelatinous. The protein content of chicken feet about 19.8g/100g and as source of collagen protein (Purwatiwidiaastuti, 2011). Chicken feet with collagen protein can utilize into instant stock.

Stock is a savory liquid made of water in which bones, meat, fish, or vegetables have been simmered. It can be eaten alone, but is most commonly used to prepare other dishes such as soups, gravies, and sauces (Rombauer et al., 1997). In Indonesia there are many types of instant stock with a variety of brands. Most people use instant stock to improve the texture, taste, aroma, and appearance of a food. The use of stock is more practical because it does not need to boil the meat with spices for hours, to produce a cup of stock simply by adding a powdered / instant stock into boiling water to create a ready-made stock. Basically the stock is bone, meat or vegetables boiled to get the flavor of the material, has a distinctive aroma and taste, liquid and slightly yellowish. Liquid stock will quickly deteriorate, therefore drying process needs to be done. The drying process can be done with traditional or modern equipment (Meidiana, 2008).

The commercial stock is considered to contain less vitamin A and vitamin C. This can be seen from the composition of the ingredients and nutritional content many highlight ingredients such as monosodium glutamate and salt that potentially cause hypertension because of the high content of salt, saturated fat and cholesterol (Machbubatul, 2008).

Therefore the stock needs the addition of other ingredients to increase the nutritional content, especially provitamin A and vitamin C contained in carrots. Pro-vitamin A is also

called beta-carotene. Provitamin A is a vitamin A precursor found in plants. The content of carrots is very important for our body, among others, to provide energy, lower blood sugar, maintain eye health, maintain brain health, a complete source of antioxidants, inhibits cancer cell growth, inhibits the aging process, maintain lung health and prevent stroke (Lingga, 2010).

2. Materials and Methods

Broiler chicken meat (shank part), Carrot, maltodekstrin, NaCl, selenium mix, H_2SO_4, NaOH, boric acid, metil red, metil blue, HCl, fenolftalein, formaldehide, *aquades*, hexane, $AgNO_3$, etanol, chloroform. The equipment used where cutter, balance, juicer, screen cloth, gelas glass, spray dryer (mini spray dryer B-290), oven, kdjedahl apparatus, soxhlet apparatus, orbit shaker, sentrifuse, rotary evaporator, spectophotometer color flex EZ.

This research used complete randomized design method that consists of 5 treatments and 3 repetitions. The data were analyzed statistically by using analysis of variance test and continued by using duncan's new multiple range test on the real standard 5%. The treatments on this research were the comparison levels between chicken feet stocks (CFS) and carrots extract (CE) that were treatment A (CFS 95% : CE 5%), treatment B (CFS 85% : CE 15%), treatment C (CFS 75% : CE 25%), treatment D (CFS 65% : CE 35%), and treatment E (CFS 55% : CE 45%).

Methods used in this research: (1) Preparation of raw materials, extraction of carrot and production of chicken stock (Swasono, 2008); (2) Production of instant chicken stock (Lahmudin, 2006). The formulation of instant chicken stock showed in table 1.

Table 1. Formulation of instant chicken stock

Ingredients	Sample				
	A	B	C	D	E
Chicken broth (ml)	665	595	525	455	385
Carrot extract (ml)	35	105	175	245	315
Maltodextrin (g)	70	70	70	70	70
NaCl (g)	10	10	10	10	10

3. Results and Discusion

3.1 Chemical composition of instant chicken stock

The chemical composition of instant chicken stock showed significant difference ($p< 0.05$) between samples (Table 2). The range of moisture, ash, total-N, protein, amino-N, fat, NaCl, and carotene total content were 4.60-6.53%, 3.85-6.42%, 1.15-2.25%, 7.20-14.08% , 0.29-0.41%, 2.43-3.88%, 1.56-1.88% and 0.48-1.51(g/100g), respectively.

Table 2. Chemical composition of instant chicken stock

Sample	Moisture (%)	Ash (%)	Total-N (%)	Protein (%)	Amino-N (%)	Fat (%)	NaCl (%)	Carotene Tot. (g/100g)
CFS95:CE5	4.60±0.02^{e}	6.42±0.06^{a}	2.25±0.02^{a}	14.08±0.13^{a}	0.41±0.01^{a}	3.88±0.01^{a}	1.88±0.03^{a}	0.48±0.31^{e}
CFS85:CE15	4.91±0.08^{d}	5.62±0.04^{b}	2.16±0.04^{b}	13.47±0.23^{b}	0.38±0.01^{b}	3.43±0.01^{b}	1.71±0.02^{b}	0.58±0.35^{d}
CFS75:CE25	5.53±0.05^{c}	4.91±0.01^{c}	1.99±0.03^{c}	12.45±0.16^{c}	0.35±0.01^{c}	3.06±0.02^{c}	1.64±0.01^{c}	0.75±0.38^{c}
CFS65:CE35	6.09±0.70^{b}	4.35±0.02^{d}	1.35±0.02^{d}	8.42±0.13^{d}	0.33±0.01^{d}	2.71±0.01^{d}	1.62±0.01^{d}	1.35±0.34^{b}
CFS55:CE45	6.53±0.04^{a}	3.85±0.04^{e}	1.15±0.52^{e}	7.20±0.32^{e}	0.29±0.01^{e}	2.43±0.02^{e}	1.56±0.01^{e}	1.51±0.64^{a}

$^{a-e}$: Different alphabet superscripts in the same column indicate significant difference ($p\leq0.05$), CFS=chicken feet stock, CE=carrot extract

Table 2 showed the higher of percentage carrot extract and less percentage of chicken stock used on instant chicken stock, the higher of moisure and carotene content. the less the carrot juice and the higher of chicken stock used on instant chicken stock, the higher ash, total-N, protein, amino-N, fat and NaCl content.

Based on results shows the more carrot juice and the less chicken stock used on instant chicken stock, the higher the resulting water content, the less the carrot juice and the more chicken stock used for instant chicken stock, the low moisture content produced. This is assumed by the influence of moisture content of the raw materials used. According to the Directorate of Nutrition of the Ministry of Health RI (2009), water content of carrot is 89.9 g per 100 g of materials, while the moisture content of chicken is lower than water content of carrot about 65.90% per 100 g of material equal to 65.90 g / 100 g of material (Purnomo, 1992). This is caused the more of carrot extract to be used, the higher the water content produced.

In the results obtained showed that the more concentration of chicken stock used the ash content of instant chicken stock is increasing significantly, otherwise the less concentration of chicken stock is used then the ash content of instant chicken stock is lower. This is because chicken feet contain high minerals such as calcium (88 mg), phosphorus (83 mg per 100 g of materials (Purwatiwidiaastuti, 2011). According to Purnomo (1992), ash content of chicken meat (raw) is 3.49%, while ash content of carrot is lower than ash content of chicken meat.

The difference in total nitrogen content that occurs due to differences in the solubility of nitrogen contained in the stock by the different concentration of chicken stock and carrots extract. In the results showed that the more concentration of chicken stock is given then the total nitrogen content of instant chicken stock is also high, otherwise the less concentration of chicken stock is given then total nitrogen content of instant chicken stock will be low.

Differences in protein levels that occur due to differences in protein solubility found in instant chicken stock by the concentration of chicken stock and carrot extract are different. In the test results obtained it can be seen that the more concentration of chicken stock is given then the protein content of instant chicken stockis also high, conversely the less concentration of chicken stock then instant chicken stock the protein content will be low. This is because chicken feet contain higher protein than carrot extract, so the added concentration of chicken stock given can increase the protein content of instant chicken stock. The content of chicken feet protein is 19 g per 100 g of matetials (Purwatiwidiaastuti, 2011), while protein content of carrot is 1.0 g per 100 g of materials (Directorate of Nutrition Department of Health RI, 2009).

Total nitrogen and protein content in all the ingredients of treatments have accordance in the SNI no. 01-4218-1996, the total nitrogen content obtained for instant stock is at least 0.01% equivalent to at least 0.06% protein content. Based on the existing SNI standard, instant chicken stock all treatments in the study have been appropriate and have accordance in the SNI requirements of total nitrogen and protein content of instant stock.

Differences in amino nitrogen levels that occur due to differences in concentration of raw materials used. In the test results obtained it can be seen that the more concentration of chicken stock is given then the amino nitrogen content of instant chicken stock will increase. The amino nitrogen content in all of the ingredients at all treatments has in accordance with the SNI standard no. 01-4218-1996, the amino nitrogen content obtained for instant stock is at least 0.02%. Based on the existing SNI standard, instant chicken stock all treatments in the study have been appropriate and have fulfilled SNI requirements of instant amino nitrogen stock.

Differences in fat levels that occur due to differences in fat solubility found in the stock by the different concentration of chicken feet and carrots extract. In the test results obtained showed that the more concentration of chicken stock used, the fat content of instant chicken

stock increased. This is because chicken feet contain higher fat than carrot extract, the added concentration of chicken feet given can increase the fat content of instant chicken stock. The fatty acid content of chicken is 8 g per 100 g of materials (Purwatiwidiaastuti, 2011), while the fat content of carrot is 0.6 g per 100 g of materials (Directorate of Nutrition Department of Health, 2009). Fat content in all ingredients at all treatments has in accorndance the SNI standard no. 01-4218-1996, the fat content obtained for instant stock is at least 0.3% and all treatments on results have been appropriate and have fulfilled SNI requirement fat content of instant stock.

The results showed the addition of chicken stock concentration and decrease in carrot extract concentration tends to increase the sodium chloride content in instant chicken stock even though the statistical results show the real difference between the treatments, but the difference is only slight. Different sodium chloride conten in each treatment are thought to be caused by the sodium chloride content in chicken feet and carrot extract. Sodium chloride content of chicken feet more than carrots so that more chicken stock is given then the sodium chloride content will increase. The sodium content of chicken feet is equal to 67 mg per 100 g chicken feet, while the sodium content of carrot is 35 mg per 100 g carrots (USDA Nutrient, 1999).

The sodium chloride content in all the ingredients at all treatments exceeds the SNI standard no. 01-4218-1996 ie sodium chloride content obtained for instant broth maximum 1.25%. Based on the existing SNI standard, instant chicken stok all treatments in the study have not been suitable and have not fulfilled SNI requirement of sodium chloride content in instant stock.

The results showed the more concentration of carrot extract is given the total carotene of instant chicken stock is also high. The difference in total carotene content caused by the different concentrations of the basic ingredients used. Lestario *et al*. (2008) states that the increase in carotene is significantly evident in the addition of carrot starch to the resulting in noodles. This research is supported by the statement Febrihantana *et al*. (2014), which states that the more carrot juice added will cause the greater the amount of carotene in yogurt so that the total carotene value increases and has a more color.

3.2 Physical composition of instant chicken stock

The physical composition of instant chicken stock showed significant difference ($p < 0.05$) between samples (Table 3).

Table 3. Physical composition of instant chicken stock

Sample	Yield (%)	Resolve Time (min.)	Colour Properties			
			L*	a*	b*	^{0}hue
CFS95:CE5	39.18 ± 0.64^{d}	4.14 ± 0.02^{a}	77.71	14.73	19.77	107.81 ± 1.58^{a}
CFS85:CE15	60.07 ± 2.82^{b}	3.28 ± 0.03^{b}	82.84	6.84	17.85	31.96 ± 1.86^{b}
CFS75:CE25	64.06 ± 0.56^{a}	3.18 ± 0.01^{c}	85.93	4.34	12.97	19.74 ± 1.34^{c}
CFS65:CE35	52.44 ± 0.65^{c}	2.52 ± 0.02^{d}	90.67	2.65	10.95	12.69 ± 0.10^{d}
CFS55:CE45	35.50 ± 1.07^{e}	2.15 ± 0.02^{e}	93.15	-1.12	6.36	5.92 ± 0.18^{e}

$^{a-e}$: Different alphabet superscripts in the same column indicate significant difference ($p \leq 0.05$), CFS=chicken feet stock, CE=carrot extract

Yield of instant chicken stock in Table 3 ranged from 35.50-64.06%. The highest yield was found in treatment C (chicken stock 75% : carrot extract 25%) with an average value of 64.06%, while the lowest rendement was in treatment E (chicken stock 55%: carrot extract 45%) with average at 35.50%. According to Desrosier (1986), the yield of dry matter is influenced by the desired water content of the starting and ending materials. The higher the water content in a product, the final weight will be higher. However, in this study the

immersion is still far from the expectation, so to be applied it is necessary efforts to enlarge of yiled because the manufacture of instant chicken stock requires a large operating costs. Differences of yield on the manufacture of the product is also caused by the influence of the tool (spray dryer) used and the end product that is sticky. The instant chicken broth are often attached to the tool so that the attached part can not be picked up and used.

The soluble time of instant chicken stock in Table 3 ranged 2.15 - 4.14 minutes. The highest soluble time was in treatment E (95% chicken stock : carrot extract 5%) of 2.15 minutes and the lowest soluble time in treatment A (chicken stock 55%: carrot extract 45%) of 4.14 minutes. The results showed that the more concentration of chicken stock used, the soluble time of instant chicken stock longer, conversely the less concentration of chicken stok used, the soluble time of instant chicken stok faster. This soluble time can be affected by the amount of fat present in the raw material. According to Winarno (2004), non-polar compounds such as fat are insoluble in polar (water) compounds, this causes instant chicken stock with more chicken feet that will have more time to dissolve. In the instant chicken stock all treatments can be seen in the absence of sediment at the bottom of the glass at the time of analysis of the soluble time. This indicates that the instant chicken stock dissolves perfectly in cold water.

The result showed that there was a significant effect between the concentration of chicken stock with carrot extract (α = 0,05) to the colour. Treatment A (95% chicken stock: carrot extract 5%) with value ^{0}hue 107.81 is categorized as yellow, treatment B (chicken stock 85%: carrot extract 15%), C (chicken stock 75%: carrot extract 25 %) with values ^{0}hue 31.96 and 19.74 are categorized red, whereas treatment D (chicken stock 65%: carrot extract 35%), E (chicken chickens stock 55%: carrot extract 45%) with value ^{0}hue 12.69 and 5.92 is categorized as red-purple. The differences in the colour category of the treatment of instant chicken stock is caused by the difference in concentration level of chicken stock and carrot extract. In the results obtained it can be seen that the lower concentrations of chicken stock and the more concentration of carrot extract is used, the colour of instant chicken stock more with the category of red-purple, while the more concentration of chicken stock and the less concentration of carrot extract, the colour of instant chicken stock faded with yellow color category. It was concluded that the more intense the orange colour that arose in the instant chicken stock was added carrot extract, it was identified the more carotenoid content in instant chicken stock useful as provitamin A which is good for health.

3.3 Sensory Evaluation

The physical composition of instant chicken stock showed significant difference ($p < 0.05$) between samples (Table 4).

Table 4. The sensory evaluation of instant chicken stock

Sample	Sensory Properties			
	Colour	Aroma	Taste	Texture
CFS95:CE5	4.23 ± 0.94^{a}	2.80 ± 0.92^{b}	3.10 ± 0.84^{abc}	3.23 ± 0.82
CFS85:CE15	3.73 ± 0.87^{b}	3.13 ± 0.73^{ab}	3.07 ± 0.58^{bc}	3.60 ± 0.72
CFS75:CE25	3.20 ± 0.76^{c}	3.03 ± 0.72^{b}	2.87 ± 0.63^{c}	3.53 ± 0.73
CFS65:CE35	3.17 ± 0.70^{c}	3.23 ± 0.77^{ab}	3.40 ± 0.77^{ab}	3.40 ± 0.89
CFS55:CE45	2.93 ± 0.87^{c}	3.57 ± 0.97^{a}	3.50 ± 0.90^{a}	3.23 ± 0.82

$^{a-c}$: Different alphabet superscripts in the same column indicate significant difference ($p \leq 0.05$), CFS=chicken feet stock, CE=carrot extract

Table 4 showed the range values of colour for instant chicken stock from 2.97 to 4.23 with the usual level to like. The colour for the preferred product is found in product E (chicken stock 55%: carrot stock 45%) reaches 4.23 with likes, while the unlikable product is product

A (chicken stock 95%: carrot extract 5%) with an average of 2.93 at the usual level. The results of sensory evaluation on the colour of instant chicken instant stock in this study showed that significant colour difference in each treatment, where the higher concentration of carrot extract from the resulting product, the instant chicken instant chicken stock will be more orange coloured. In the E panelist treatment gives the highest value because the colour of the instant chicken stock generated instant inspiration looks attractive with its orange colour, while for product A brewing colour produced yellow. The colour contained in instant chicken stock on treatment A is dominantly donated by chicken stock is yellow, while the colours contained in the B, C, D and E treatments are predominantly contributed by carrot extract. This suggests that the addition of high concentrations of carrots yields instant chicken pinch instant broth with an attractive orange colour. Factors affecting the color difference of instant chicken stock products are the difference in concentration of chicken stock and carrot extract.

In the aroma test results obtained in Table 4 that the more concentration of chicken stock used, the instant chicken stock produced somewhat fishy smell. The smell is a bit fishy in treatment A. This is caused by the dominance of the smell of chicken feet compared to the smell of carrots, while more carrot extract, the smell of instant chicken stock becomes ordinary. Aroma is common in D and E products, whereas B and C products have a similar odour that is the smell of carrot mixed stock and binder or maltodextrin.

The expected flavor of instant chicken stock is a distinctive taste of stock. The results of sensory evaluation on taste in Table 4 can be seen that the taste of instant chicken stock of 5 treatments gives a dislike to the usual. The average results of the assessment of 30 panelists on the test results that is with a score of 2.87 to 3.50. The highest value is in product E that is 3.50 with the closest approximation level and the lowest value in product C is 2.87 with the approximate level. The resulting instant chicken stock indicates a level of preference for different flavors. This is influenced by the difference in treatment of each instant chicken stock produced, which is the comparison between chicken chicken broth and carrot essence. The addition of concentration levels of chicken stock and carrot extract in the results is not favoured by the panelists. This is because more chicken stock and carrot extarct diminish the flavour of chicken instant stock.

The results showed the difference of comparison level of chicken stock and carrot extract did not give real effect to the texture of instant chicken stock produced at the level of $\alpha = 5\%$. The results of the assessment on the texture of instant chicken stock ranged from 3.23 to 3.60. In this study the texture of instant chicken stock produced is soft and smooth. This is due to the nature of the binder (maltodextrin) used (Burdock, 1997). The figure of instant chicken stock showed at Fig. 1.

Figure 1. Instant chicken stock

4. Conclusions

The best product of the instant stocks that had been produced was on treatment E (chicken feet stocks 55% : carrots extract 45%) with the chemical characteristics were water content

6.53%, ash content 3.85%, total nitrogen content 1.15%, protein content 7.20%, nitrogen amino content 0.29%, fat content 2.43%, sodium chloride content 1.56%, total carotene 1.51 g/100g. The physical characteristics were yield 35.50%, soluble time 2.15 minutes and colour with value ^{0}hue 5.92 (red-purple) and based on sensory test, the colour 4.23, aroma 3.57, taste 3.50 and texture 3.23.

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Growth, Yield and Seed Quality of Corn (*Zea mays* L.) due to Leaf Defoliation After Tassel ini Dry Land of Lombok Island Indonesia

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Abstract

Corn is one of the major commodities in Indonesia including in Lombok Island. The productivity reached 5.74 t/ha but still lower than composite corn such as Lamuru 7.60 t/ha and Srikandi Kuning 7.92 t/ha. This study aim to determine the effect of leaf defoliation method on the growth, yield and seed quality. Field experiment was conducted at Sandubaya experimental station of AIAT WNT from January to July 2015. Experimental design was arranged in two-factor Nested Design that included nested defoliation factor (P) on a variety (V) factor. Variety factor consisted of 3 levels: Lo (Local), La (Lamuru), Sk (Srikandi Kuning) and leaf defoliation factor consisted of 5 levels: P0 (without leaf defoliation), P1 (on 2 top leaves + tassel), P2 (on 4 top leaves + tassel), P3 (on 4 bottom leaves) and P4 (on 2 bottom leaves). Each treatment replicates 3 times. Yield was used for seed viability test in the laboratory. Leaf defoliation method at P0, P1, P2, P3 and P4 did not have significant effect on the seed weight and grain yield, however between varieties showed that defoliation on 2 bottom leaves (P4) provides seed yield of 6.68 t/ha Sk compared to 5.30 t/ha La and 3.91 t/ha Lo.

Keywords: corn, dry land, leaf defoliation, Lombok Island

1. Introduction

Corn is the main commodity of agriculture as raw material in food manufacturing industri-es and feed industries. Corn production in Indonesia in 2013 decreased 4.54% from 2012 (BPS, 2014). The productivity was still lower than the potential yield of composite corn for about 7.60 t ha^{-1} (Lamuru) and 7.92 t ha^{-1} (Srikandi Kuning) grains. Potential development of composite corn in NTB is quite greater, particularly Lamuru and Srikandi Kuning varieties. These varieties are well adapted to soil and climatic conditions in NTB. It has been supported by PIJAR (Cattle, Corn, and Seaweed) Program, which makes corn as local superior commodity.

Arid land in NTB covers 1,807,463 ha (84% of the whole areas in NTB). The available land for corn cultivation is 118,345 ha (BPS, 2010). Based on geological, physio-graphic, and climatic conditions, they are classified into 6 ordos, such as: Entisols, Inceptisols, Mollisols, Vertisols, Andisols, and Alfisols. Arid land under dry climate, such as in NTB, has low rainfalls and limited water source, so that it looks obvious during dry season and the cultivated crops are limited as well (Mulyani and Syarwani, 2013). Alternative of increasing corn productivity on arid land, such as in NTB, could be done through breeding engineering by using superior varieties of composite, qualified seeds, and leaf defoliation technology. Application of superior composite varieties would increase the yield 42.3– 49.8% of local varieties (Saidah *et al*., 2004).

Defoliation on organs of corn, particularly leaf and tassel, can be done if existence of such organs is considered unproductive for photosynthetic process. Intensity of light radiation, which is intercepted by leaves, is getting lower from top to bottom, as well as the photosynthetic rate on the bottom leaves that keep reducing, as well as the respiration process (Sugito, 2012). Defoliation organs, which inhibit light transmission, such as unproductive staminate or leaves in photosynthetic rate, would not reduce the yield of seeds (Permanasari and Kastono, 2012). It has been supported by Kuruseng and Wahab (2006), in which defoliation leaves below the cob after pollination has given productivity 7.78 t ha^{-1} better than

the control. The Objective of the research was to obtain the appropriate leaf defoliation technology after tasseling (70 DAP) phase on growth, yield, and quality of corn seeds at arid land.

2. Materials and Methods

This research was conducted in the field and laboratory. Research in the field was based on Nested Design. The treatments included some factors, such as leaf defoliation (P) nested on variety (V) factor. The treatment was repeated 3 times and produced 45 treatments. Leaf defoliation was conducted following the emergence of tassel (70 days after planting). The variety factors comprise of 3 levels, Lo = Local, La = Lamuru, Sk = Srikandi Kuning, and leaf defoliation factor includes 5 levels, P0 = without leaf defoliation (control), P1 = defoliation on 2 top leaves + tassel, P2 = defoliation on 4 top leaves + tassel, P3 = defoliation on 4 bottom leaves, and P4 = defoliation on 2 bottom leaves.

Observation was done by taking two plants as sample for each treatment. Observation on growth and environment variables was done at 42, 65, 75, 85, 95 and 105 DAP. Observation on yield components included: length of cob, diameter of cob, weight of seeds (cob^{-1}), and yield of seeds ($t\ ha^{-1}$). Seed viability test included percentage of germination, moisture content of the seed, viability of seed, and dry weight of seedling. Analysis on the crop growth includes relatives growth rate, net assimilation rate, and light interception. Data observation was analyzed using analysis of variance (F test) at 5% level and continued with LSD test at significant 5% level.

3. Results and Discussion

3.1 Plant Growth

Growth is physiological process in plant, including increasing size, shape, and numbers in certain time, such as on corn that can be seen from the change of height, numbers of leaf, and accumulation of dry weight, which can be observed through relatives growth rate and net assimilation. The research on leaf defoliation after tassel was intended to optimizing light interception on leaf in photosynthetic process, so photosynthates more effective and will be translocated to the organs (seeds), therefore quality of seeds would be better than the control. Defoliation of unproductive leaves for photosynthesis could create microclimate, which is beneficial for growth the crop by reducing organs, such as leaf and tassel that inhibit light interception.

Table 1. Mean of Relatives Growth Rate in Differences of Leaf Defoliation Corn After Tassel

Treatment	Relatives Growth Rate ($g.g^{-1}hr^{-1}$) in Differences Age of Plant (DAP)							
	65 – 75		75 – 85		85 – 95*		95 – 105*	
Lokal (Lo)								
P0	4,40	bcdef	4,18	bcde	-		-	
P1	4,27	abcd	4,00	ab	-		-	
P2	4,20	ab	3,94	a	-		-	
P3	4,15	a	4,07	abc	-		-	
P4	4,14	a	3,94	a	-		-	
Lamuru (La)								
P0	4,51	ef	4,37	ef	4,39	bc	4,47	bc
P1	4,48	def	4,35	ef	4,50	bc	4,57	bcd
P2	4,24	abc	4,10	abcd	4,20	a	4,27	a
P3	4,25	abcd	4,29	def	4,44	bc	4,46	bc
P4	4,28	abcde	4,23	cde	4,35	ab	4,54	bcd
Srikandi Kuning (Sk)								
P0	4,53	f	4,34	ef	4,52	c	4,58	bcd
P1	4,28	abcde	4,24	cde	4,44	bc	4,62	cd
P2	4,46	cdef	4,19	bcde	4,38	bc	4,41	ab
P3	4,35	abcdef	4,23	cde	4,38	bc	4,48	bc
P4	4,34	abcdef	4,51	f	4,50	bc	4,72	d
LSD 5%	0,24		0,23		0,15		0,20	

*: Values followed by the same letters are not significantly different according to LSD 5%, ns: non-significant ,
*: Local varieties are harvested early, DAP: day after planting

The application of composite corn, Lamuru and Srikandi Kuning varieties, was expected to have high potential yield along defoliation treatment, and could providehigh productivity. Lamuru and Srikandi Kuning varieties could well adapted on arid land, such as in West Nusa Tenggara. The defoliated leaves could be utilized as green feed for cows in order to support

PIJAR (Cattle, Corn, and Seaweed) program. Leaf defoliation on corn was done at 70 DAP or after tassel phase. Tasseling is a generative phase that is more sensitive than the vegetative phase along with leaf defoliation treatment (Khaliliaqdam *et al*., 2012). Defoliation on the sink organ, which is no longer beneficial, such as leaf and tassel, was expected to increase accumulation of dry matters to the seeds. Defoliation on sink could reduce seed competitor in obtaining assimilate produced by the leaf (Asro, 2009). According to Roshan *et al.* (2013), leaf defoliation and tassel affect on physiological process, reduced numbers of leaf or defoliation causes the crops readapt to the environment. After pollination, the staminate (tassel) absorbs 20–40% sunlight, which causes less light interception by the leaf.

In general, leaf defoliation after tassel has significant differences and lower than the control toward Relative Growth Rate (RGR) at 65-75 DAP, but shows significant differences at 75–85 DAP, 85–95 DAP and 95-105 DAP, except on defoliation P2 (4 top leaves along with tassel) shows significant difference and lower than the control (Table 1). Such condition is due to the composite corn varieties could adapted after leaf defoliation, so that it would inhibit the relative growth rate. Leaf defoliation does not show significant effect on mean of Net Assimilation Rate (NAR) at 65–75 DAP, but leaf defoliation on Lamuru and Srikandi Kuning varieties do not show significant difference on net assimilation rate. Leaves that adjacent to the soil surface will accept less radiation due to shade of leaves above them. If the bottom canopies accept light below light compensation point, the lowest canopies will be unusefull to the crops themselves because the resulted carbohydrate is less than required to maintain those leaves (Sitompul and Guritno, 1995).

Results for analysis of variance on leaf defoliation toward light interception of Local variety without defoliation (P0) showed significant difference and higher than P1, P2 and P3, but did not show significant difference with P4. Leaf defoliation on Lamuru and Srikandi Kuning varieties did not show any significant difference among treatments P0, P1, P2, P3 and P4. Mean of light interception on Local varieties is significantly different and lower than Lamuru and Srikandi Kuning at 75 and 85 DAP. Mean of light interception on Lamuru and Srikandi Kuning do not show significant difference at 95 and 105 DAP.

Leaves do not absorb the whole intercepted light. Most of sunlight is reflected to atmosphere and the rest is passed through downward to the leaves. Defoliation of leaf and tassel could affect distribution of assimilate between reproductive organs (cob of corn) and vegetative organs (leaf, stem, and root). The longer stem that being cut, the faster light to be run out due to the position of adjacent leaves, so that percentage of absorbed light by total leaves is leaves is getting lower with length of cutted stem (Didik *et al.* 2005; Sugito, 2012; Heidari, 2013).

3.2 Yield Components

Results of research showed significant difference between Local varieties, Lamuru and Srikandi Kuning, toward yield components as indicator of production, such as length of cob (cm), diameter of cob (cm), weight of seed (g cob^{-1}) and yield of seeds(t ha^{-1}). Defoliation on Local varieties (P0, P1, P2, P3 and P4) showed significant difference and lower than Lamuru and Srikandi kuning by the same treatment toward yield compo-nents. Defoliation on Lamuru variety (P0, P1, P2, P3 and P4) and Srikandi kuning did not show significant difference on each treatment toward yield components that being observed. As well as defoliation on P0, P1, P2, P3 and P4 did not show any significant difference to the other ones.

Table 2. Mean of Yield Components Corn in Differences of Leaf Defoliation After Tassel

Treatment	Cob Length (cm)		Cob Diameter (cm)		Seed Weight (g cob^{-1})		Grain Yield (t ha^{-1})	
Lokal (Lo)								
P0	14,00	a	3,82	a	99,3	a	3,50	a
P1	14,47	a	3,77	a	103,3	a	3,46	a
P2	14,18	a	3,79	a	97,7	a	3,95	a
P3	14,61	a	3,73	a	94,4	a	3,69	a
P4	14,44	a	3,95	a	115,3	a	3,91	ab
Lamuru (La)								
P0	17,20	b	4,76	bc	213,5	b	5,66	de
P1	17,10	b	4,71	bc	198,1	b	5,84	de
P2	16,43	b	4,85	c	212,3	b	5,83	de
P3	16,83	b	4,67	bc	196,1	b	6,10	de
P4	16,63	b	4,63	bc	187,9	b	5,30	cd
Srikandi Kuning (Sk)								
P0	17,40	b	4,58	bc	212,3	b	5,75	de
P1	17,57	b	4,69	bc	217,9	b	5,90	de
P2	16,69	b	4,52	b	189,2	b	5,20	bcd
P3	17,67	b	4,71	bc	223,9	b	5,81	de
P4	16,83	b	4,64	bc	205,4	b	6,68	e
LSD 5%	1,67		0,32		36,17		1,36	

*: Values followed by the same letters are not significantly different according to LSD 5%, ns: non-significant

Results of the research showed that length of cob and weight of seeds per cob has the same significant difference pattern. Length of cob for Local (Lo) variety has significant difference and lower than Lamuru (La) and Srikandi Kuning (Sk). Leaf defoliation after tassel (at 70 DAP) did not show significant difference on weight of seeds per cob and yield of seeds on Local, Lamuru, and Srikandi varieties. Mean of seeds, weight per cob did not show significant difference among treatments (P0, P1, P2, P3, and P4), but had significant difference among varieties. Mean of seeds, weight per cob on Local variety showed significant difference and lower than Lamuru and Srikandi Kuning. It provided information that leaf defoliation did not affect on weight seeds per cob, but it was determined by genetic properties of each variety.

Cob's length of Lamuru and Srikandi Kuning varieties did not show significant difference, as well as dry weight of seeds per cob. It conformed to Heidari (2012) who stated that length of cob and weight of seeds per cob play important roles in increasing yield of seeds. Yield of seeds from this research was 5.20 t ha^{-1} Srikandi Kuning variety on defoliation of 4 top leaves along with tassel (P2) lower than defoliation 2 bottom leaves (P4) was 6.68 t ha^{-1}. Yield of seeds on defoliation P4 showed that Local variety was significantly different and lower (3.91 t ha^{-1}) than Lamuru (5.30 t ha^{-1}) and Srikandi Kuning (Table 2).

Mean of seeds yield P4 Lamuru variety was significantly different and lower on P4 than Srikandi Kuning. Results of this research showed that genetic properties of each variety play important roles in determining the grain yield and crop resistance in restoring condition of the crop after such defoliation. The amount of dry matter accumulation during the initial period of seed filling will be determine at different yield of the obtainable grains. Higher intensity of leaf defoliation causes less resulted dry matters. Increasing intensity of leaf defoliation also decrease weight of cob and weight of seeds (cob^{-1}) (Barimavandi et al., 2010; Zuchri, 2010; Heidari, 2012).

Defoliation 2 bottom leaves (P4) on Srikandi Kuning variety brought about the best yield of grains by leaf defoliated outputs 0.64 t ha^{-1}. Defoliation P4 is advantageous to be applied by the farmers in order to gain double benefits, for instance, yield of grains for human consumption and defoliate leaves as feed. These are supported by results of the research by Ahmadi *et al.* (2009), which showed that defoliation on wheat did not have significant effect on grain yield due to supply of the resulted assimilates could fulfill the need for seed's development. It conformed to suggestion by Emam *et al.* (2013), in which the seed yield from 50% defoliation at 30 days after half-silking showed no significant difference with the control, due to assimilate remobilization from vegetative organs could compensate the photosynthetic reduction.

3.3 Seed Viability

In General leaf defoliation not showed significant effect on parameter of seed viability. Significant differences in testing seed viability variable were shown among the observed varieties, which included percentage of germination, seed vigor, speed of growth seeds, and dry weight on Local varieties, which were significantly different and lower than Lamuru and Srikandi Kuning. Mean of the seed moisture after 3 storages did not show significant differences between defoliation treatments and varieties.

Table 3. Mean of Seed Moisture Content and Seeds Viability in Differences of Leaf Defoliation Corn After Storage 3 Months

Treatment	Seed Moisture Content (%)			Percentage of Germination (%)					
	1st Month	2nd Month	3rd Month	1st Month		2nd Month		3rd Month	
LoP0	10,76	11,61	11,81	96,50	abc	81,75	a	78,75	ab
LoP1	11,16	11,32	11,49	92,75	ab	82,25	a	77,25	a
LoP2	10,87	11,08	11,63	97,75	c	85,75	ab	85,50	abc
LoP3	10,01	11,23	11,59	96,75	abc	82,00	a	80,00	ab
LoP4	10,88	11,67	11,77	92,25	a	80,50	a	81,00	abc
LaP0	10,68	10,63	11,26	98,25	c	98,50	d	85,50	abc
LaP1	10,47	10,90	11,42	98,00	c	91,25	abcd	86,25	abc
LaP2	11,58	12,01	11,51	97,50	c	87,25	abcd	81,00	abc
LaP3	10,53	10,98	11,83	96,25	abc	87,00	abc	80,75	ab
LaP4	10,63	10,68	11,84	97,00	bc	82,25	a	82,75	abcd
SkP0	10,58	11,48	11,61	98,75	c	97,75	cd	87,50	bc
SkP1	10,88	10,66	11,33	98,75	c	82,50	a	82,00	abc
SkP2	10,68	10,76	11,08	98,50	c	96,75	bcd	88,00	b
SkP3	10,71	11,08	12,03	94,75	abc	81,75	a	80,25	abc
SkP4	10,48	10,51	11,89	98,25	c	97,25	cd	90,25	c
LSD 5%	ns	ns	ns	4,54		11,39		9,26	

*: Values followed by the same letters are not significantly different according to LSD 5%, ns: non-significant

Koes and Rahmawati (2009) stated that seed moisture content during the storage and duration of storage are highly determine the achieved productivity, seed storage under moisture levels 10–11%, in general, provides higher productivity than storage under moisture level more than 14% in the same period of storage. Mean of seed moisture as a result of research ranged between 10–12% after 3 months storage. Seed moisture content in this research did not show significant difference among treatments. According to research by Govender *et al.* (2007), seed storage under moisture ≤ 14% was intended so as to the seeds would not experience seed deterioration, so that quality of the seeds can be maintained.

Percentage of seed germination after 3 months storage on Local variety LoP0 did not show significant differences with LoP1, LoP2, LoP3 and LoP4, as well as Lamuru LaP0 variety did not show significant differences with LaP1, LaP2, LaP3 and LaP4. The same results were shown on Srikandi Kuning variety between SkP0 and SkP1, SkP2, SkP3 and SkP4 did not significant differences. Results for analysis of variance of leaf defoliation and varieties on percentage of seed germination showed significant differences between Local variety and Lamuru and Srikandi Kuning, but percentage of seed germination did not show significant differences between Lamuru and Srikandi Kuning varieties. Results of the research conformed to results of the research by Bustamam (2004), leaves position 25% above the undefoliated-cob had no significant effect seed germinative ability with the control.

Results of the research showed that percentage of seed germination after 3 months-storage on Lamuru and Srikandi Kuning varieties reached ≥ 80% (Table 3). It mean leaf defoliation did not have significant effect on quality of the produced seeds. Therefore, the seed yield due to such treatment can be used as planting materials for the next planting season by taking into account the percentage value of seed germination. This is supported by suggestions of Kartahadimaja *et al.* (2013) and Widajati *et al*. (2012), high quality seeds are determined by physiological quality (seed viability) and longer storability.

Analysis of variance on leaf defoliation treatment and varieties toward seed vigor, in general, showed non significant differences after storage for 3 months. Results for analysis of variance on mean of speed of growth seedling as vigor indicator of growth strength after storage for 3 months showed that leaf defoliation LoP0 was significantly different and lower

than LoP3, but LoP0 had no significant differences with LoP1, LoP2 and LoP4. Leaf defoliation on Lamuru LaP1 was significantly different and higher than LaP2, but LaP1 had no significant differences with LaP0, LaP3 and LaP4. Leaf defoliation on Srikandi Kuning SkP1 was significantly different and lower than SkP3 and SkP4 toward the speed of growth seeds (K_{CT}) on the third testing. Mean of speed of growth seeds on Local variety was significantly different and lower than Lamuru and Srikandi Kuning, as well as mean of K_{CT} Lamuru was significantly different and lower than Srikandi Kuning, except on SkP0 and SkP1, which had non significant differences after storage for 3 months.

4. Conclusion

Leaf defoliation method on P0, P1, P2, P3 and P4 has no significant effect on the number of grains per cob and grain yield, but between varieties show that defoliation on 2 bottom leaves (P4) provides grain yield of 6.68 t ha^{-1} (Srikandi Kuning), 5.30 t ha^{-1} (Lamuru) and 3.91 t ha^{-1} (local). Methode of leaf defoliation did not significantly affect on seed moisture content after 3 months of storage.

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Folate Content In Spinach (*Amaranthus* sp.), Katuk Leaves (*Sauropus androgynous,* (L.) Merr) and Singgalang Radish (*Brassica oleracea) After Being Processed*

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Abstract

Folate mostly found in green vegetable is an essential vitamin for human body particularly for fetus and baby growth. However, the content of the folate in the vegetable would reduce due to the processing method. This research aims to determine the folate content in vegetable before and after being processed. The selected vegetables that used in this research were Spinach, Katuk leaves and Singgalang Radish. The vegetables were processed by boiling, stir frying and steaming them and also by serving it raw. The folate content was quantified by applying HPLC analysis. The result showed that processing method, particularly stir frying, affected folate content.

Keywords: folate; processing methods; green vegetables; HPLC analysis

1. Introduction

Folate, known as B9 vitamin, are essential for human bodies. Folic acid plays a role in the metabolism of amino acids needed in the formation of red blood cells (Mahenaz & Ismail 2012). A deficiency of folate causes abnormal cell and megaloblastic anemia in adult and result in Neural Tube Defect, low birth weight infant, and premature infant in pregnant women.

Many solutions are done to prevent folate deficiency, namely by consuming foods high in folate and folic acid-fortified foods. In Indoensia, authorities recommend a folate intake of 400 mcg per day for men and women with an increase to 200 mcg per day for pregnant women (Regulation of Health Minister, 2013), in accordance with the recommended daily intakes in the USA are 400 lg per day for both men and women and 600 lg per day for pregnant women (The National Academics, 2011).

Folate mostly found in green vegetable. But, folate vulnerable to warming. In daily life, some green vegetables are usually cooked before consumption. Some cooking techniques are done to consume vegetables. The cooking process at high temperature allows the decreasing levels of folate. In present study, the ecooking methods (i.e., boilling, and frying) decreased folate content in commonly consumed vegetables in the South Pacific (i.e., drumstick leaves, taro leaves, bele leaves, amaranth leaves, fern/ota, okra, and french bean) (Maharaj *et al*., 2015). In other study, the industrial processing decrease significantly the folate content of spinach and green bean (Delchier *et al.*, 2013).

There are limiting data about the effect of cooking methods on the folate content of vegetables in Indonesia. This research aims to determine the folate content in vegetable before and after being processed. The selected vegetables that used in this research were Spinach, Katuk leaves and Singgalang Radish are commonly marketed and consumed in West Sumatera, Indonesia.

2. Materials and Methods

2. 1. Material and Tool

The green vegetables sampling are randomly selected in traditional market of Padang. Three green vegetables were selected, namely : Spinach (*Amaranthus sp*), *Katuk* leaves (*Sauropus androgynous,* (L.) Merr), and *Singgalang* Radish (*Brassica oleracea).*

The chemical material used for the analysis include Methanol 75%, Etanol p.a (Merck), Acetonitril pro HPLC, Standard Stock (Sigma), Acetic acid, Merchaptoethanol.

The tools were used in this study are Shimadzu LC-20AD High Performance Liquid Chromatography, Shimadzu SPD-M20A detector, C-18 Colom (5 mm, 4.6 x 250 mm i.d.) , micro syringe, sentrifuge, other glass equipments.

2. 2. Cooking Treatments

The vegetables are being prepared by removing the parts that are not eaten then washed in running water. Vegetables are cut into pieces with a length of approximately 3 cm then stored in the refrigerator to keep them fresh. All kinds of vegetable cooked according to subsequent treatment. Four different cooking methods were tested: fresh-cut, boiling, steaming, and stir-frying.

In boiling method, 300 g of fresh chunks of green leafy vegetable was added to 800 ml of boiling water with a ratio of 1: 2.7. Time and temperature are 5.0-7.0 minutes and 93-95^{0}C. During the process, the pan is covered and the vegetable is stirred occasionally so that it cooked evenly. After cooking, vegetables temperature and period is recorded. The vegetables then removed, drained for a while and being analyzed after. Analysis were performed on fresh vegetables, boiled vegetables, steamed vegetables, stir-fried vegetables, boiled water, and steamed water.

Steaming is done by placing 300 g of green leafy vegetables above 200 ml of boiling water with a ratio of 1.5: 1. Time and temperature are 5.0-7.0 minutes and 93-95^{0}C. Pot is closed during the cooking of vegetables. Finally, the vegetable was raised and was analyzed. Analysis were performed on fresh vegetables, boiled vegetables, steamed vegetables, stir-fried vegetables, boiled water, and steamed water.

2. 3. HPLC Analysis

Standard. Folic acid were obtained from Sigma Chemical. Standard stock solutions were prepared by dissolving folic acid separately in Methanol to a concentration of 10 ppm. Concentrations were determined in pH 7.0 buffered solutions, using UV absorption at 283 nm.

Preparation of folates from selected green vegetables. Samples were prepared by addition 10 ml methanol, 1 ml buffer and 0.5 ml merchaptorthanol. Suspended of sample were got by sentrifuge 2 ml filtrat for 10 min at 1000 rpm. The supernatants were filtered through a microfilter using 0.2µm Whatman filter.

HPLC measurement of folic acid. A reversed-phase gradient HPLC method was performed as a modification of the procedure recently described (Bagley and Selhub, 2000). The folates were separated on an VP-ODS (5 mm, 4.6 x 250 mm i.d.) analytical column (Keystone Scientific). A flow rate of 1 mL/min was used. The mobile phase program consisted of 3 min with 100% A (acetonitril and acetic acid in water) followed by a linear gradient of 10 min to 75% A:25% B. The absorbance of folic acid was monitored with a diode array detector set at 283 nm wavelengths. Peak identification was based on a combination of the retention time and the spectral characteristics.

2. 4. Statistical Analysis

The data were analyzed by paired sample t-test using SPSS 17.0 for Windows. A significance level of 0.05 was chosen.

3. Results and Discussion

HPLC analysis was conducted to obtain the Folate content in the green vegetables that are fresh, boiled, steamed and in the boiled and steamed water. The results of sample analysis are in form of folate absorbance values that mcg/g content are obtained by using the regression equation, then units conversion of to mcg/g fresh weight, expressed as folic acid. The Folate content that are obtained is explained in the following Figures.

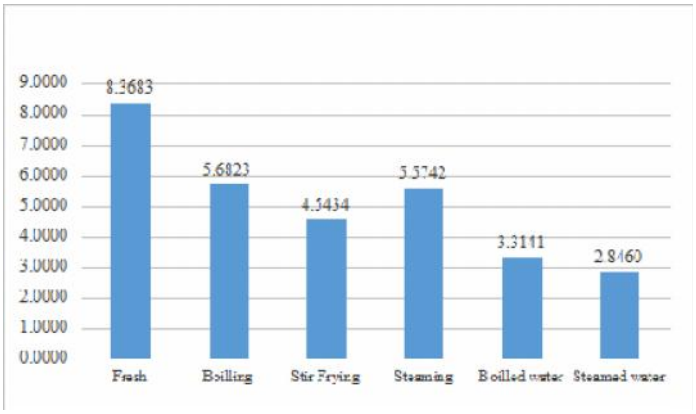

Figure 1. Folate contents in Spinach (mcg/g)

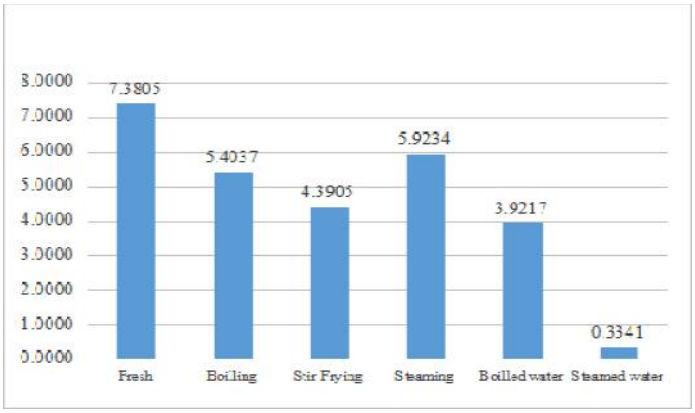

Figure 2. Folate contents in Katuk Leaves (mcg/g)

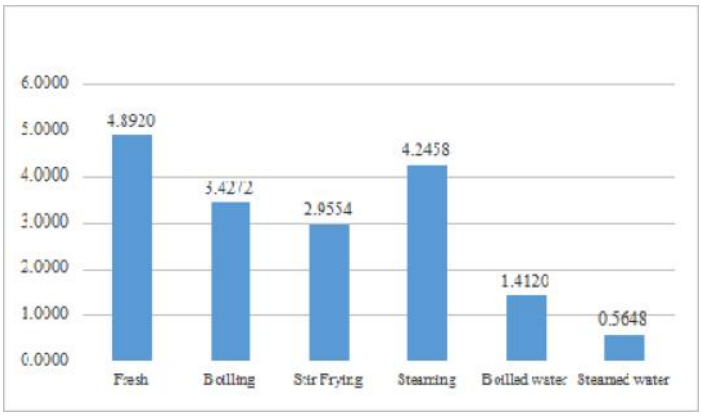

Figure 3. Folate contents in Singgalang Radish (mcg/g)

Folate content in fresh vegetable pieces ranged from 4.8920 to 8.6383 mcg/g of material. Folate content of fresh spinach are respectively 8.6383 mcg/g of material. These results are higher than the folate content of Katuk Leaves and Singgalang Radish.

The cooking process results in a change of folate content in green vegetables. Shown in Figure 1, folate content of spinach significantly decrease ($P<0.05$) after boiling process from 8.6383 mcg/g into 5.6823 mcg/g of material. The percentage loss of folate in boilling spinach was 34%. In Figure 2 and Figure 3, the boiling process also affects the reduction of folate content in Katuk Leaves (27%) and Singgalang Radish (30%). The Figures also showed increasing of folate content in boiled water. It showed that the folate loss on boilling and steaming accounted in the boilling and steaming water. Maharaj *et al*. (2015) showed that boiling vegetables can lead to decreased folate in some vegetables commonly consumed by South Pacific people, due to dissolve in boiling water. It also showed the fact that folate is water soluble vitamin and thus leached into boilling water (Bassett and Samman, 2010).

The steaming process also results in a change of folate content in green vegetables. Shown in Figures, folate content decrease after steaming process in Spinach, Katuk Leaves and Singgalang Radish and increase folate content in steamed water. But, the decerasing of folate in spinach is not significantly ($P<0.05$). The loss of folate was allowed by increasing folate in steamed water less than the boilling process. This was because the folate dissolved in boiling water or steaming is the result of folate leaching by added water.

On the other hand, after the vegetables were stir-fried, the folate of vegetables were significantly decrease. the decreasing of folate contents were more than boiling and steaming. This happens because of the heat directly from the cooking medium to the vegetables. Stir-frying is cook foods in a thin film of hot oil in a skillet set on a hot burner (America's Test Kitchen, 2012). Each cooking method resulted in a decrease of folate in green vegetables. Folate is a compound that are not stable so it is difficult to maintain, particularly in stir-frying process.

4. Conclusion

The conclusion of this study were the process of steaming, boiling, and stir-frying decrease the folate content. The folate loss on boilling and steaming accounted in the boilling and steaming water. the steaming process can prevent loss of folate content, particularly in spinach. The stir-frying process decerase more folate content than boiling and steaming.

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The Effect of Various Macroalgaes Extract in Lombok to Mortality of *Artemia salina* Larvae

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Abstract

This research aimed to determine the effect of various macroalgae extract in Lombok marine water to mortality of *Artemia salina* larva. About 9 species of macroalgaes including *Gracilaria sp, Sargassum crassifolium, S.policistum* sp1, *S.policistum* sp2, *S.cristaefolium, Achantophora muscoides, A.spesifera, Padina sp, and Gelidium ratifolium*, were extracted through maseration method using methanol and dichloromethane. Each extract with 3 level of concentration (5ppm, 10ppm, 100 ppm for DCM phase and 100ppm, 200ppm, 300ppm for methanol phase) was added to *Artemia salina* cultures (2 days in age) containing 10 individuals respectively. The results suggest that addition of *Sargassum crassifolium, S.policistum* sp1, *Achantophora muscoides, A.spesifera and Gelidium ratifolium* extract brings the high number of mortality to *Artemia salina* larva (>60% in average). The average number of larva mortality that was caused by addition of *S.policistum* sp1, *Achantophora muscoides, and Gelidium ratifolium* methanol extract are 7, 10, 10 respectively. Additon of *Sargassum crassifolium, S.policistum* sp1, *Achantophora spesifera and Gelidium ratifolium* DCM extracts give the average number of mortality about 6, 6.33, 7.33, and 10 respectively. Furthermore, the median lethal concentration (LC50) ef each extracts should be measured and performed in other research.

Keywords : macroalgae, extract, mortality, *Artemia salina*.

1. Introduction

Cancer is defined as an abnormal growth of cells which tend to proliferate in an uncontrolled way and, in some cases, to metastasize (spread). Cancer is considered as a major cause of death and main public health problem in Indonesia. Major therapy for cancer so far is conventional therapy by medication and chemotherapy, at which they are commonly has unpleasant and bad side-effect to patient (Kamima, 2009). Therefore, there is an urgent attempt to obtain natural chemotherapy medication with less side-effects. One potential source of anticancer agent is macro algae (sea weed) from Lombok's marine water.

Lombok is one of main island from West Nusatenggara Province. It bordered by Wallace's and Weber's lines as well as a major and two minor through-flow currents, and thus retain diverse and unique marine flora and fauna, including macro algae diversity. There are at least 88 species of seaweed were found in WNT marine water (Sunarpi *et al*., 2005, 2006) including 24 wild and cultivated species of red macro algae (*Rhodophyta)* (Eem et al., 2014, Sunarpi et al., 2014), and 10 species of brown algae (*Phaeophyta)* (Sunarpi et al., 2005). This high diversity provides great potential that seaweed from WNT could be a great source of anti-carcer agent.

There are a few methods to determined wether a substance has anticancer activity. One of those method is Brine Srimp lethal test (BSLT) using *Artemia salina larvae.* This test is considered as a useful tool in preliminary assessment of biological activities of plant extracts. The technique is economic and utilizes small amount of test material (Pisutthanan et al., 2004). Since its introduction, this in vivo test has been successively employed for bioassay-guide fractionation of active cytotoxic and antitumor agents (Ahmed et al., 2010; Ramachandran et al., 2011).

The potency of macroalga as a source for anticancer agent could be determined with preliminary test using *Artemia salina* larvae. Therefore this research was carried out to know the effect of addition various macroalga extracts to mortality of *Artemia salina* larvae. This research is aimed to find sample/species of macroalga that given the high mortality of *Artemia salina* larvae and has potency to become source of anticancer agent. The result of this research provides information about species of macro alga that can be used as the source of anticancer compound in further research.

2. Materials and Methods

This research were carried out from December 2016 to February 2017 in Laboratory of Immunobiology, University of Mataram.

2.1 Sample preparation and extraction

Nine species of macroalgaes (*Gracilaria* sp, *Sargassum crassifolium*, *S.policistum* sp1, S.*policistu*m sp2, *S.cristaefoliu*m, *Achantophora muscoides*, *A.spesifera, Padina sp, Gelidium ratifolium)* were cleaned then dried in room temperature for 2-4 weeks. 50 mg of each dried macroalgaes were grinded into pieces. 250 mL (1;5, w/v) of Dichloromethane solution was added into each samples then leave in room temperature for 48 hours. Suspension was filtered with filter paper. Filtrate were laid into vacum evaporator for 48 hours. Pellet were extracted using 250 mL methanol (1:5, w/v) then maserated for 48 hours. Filtrate from methanol extraction were filtered then laid into vacum evaporator for 48 hours. Each extracts (methanol and DCM) from 9 samples of macroalga were stored at refrigerator to maintain the evaporation procces.

2.2 Mortality assay using *Artemia salina* larvae

Mortality assay of *Artemia salina* larvae were conducted with 3 level of concentration of each macroalgae extract (5, 10, and 100 ppm for DCM extract and 100, 200, 300 ppm for methanol extract). Each extracts of macroalgae were poured into ELISA well that contained 10 larva of *Artemia salina (*2 days old) with 3 replication for each treatments respectively. After 48 hours, the mortality of Artemia salina larva in each treatments were calculated. Data were analyzed with ANOVA test using minitab 14 computer programme .

3. Results and Discussion

ANOVA analysis using minitab 14 showed that variety of macroalgae species and level of concentration of each extracts gave the significant effect to mortality of *Artemia salina* larva (table 1). 5 Samples of macroalga (*Sargassum crassifolium, S.policistum* sp1, *Achantophora muscoides, A.spesifera and Gelidium ratifolium)* brings the high number of mortality to *Artemia salina* larva (Table 2 and table 3).

Table 1. Two-way ANOVA test of Larva Mortality using minitab 14. Computer Programme.

R denotes an observation with a large standardized residual.

Two-way ANOVA: larva mortality versus concentration, sample

Source	DF	SS	MS	F	P
concentration	2	11.611	5.8056	8.96	0.002
sample	8	200.736	25.0920	38.73	0.000
Error	16	10.367	0.6479		
Total	26	222.713			

S = 0.8049 R-Sq = 95.35% R-Sq(adj) = 92.44%

According to this result, the concentration of each macoalgae extracts gives the significant effect to mortality of *Artemia salina* larva. Therefore the analysis of LC50 of each extracts of macroalgae should be measured and performed on other research in order to know the optimal concentration that gives the highest number of mortality.

The number of mortality of *Artemia salina* larva in methanol extracts of macroalga showed that there are 3 macroalgae extracts (*Sargassum policistum* sp 1, *Acanthophora muscoides* and *Gellidium ratifolium)* brings the highest number of mortality. The number of death larva that caused by addition to these extracts in highest concentration were 7, 10 and 10 larva respectively (table 2). Additon of *Sargassum crassifolium, S.policistum* sp1, *Achantophora spesifera and Gelidium ratifolium* DCM extracts give the average number of mortality in their highest concentration about 6, 6.33, 7.33, and 10 respectively (table 3)..

Table 2. Mortality of *Artemia salina* larvae in Each Methanol Extract of Macroalgae

Sample	Control	Concentration (ppm)		
		100	200	300
K	2.67			
1		3.00	5.00	3.33
2		3.00	4.33	4.33
3		3.33	7.33	7.00
4		3.33	3.00	3.67
5		3.33	4.33	3.33
6		8.67	10.00	10.00
7		1.67	2.00	2.33
8		1.00	3.67	2.67
9		9.67	10.00	10.00

Table 3. Mortality of *Artemia salina* larva in Each DCM Extract of Macroalgae

Sample	Control	Concentration (ppm)		
		5	10	100
K	4.44			
1		4.33	5.00	3.67
2		3.67	4.00	6.00
3		5.00	6.00	6.33
4		4.00	3.33	5.33
5		4.67	2.67	4.33
6		3.00	3.33	3.00
7		7.00	8.67	7.33
8		8.00	7.33	5.67
9		7.67	8.00	10.00

According to the result, we can conclude that there are at least 5 macroalgae species that has potency a source of anticancer agents. Sanchez *et al (*1993) suggests that bioassay againts *Artemia salina* is a simple and inexpensive method to test cytotoxicity, to biodirect fractionation of natural products and as a predictor of antitumor and pesticidal activity. It also indicates antiviral, antiplasmodial, antifilarial, antimalarial activities (Sleet *et al*, 1983). Therefore further research should be carried out directly in human cancer cell using these 5 extracts to measured the effect of these extracts in cancer cell.

The results provide new promising source for novel biological activity for anticancer. Extracts of microalgae are mainly characterised by their complex chemical mixture. In a preliminary assay, the results can be diffuse and not well bio-directed. Thus, this research should be continued with pytochemical assay to identify the active compounds that produced by macroalgae.

4. Conclusion

The results of this research suggest that addition of *Sargassum crassifolium, S.policistum* sp1, *Achantophora muscoides, A.spesifera and Gelidium ratifolium* extract brings the high number of mortality to *Artemia salina* larva (>60% in average). This research should be continued to determine the lethal concentration (LC50) of its extracts, pytochemical assay to identify the active compounds that produced by macroalga and bioassay using human cell.

Acknowledgement

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Tuned Mass Damper as Alternative Solution for Pedestrian Comforet in Existing Truss Bridge

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Abstract

This study proposes to improve the level of pedestrian comfort on existing steel frame bridges due to vehicles stopping on bridges with engine conditions lit using tunned mass damper based on The Ontario Bridge Code and Bridge Management System graphs. Static deflection measurements in the field obtained a result that is 65,82 mm and the natural frequency of the structure is 2,14 Hz, based on the standard graph of The Ontario Bridge Code and Bridge Management System Soekarno-Hatta bridge into the area that is not comfortable. Then the researcher proposed the improvement by using the addition of tuned mass damper placed in the middle of the bridge span with an optimum mass ratio of 4,5% then obtained the first frequency value of 1,8 Hz with an amplitude of 8,7231 mm and the second frequency of 2,4 Hz with an amplitude of 7,2132 mm. Frequency and amplitude values after being given this mass tuned damper if plotted on a standard graph The Ontario Bridge Code and Bridge Management System fit into a comfortable area.

Keywords: Steel frame bridge, pedestrian comfort, static deflection, natural frequency, tuned mass damper, The Ontario Bridge Code, Bridge Management System.

1. Introduction

Increased population and the development of infrastructure in an area, it will increase the volume of traffic in the area. It can be found in densely populated areas such as urban areas. In urban areas an increase in traffic volume will result in congestion occurring along the road, especially if this transport route passes over the bridge. This is contrary to Regulation of the Minister of Public Works No. 19 / PRT / M / 2011 concerning Road Technical Requirements Article 16 and Road Planning Technical Criteria and Government Regulation Number 43 The year 1993 regarding Infrastructure and Road Traffic Article 66 states that vehicles stop banning over the bridge.

The existence of a vehicle that stops on the bridge with the condition of the engine turns on can cause excessive vibration on this bridge will result in the discomfort of pedestrians crossing the bridge. This can be improved by suggesting improvements to the bridge structure using a tuned mass damper at the center of the bridge span. The selection of bridge Soekarno-Hatta Malang as a case study because this bridge is a standard bridge Bina Marga scattered in various regions in Indonesia. The bridge is also located in areas with heavy traffic because it is located in the city and close to vital buildings, so it can be used as a case study for the analysis of vibration due to vehicles that stop on the bridge with the engine condition remains lit and expected the results of this study can be used as a reference for the handling of typical bridges in other areas.

According to Chopra (1995) the tunned mass damper is an addition of mass to the main structure that can be used to reduce the vibration of the incoming wind in this building when it reaches the "disturbing" level of residence, and can reduce up to 40%. According to Chang (2009) the mass ratio in the Tuned mass damper is 2% - 6.7% of the mass of the main structure. The use of the Tuned mass damper will be effective if installed in the middle of the bridge span and the tuned mass damper has components of md, cd, and kd as in the equation below as shown in figure. 1.

$$\begin{bmatrix} M_1 & 0 \\ 0 & m_d \end{bmatrix} \begin{Bmatrix} \ddot{x} \\ \ddot{y} \end{Bmatrix} + \begin{bmatrix} C_1 + c_d & -c_d \\ -c_d & c_d \end{bmatrix} \begin{Bmatrix} \dot{x} \\ \dot{y} \end{Bmatrix} + \begin{bmatrix} K_1 + k_d & -k_d \\ -k_d & k_d \end{bmatrix} \begin{Bmatrix} x \\ y \end{Bmatrix} = \begin{Bmatrix} P_1(t) \\ 0 \end{Bmatrix} \quad (1)$$

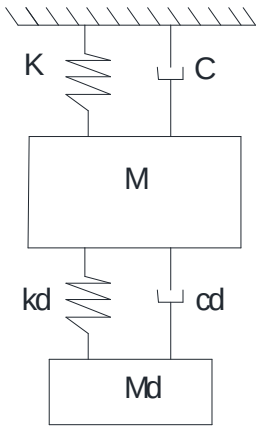


Figure 1. Tunned mass damper

2. Materials and Methods

2.1 Research Sites

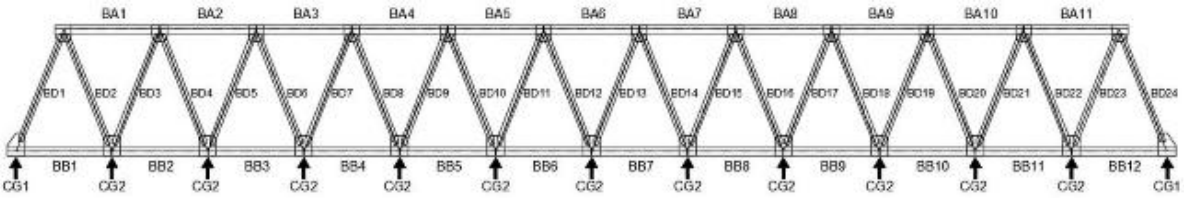
The Soekarno-Hatta Bridge is located on Jl. Soekarno Hatta, Jatimulyo, Malang City, East Java with a total span of 100 m which was built in 1988. This research uses direct data retrieval method from field done by PUSJATAN on September 3, 2016. Bridge model making using SAP2000 program validated by result measurement in the field.

2.2 Data bridge structure

Type of structure	: Transfield steel frame
Floor plates	: Reinforced concrete
Landscape length	: 60 m + 40 m
Floor Width of vehicle	: 7 m
Width of sidewalk	: 2 x 1 m
Number of lanes / lane	: 1 Line / 2 lane
High order	: 6.35 m

2.3 Measurement of quality and dimensions of steel

Based on the measurement data of the bridge profile in the field obtained the dimension of elongated girder profile, transverse girder, upper stem, rootstock, diagonal road and wind bond.



Picture 2. Frame of Soekarno-Hatta Bridge of Malang

2.4 Measurement of bridge response

To get a description of the behavior of the upper structure of the given load, the sensor is placed in the form of strain gage and accelerometer at ¼ and ½ spans, and the installation of deflection point using the total station at each point of a knot. Measurement of bridge response is generally done by static response and dynamic responsemethod. The load used in the form of trucks as many as 6 units that have been weighed with the total weight of each truck 20.14 Ton. The static loadingconfigurationshown in Figure 3 and the dynamic loading configuration shown in Figure 4.

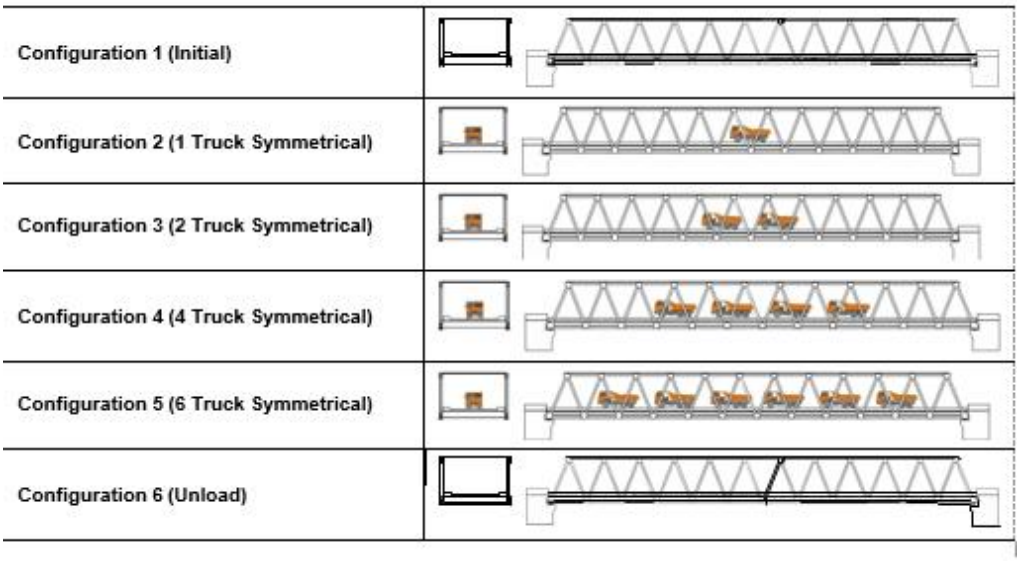


Figure 3. Static loading configuration

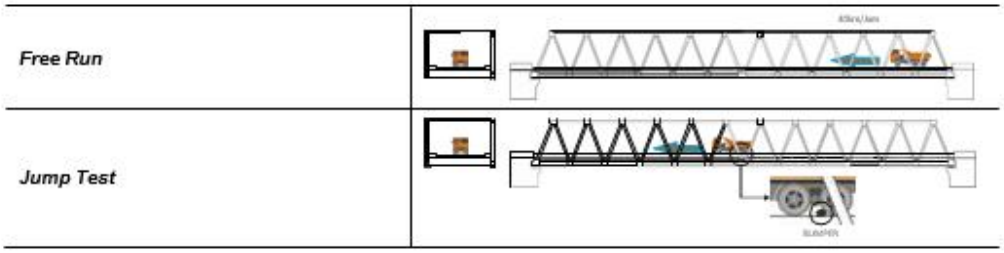


Figure 4. Dynamic loading configuration

The bridge building analysis model is constructed with geometry according to standard A200 type A7 steel frame bridges such as Figure 1 using SAP2000 v.18 software. Main steel frames (bottom truss, upper truss anf diagonal truss), elongated girder, transverse girder and upper wind bond are modeled as the 3D frames, lower wind bonds is modeled as 3D truss. Material data used are SM 490 / BJ 55 (fu = 550 MPa and fy = 410 MPa) with dimensions of stem profile according to the measurement result in the field and the concrete material with fc '= 30 MPa.

3. Results and Discussion

3.1 Frequency of structure

Based on field measurement data modeled on the SAP2000 the program, the frequency obtained from the field measurement is 2.14 Hz and the first frequency of the modeling is 2.144 Hz, so there is a difference of 0.18%. The first mode of the structure is the vertical movement shown in Figure 5.

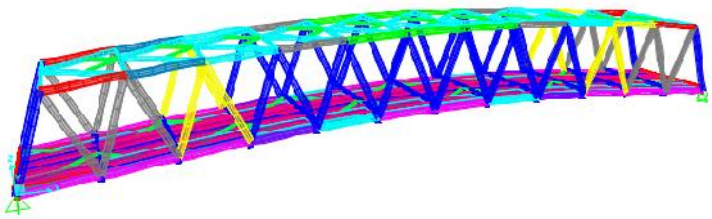


Figure 5. Results of the first mode modeling

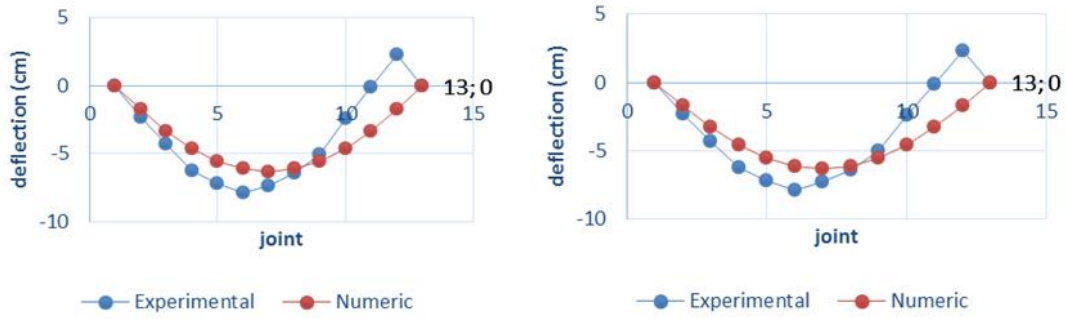
3.2 Deflection

The data of deflection measurement at bridge condition without vehicle load with observation at each point of buss in field using total station and modeling of bridge structure using SAP2000 program on the upstream side is shown in Table 1 with comparison graph of

experimental and numerical deflection of upstream side shown in Figure 6.a and the downstream side is shown in Figure 6.b.

Table 1. Comparison of experimental and numerical upside-down deflections

joint	Experimental		numeric
	Upstream side	Downstream side	(cm)
	(cm)	(cm)	
1	0	0	0
2	-2,3	-2,36	-1,72
3	-4,1	-4,32	-3,33
4	-5,8	-6,27	-4,62
5	-6,49	-7,23	-5,57
6	-6,79	-7,88	-6,13
7	-6,79	-7,34	-6,32
8	-5,6	-6,4	-6,13
9	-4,4	-5,07	-5,57
10	-1,92	-2,44	-4,62
11	-0,12	-0,11	-3,33
12	2,27	2,32	-1,72
13	0	0	0



a. Upstream side b. Downstream side

Figure 6. The Comparison Chart of Experimental and Numerical Downgrade Experiments

The results of the measurement deflection data in the field and with the SAP 2000 program due to static load testing as shown in Figure 2 on the downstream side of point 7 are shown in Table 2 and the static deflection and load graphs are shown in Figure 7.

Table 2. Comparison of experimental and numerical upside deflections

No	Configuration	Weight of truck	Downstream side	experimental	Numeric	Frekency
		KN	joint	(mm)	(mm)	Hz
1	Configuration 1	0	Joint 7	0	0	2,196
2	Configuration 2	20,14	Joint 7	3,5	2,8	2,144
3	Configuration3	40,28	Joint 7	5,8	4,9	2,103
4	Configuration 4	80,56	Joint 7	11,2	9,1	2,034
5	Configuration 5	120,84	Joint 7	19,6	15,6	1,981
6	Configuration 6	0	Joint 7	1,3	0	2,196

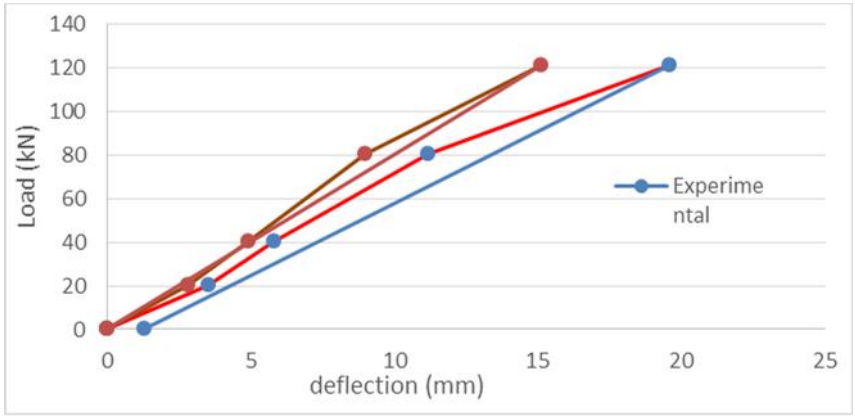


Figure 7. Static load and deflection relation

There is a difference between static deflection measurements in the field and program modeling, this may be due to several causes, including steel elements used in modeling still in elastic condition and on field measurements already in elastic condition.

The static data frequency and static deflection results in the field and structure modeling using the program are shown in Table 3 and plotted on the pedestrian comfort graph based on The Ontario Bridge Code and Bridge Management System shown in Figures 10 and 11.

Table 3. Static deflection and frequency

	Total static defelction(mm)	Frekuency(Hz)
Experimental	-93	2,14
Numeric	-65,83	2,144

Based on Figure 9 with the first frequency relation and static deflection by field measurement and modeling, the bridge indicates the uncomfortable area. Based on Figure 10 with static deflection and span length the bridge indicates the uncomfortable area. So it can be concluded that the bridge Soekarno-Hatta Malang based on the standard graph of convenience TheOntario Bridge Code and Bridge Management System in an uncomfortable condition and needed repairs

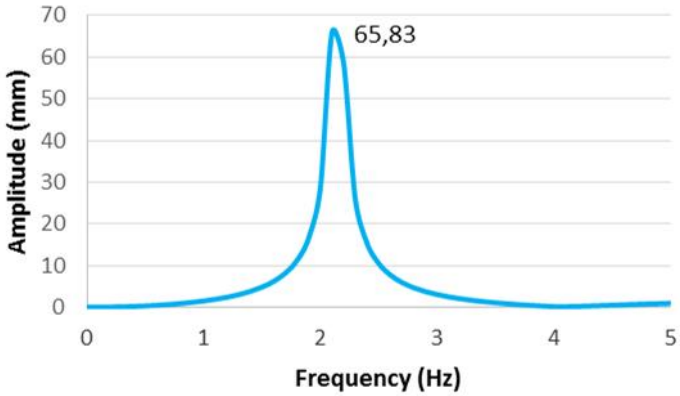


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Figure 8. Response structure without TMD

Based on Figure 8 can be seen amplitude value of 65.83 mm and frequency of 2.14 Hz. The point under consideration is the point located on the bridge span (point 211) with load input is a steady state function that represents the vibration of the vehicle with the vehicle frequency of 30 Hz.

5.2 With Tuned Mass Damper

To reduce vibration due to vehicle stops, then added Tuned Mass Damper vertical (direction Z). The optimum mass ratio that Tuned Mass Damper can use is 4.5% of the structure mass and 25% damping. Tuned Mass Damper placed in the middle of the bridge span is a meeting between the transverse girder 6 and the girder lengthwise 28 and 29.

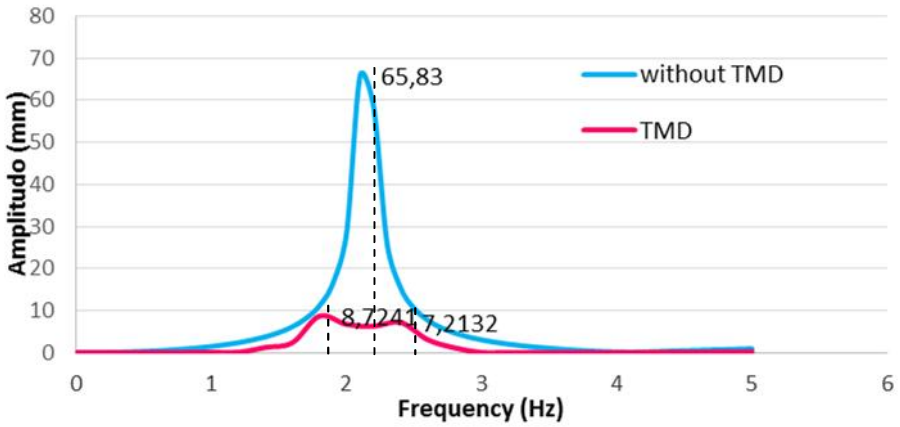

Figure 9. Amplitude and frequency relationship

Results from the installation of TMD shows a frequency of 1.8 Hz with an amplitude of 8.7321 mm and a frequency of 2.4 Hz with an amplitude of 7.2132 mm.

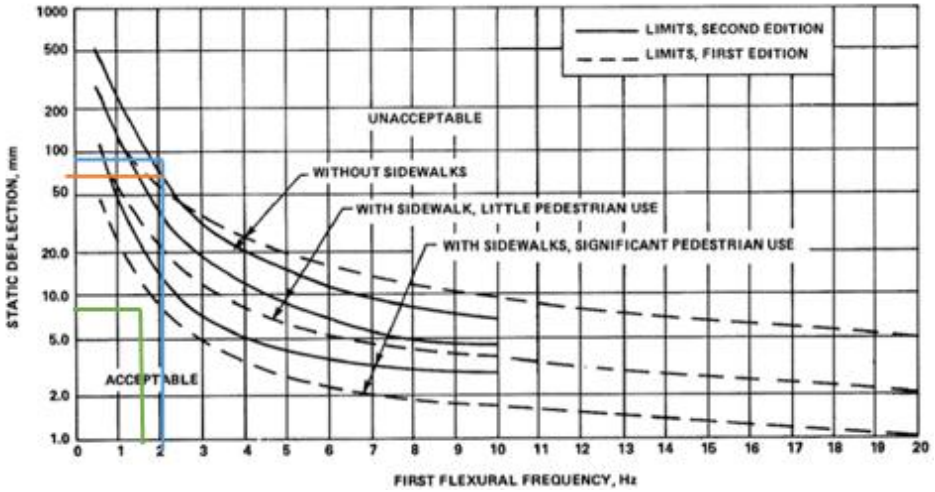

Figure 10. Comparison of comfort with and without TMD

Information

: numeric
: experimental
: with TMD

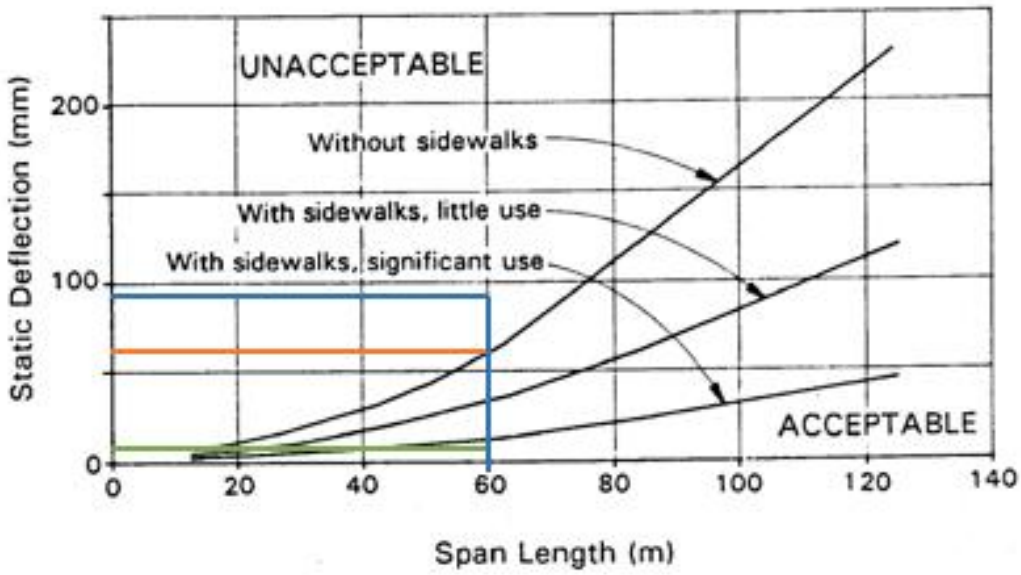

Figure 11. The maximum static deflection for highway bridges with sidewalks

Information

: numeric
: experimental
: with TMD

Based on Figure 10 can be seen the results of pedestrian comfort analysis that refers to the rules of The Ontario Bridge Code and Bridge Management System before being given an improvement does not meet the standards of comfort, and after the proposed improvement by using the Tuned mass damper than the standard of pedestrian comfort is met. The use of a mass ratio of 4.5% of the main mass of the structure also meets the convenience standards on The Ontario Bridge Code and Bridge Management System for all static loading configurations.

4. Conclusions

Based on this research, it can be concluded:

1. The frequency obtained from the measurement at the Soekarno-Hatta bridge field is 2,14 Hz and the first frequency of the modeling is 2,144 Hz, so there is a difference of 0,18%.
2. The maximum total deflection in the field on knot 7 with configuration 2 is 76,9 mm and the program is 65,9 mm
3. Based on the standards of The Ontario Bridge Code and Bridge Management System, the Soekarno Hatta Bridge is in an uncomfortable condition.
4. The addition of tuned mass damper with a mass ratio of 4,5% of the mass of the main structure, the first frequency value is 1,8 Hz with an amplitude of 8,7241 mm and the second frequency is 2,4 Hz with an amplitude of 7,2132 mm. The value obtained from the program is verified by manual calculation with the formula obtained by the main structure frequency value of 2,113 Hz and after the addition of tuned mass damper obtained the value at frequency 1 of 1,735 Hz and at frequency 2 of 2,375 Hz.
5. The result of improvement value with tuned mass damper is plotted on the standard of The Ontario Bridge Code and Bridge Management System of Soekarno Hatta Bridge in convenient condition.

6. The maximum deflection due to maximum live load on configuration 5 is 6 trucks with total weight of 120,84 Ton in the field of 19.6 mm and 15,1 mm modeling.
7. The addition of a tuned mass damper with an optimum mass ratio can improve pedestrian comfort.

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Children's Playground and Safety at the Kahayan Riverbank Settlement, Palangkaraya

Parmonangan Manurung

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Abstract

Kahayan riverbank settlement is an informal residential area located in downtown of Palangkaraya City, in Central Kalimantan Province. The settlements in this region consist of stilt houses connected by circulation paths with a height of 2 to 4 meters from the ground. The majority of houses are built with wood material so it is very vulnerable to the occurrence of a fire hazard. Typology of settlements in the form of houses on stilts and floating houses have an impact on the lack of public open space. This condition also affects children's play activities in the area. The research method used is qualitative method by conducting direct observation at research location, interviewing children and surrounding community, and literature study to sharpen analysis and get a conclusion. From the results of the study found that children play in open spaces that are not suitable allocation such as circulation path, the location of the former occurrence of fire, even on the roof of the house. This happens because of the limited open space that can be used as a play area for children. Based on the results of the discussion can be concluded that the need for open space as a representative child play area is very important for the area of informal settlements on the banks of the river Kahayan

***Keywords*:** children, open space, river banks, playground, safety.

1. Introduction

Based on Statistics Indonesia, (2013), in 2015 the population of Indonesia reached 255.5 million. The population of Indonesia is expected to increase rapidly in 2035 and will reach 305.6 million. The number of children aged 0-14 years in Indonesia in 2015 reaches almost 30% of the total population of Indonesia. The majority of Indonesian people live in downtown. This condition has an impact on urban density and the development of informal settlements in urban areas (UN, 2014). Kirazoğlu and Akpinar (2015) said the needs of children for social relations and opportunities to express themselves on the development of the city has not been met. Manurung (2016) mentioned that the lack of play space in urban areas resulted in children looking for alternative space for play in other locations; some of the locations were unsafe location.

The city of Palangkaraya is the capital of Central Kalimantan province and traversed by the Kahayan river which is one of the largest rivers on the Borneo island (Hamidah, et.al., 2016). Based on data from BPS-Statistic of Palangkaraya Municipality (2016), the population in Palangkaraya City in 2015 reached 259,865, and 66,708 of whom were 0-14 years old. The Kahayan riverside settlement is located in the center of Palangkaraya, this location is chosen to be a research site because it has distinctive characteristics. Being on the surface of the river and its condition is very dependent on the water level of the river. This study aims to identify play areas used by children in the Kahayan riverside settlement area as a play area. Research has been conducted using qualitative methods through direct observation in the field, as well as interviewing 28 children playing in four different locations. Interviews were also conducted on adults located at the observation site. The results are then analyzed using qualitative methods and related theories to obtain conclusions.

2. Literature Review

Children should have a chance to play (Macintyre, 2010; Fromberg & Bergen, 2015), the right of children to play is also governed by the laws of Indonesia contained in the Child

Protection Act governing the right of the child to get a chance to play. In Article 11 of the Law of the Republic of Indonesia No. 23 of 2012 on Child Protection, mentioned that children are entitled to have the opportunity to play and develop themselves. Play has an important meaning for children because according to Dargan & Zeitlin (2006) and Fromberg & Bergen (2006) through play activities, children can develop their knowledge and abilities. Suhaeni (2010) said the density of settlements affects the inhabitants because society requires social interaction. Meanwhile, Wonoseputro (2007) mentioned, the existence of children's outdoor playground has been diminished and replaced by some fantasy world. In fact, according to Article Protection of facilities and infrastructure must be provided by the state and government to protect children. Open space has an important role in children's development because through the open space children will experience the learning process (Setyowati, 2012), while Omerod & Green (2002), said that a well-built environment can have a positive impact on the quality of life of children. Based on this literature study, it can be concluded that children need a representative play space to allow them to learn, socialize and have a good quality of life.

3. Results and Discussion

The location of the study was chosen based on the level of complexity and density of settlements and was able to represent the condition of other residential areas. The location of research sites is a high-density settlement. Based on observations in the field, there are two types of houses in this location, namely floating house (located above the river) and the stilt house is on the banks of the river, this condition in accordance with the study done by Hamidah, et.al. (2016). Floating house is strongly influenced by the level of the river surface, in the rainy season when the river level increases, then the level of this type of house will also increase. Conversely, in the dry season when the river water receded, then the position of the house is also lower. Meanwhile, the type of house stilt house, built on wooden columns that are submerged during the rainy season and clearly visible during the dry season (Hamidah, et.al., 2016). The material used to build houses is wood, this results in the location of the settlement is very vulnerable to fire hazard.

Figure 1. The location of research
(Source: Google maps)

Circulation paths connecting each of building masses are built on wooden structures and some of the other circulation pathways have been renovated using reinforced concrete structures. Field observations show the average width of the circulation pathway connecting each house is 1.5 m. This circulation is passed by motorcycle, bicycle, and pedestrian. At the location, there is no open space that serves as a public space. According to (Hamidah, et.al., 2016), there is a social facility in the Kahayan riverbank settlement area, a community hall used to accommodate various activities and meetings of citizens.

Figure 2. Floating houses (left) and Stilt houses (right)

Based on observations at the study sites found that children play in several locations, namely:

- at the circulation path
  There were some children play at this location, but the available space for play is very limited because they have to share the space with pedestrians and bikers. The circulation path width of only 1.5 m resulted in limited play space for them. However, because it is at a high level, children can use this space during the rainy season and dry season.

Figure 3. Children are playing on the circulation path

- an open space caused by the decrease of river water level
  In the dry season, the water surface of the river will decrease to form an open space that is in between the mass of the building and can be used as a children's playground. But, they cannot use this space during the rainy season due to rising river level.

Figure 4. Children are playing on an open space caused by the decrease of river water level.

- an open space caused by fire
  According to Borneo News (www.borneonews.co.id) fire incident has occurred nine times in the Kahayan riverside settlement area and the last fire incident occurred on February 21, 2017. Field observation showed that the fire occurred in the area of river settlements Kahayan formed an open space. This open space had been used by children as a playground. However, the space used is quite dangerous because the material left by the fire can endanger the safety of children.

Figure 5. Children used open space caused by fire

- on the rooftop of a house
  Limited outdoor playground resulted in some children playing on the roof of the houses. This area is very dangerous for the safety and safety of children because children will be dropped or stung by electricity wire. But from interviews with children, it is found that they often play on the roof of the house and they are not afraid to play in that location.

Figure 6. Children used rooftop as a play area

The results of interviews with children show that the majority of children say that almost every day they play in the area. They chose the location because the better place is not available in that location, especially when the water level increased. The playground is uncomfortable but we loved it. While interviews with several adults at the site show that, the play location is not representative, but there is no other play location provided for children. Location is not safe for children, and they play without adult supervision. It should be provided a representative, safe, and comfortable playground for children.

The results showed that children in the Kahayan riverbank settlement area utilized several locations as play areas even though the location was dangerous for their safety. The locations used are temporary open spaces because they are formed by the dry season and the fire disaster. The absence of a representative playground location resulted in children playing in dangerous locations. They play in the location around the river without fear and fear because they are used, this is in accordance with what was submitted Setiawan (2006) that, children love to play in the river and its surrounding because the river is a challenging location, and children also have a positive perspective on the river that is located around their residence.

4. Conclusion

The absence of a representative play space resulted in children using several areas as a playground such as:

- at the circulation path
- an open space caused by the decrease of river water level
- an open space caused by fire
- on the rooftop of a house

The importance of children's playground should be responded by providing child safety and friendly playground

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The Potency of Kersen Leaves (*Muntingia calabura* Linn.*)* to Decrease High Blood Sugar Level

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Abstract

Along with the increasing prevalence of diabetes mellitus in Indonesia in the past 5 years, various studies has been conducted related to drugs that can be used to decrease blood sugar levels. Natural materials become prevered alternative treatment to decrease high blood sugar level due to the high cost of synthetic drugs, limited availability and the increasing understanding of medicinal plants. This literature review discusses the potency of Kersen leaf extract (Muntingia calabura Linn.) as an alternative to decrease high blood sugar. According to various studies, kersen leaves contain flavonoids that are thought to have antidiabetic pharmacological effects. Flavonoids are able to decrease high blood sugar by inhibiting the breakdown of carbohydrates into sugars and inhibiting the absorption of sugar in the small intestine, stimulating insulin secretion by pancreatic β cells, activating insulin receptors, and repairing damaged pancreatic β cells through antioxidant activity. A number of studies have been conducted to show the hypoglycemic effects of kersen leaves extract by using different experimental models with different doses.

Keywords: Kersen, High Blood Sugar, Flavonoids.

1. Introduction

Diabetes is a chronic disorder in the metabolism of carbohydrates, fats and proteins. Diabetes results from either insulin deficiency or malfunction (Akter et.al, 2014). Treating diabetes requires drug treatments and lifestyle changes. Nowadays there are many options used to treat diabetes such as drug therapy, pharmacoteraphy and diet therapy (Apriyanti, 2016). Drug therapy such as insulin treatments are most often used amongst the others because it is easy to apply and giving fast result. Although it is most often used, drug therapy have some disadvantages including drug resistance, side effects and even toxicity therefore treatments with medicinal plants are recommended (Apriyanti, 2016; Malviya et.al, 2010). Most plant contains natural materials such as secondary metabolites that often have anti-diabetic effects. Many researches in Indonesia have been studying about Kersen (*Muntingia calabura* Linn.) leaf extract over the past few years, and the results shown that kersen leaf extract has the ability to decrease high blood sugar level significantly (Hajiaghaalipour and Arya, 2015). Kersen leaves extract contain flavonoids that are thought to have antidiabetic pharmacological effects (Brahmachari, 2011). The main purpose of this article is to introduce Kersen leaf as an effective medicinal plants used for treating diabetes.

2. Materials and Methods

Material used in this paper was publication regarding diabetes and the potency of kersen leaf extract to decrease high blood sugar level obtained from databases such as Science Direct, Proquest, Google Scholar and Scopus. In the literatures, Kersen also named as Talok, Singgepor and Jamaican Cherry (Kram and Keller, 2001). Keywords used in this review included “kersen”, “Jamaican cherry”, diabetes and medicinal plants. Out of the 54 collected articles published between 2001 until 2017, 13 were used in this paper. The search was restricted to English and Indonesian language articles.

3. Results and Discussion

Previous studies regarding the potency of Kersen leaves to decrease high blood sugar level are presented in Table 1 below.

Table 1. Researchs shown potency of kersen leaves as an anti-diabetic agents

No	Discussion	References
1	Pre and Post test control group design with 25 diabetic rats treated with different doses of kersen leaf extract (0,1875 g/kg body weight, 0,25 g/kg body weight, 0,3125 g/kg body weight). Blood sugar samples were collected on 0, 30, 60, 90 and 120 minutes after treated with different doses of kersen leaf extract. The results shown that kersen leaf extract of 0,3125 g/kg body weight significantly decrease rat's blood sugar level.	Apriyanti, 2016
2	Pre and Post test control group design with 12 diabetic person treated with kersen leaf extract (dose unknown). The results shown that the average blood sugar levels after intervention deceased by 305.58 to 178.33 Kersen leaf extract significantly decrease respondent's blood sugar level.	Musriana and Zahroh, 2016
3	Five groups of diabetic rats (induced with streptozotocin) were treated with kersen leaf extract. Their blood sample were collected for two weeks (once every week) and then analysed using ANOVA. The result shown that treatments with kersen leaf extract significantly decrease blood sugar level of diabetic rats if it is given with the dose of 100 mg/kg body weight.	Pramono dan Santoso, 2014
4	The present investigation, describes the phytochemical analysis, in vitro antioxidant and antidiabetic property of *Muntingia calabura* leaves extracts along with estimate the inorganic components of the leaves. Total phenolic and flavonoid content in the extracts were estimated by Singleton and Zhishen method. Ethanolic extract of leaves revealed the presence of high phenolic (33.33±0.13µg GAE/mg) and flavonoid (123.31±0.54µg CHE/mg) content. Treatment of Streptozotocin-Nicotinamide induced type II diabetic rats with extracts caused significant reduction in fasting blood glucose level in a dose dependent manner. All the crude extracts showed dose dependent antioxidant and anti-hyperglycemic activity, capable of offering protection against free radical mediated damages.	Sindhe et.al., 2013.
5	Hypoglycemic and antihyperglycemic effect of methanolic extract of *Muntingia calabura* L. leaves was evaluated in normoglycaemic, glucose loaded and alloxan-induced (135 mg/Kg body weight) diabetic rats. The extract (500 mg/kg body weight) significantly lowered the blood glucose levels to an extent comparable to that produced by standard antidiabetic drug (Glipizide 5 mg/Kg body weight) in both normal and diabetic rats. The extract (500 mg/kg body weight) increased the glucose tolerance in glucose loaded rats. The results suggest that methanolic extract of *Muntingia calabura* L. leaves possess significant antidiabetic activity.	Sridhar et.al, 2011
6	Cherry (*Muntingia calabura*) is particularly useful as a shade tree by the roadside. The leaves contains flavonoids, saponins, tannins and triterpen, steroid. The compounds in pharmaceuticals has a role as an antioxidant, anti diabetic, a bitter taste, antimicrobial, diuretic, etc. This research aims to determine the chemical compounds in cherry leaves that has properties as catcher free radicals. Based on analysis of GC-MS showed that volatile compounds consist of myrcene (5,927%), thymol (3,543%), α terpinol (11,831%), linalool (2,240%), geraniol (21,718%), nerol (4,375%), citronellol (12,837%), eugenol (17,498%), α lonone (1,413%), β sitosterol (7,806%), α Amyrin (3,167%), Lupelol (4,228%), α tocopherol (1,975%), dan β carotene (1,425%). Result analysis of LC-MS showed that consist of Fumaric acid (6,643%), Succinic acid (4,903%), Niacin (0,718%), Malic acid (2,863%), Cinnamic acid (4,945%), Pyridoxine (1,893%), Gallic acid (21,428%), Ascorbic acid	Triswaningsih et.al, 2017

	(6,121%), Glucose (8,166%), Fructose (20,690%), Pantothenic acid (1,478%), Biotin (1,025%), Thiamine (1,158%), Kaempferol (6,825%), Catechin (14,407%), Quercetin (10,623%), Riboflavin (1,131%) and Folic acid (1,553%).	
6	Among the phytochemicals assessed, the carbohydrate, glycosides, tannin, phenolic compounds, proteins and aminoacids showed strong reactions, whereas, moderate reaction was observed with rest of the phytochemicals. Positive result was observed with flurosence study. The total yield obtained from 15gm powder was 09.95% with leaf and 16.01% with fruit. The carbohydrate content was found to be higher with leaf (204.0±3.46mg/g carbohydrate) when compared to fruit (75.33±4.61mg/g carbohydrate). But, the protein content was higher with fruit extract (6.44±0.15mg/g protein) on comparison with leaf extract (2.04±0.15mg/g protein). Moderate amount of aminoacids content was observed with leaf and fruits. The behavior of the extract powder was positive for alkaloids, proteins, flavonoids, anthroquinone.	Khrisnaveni and Dhanalaksmi, 2014.
7	Antidiabetic study showed that aqueous and methanolic extracts inhibited rat's intestine α-glucosidase activity with the IC 50 values of 1.45±0.19 and 0.88±0.60mg/ml, suggesting the ability of the plant to delay glucose absorption from small intestine, hence reduce hyperglycemia. Meanwhile, the chloroform and hexane extracts possess anti-glycation activity with the IC 50 values of 1.03 and 2.38mg/ml, respectively. This observation suggests that such extracts and might have the potential to prevent the occurrence of diabetic complications. Total phenolic content in the aqueous, methanolic, chloroform and hexane extracts were 334.38±3.24, 221.67±9.43, 78.13±0.88 and 44.17± 2.36mg GAE/g extract, respectively. Antioxidant assay showed that aqueous and methanolic extracts possess potent reducing power and DPPH scavenging activity (IC 50 : 22.28±2.20 and 23.28±1.30µg/ml). These potent activities might be attributed to the amount of phenolic compounds presence in such extracts. In conclusion, *Muntingia calabura* possess antidiabetic, anti-glycation, antioxidant and mild cytotoxic activities. These results indicate that *Muntingia calabura* might have the potential to be developed as new pharmacological agent targeting on diabetes mellitus management.	Adam et.al, 2015.

4. Conclusion

Plants can be used as natural antioxidants and effective herbal medicines, such as Kersen (*Muntingia calabura L.*) due to their anti-diabetic compounds, such as flavonoids, tannins, phenolic, and alkaloids that improve the performance of pancreatic tissues by increasing the insulin secretion or decreasing the intestinal absorption of glucose. More researches are needed in order to separate the active components in kersen, the dose of kersen leaf extract that can be used to decrease high blood sugar level, and molecular interactions of their compounds for analysis of their curative properties.

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Subsurface Structure Interpretation of Southern Flank of Tangkuban Parahu Based on Gravity Method

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Abstract

Tangkuban Parahu is one of strato type volcano which grows in the eastern of Sunda Caldera. Theeruption is grouped in three phases, such as explosive phase, effusive phase and now the volcano is growth phase small explosive, interspersed phreaticsometimes. Therefore, this volcano is interesting to be studied related it'sgeological phenomenon.A subsurface geological researchis essential to know the description of subsurface structures. Geophysical research use gravity method assessed effectively and efficiently, to know density of subsurface rock can make up TangkubanParahu based on gravity anomalies on the surface, so the subsurface geological condition can be prediction by rock density which is known. The research aims to get gravity anomalies maps, and subsurface geologycal modelling. There are thirty five gravity observation data of direct acquisition in the field, regional and residual anomalies separation using the 2D fast fourier transform lowpass filter method.This investigation gives better understanding on the subsurface structure of Southern Flank of TangkubanParahu Volcano, there are two normal faults, based on cross section A to B and C to D, comonly, there are two units of rock make up TangkubanParahu, Consits of old volcano product and young volcano product.

Keywords: Tangkuban Parahu, Gravity Method, Lowpass Filter, Forward Modelling.

1. Introducton

Tangkuban Parahu is one of strato volcano type. According to Van Bemmelen (1934 in Kusumadinata 1979) This Volcano which grows in the eastern of Sunda Caldera. Based on the pattern, theeruption is grouped in three phases.The explosive phase that produces pyroclastic and lava, The effusive phase produces many lava flows composed of basaltic andesite, now the volcano is growth phase small explosive, interspersed phreatic eruption sometimes. Therefore, this volcano is interesting to be studied related it's geological phenomenon. A subsurface geological researchis essential to know the description of subsurface structures such as rocks, fracture, and groundwater encouragingphreatic eruption. Geophysical method is one of direct method which use to know about subsurface geological condition Geophysical research use gravity method assessed effectively and efficiently, to know density of subsurface rock can make up TangkubanParahu based on gravity anomalies on the surface, so the subsurface geological condition can be prediction by rock density which is known.

Gravity method of basic teory is Newton's Law, wich is Sir Isaac Newton say that "the tensile force between two objects is proportional to both the mass of the body and inversely proportional to the square of the distance between the centers of the two masses" in mathematically like as equation 1.

$$F = G\frac{m_1 m_2}{r^2} \quad (1)$$

Imformation:

F : Force (Newton)

G : Constant ($6.67 \times 10^{-11} N.m^2.kg^{-2}$)

m_1 : Mass 1

m_2 : Mass 2

r^2 : Distance

From the equation it can be explained that the force of gravity is a force acting between two objects, for example between man and earth where the magnitude of force will be proportional to the mass of the two bodies and inversely proportional to the distance between the two objects.

In addition there is also Newton's law of motion which states that force is the magnitude of the multiplication of the mass and its acceleration. Mathematically can be written as follows equation 2.

$$g = G\frac{M}{R^2} \quad (2)$$

Information:

g : The average acceleration of gravity on the surface of the earth($1 m/s^2 = 100 cm/s^2 = 10^5 mGal$),

G : Constants ($6.67 \times 10^{-11} N.m^2.kg^{-2}$)

M: Mass of Earth (kg)

R : Earth radius (m).

Based on equation 2 it can be explained that the magnitude of the gravitational force on the surface of the earth depends on the measurement of the center of the earth (latitude, and altitude) because the varying morphology of the earth's surface will give different distances to the center of the earth. However, in practice, the gravitational force of the measurement results can differ greatly from the calculation result caused by the disturbance of a subsurface mass zone affecting the gravitational field. For example, rocks with a much lower mass density of adjacent rocks will cause differences in the measured gravitational value in the area, the difference in gravity values being what is called the gravity anomaly.The existence of this gravity anomaly can be used to predict rock conditions and subsurface structures, this approach is called the gravity method. This method is one of the geophysical methods used to measure the variation of the earth's gravitational field due to differences in mass density between rocks. Measurements can be done on land or at sea by boat or airplane. The measuring tool used in this method (Gravimeter Scintrex CG-5 Autograv) has a high accuracy because the difference in measured gravitational field is relatively small. The general objective of this research is to obtain a complete Bouguer anomaly map, regional anomaly map, and residual map, and from the general objective is expected to depict the model of subsurface structure, based on the complete Bouguer anomaly.

Commonly, fault is geological structure which control of research area. Lembang's Fault is a big faults in this area, from East to West this fault expanding which separate Sothern Flank between Bandung Plateau. Located of the fault through 10 km of Northern of Bandung. The fault is active which gawir fault of north side. About 22 km Overall length of Lembang Fault, as a straight line look at from Eastern Palasari Mountain to West near from Cisarua (see Figure 1). Previous investigations have linked that the dominant Lembang fault is the Normal Fault occurring after eruption of Sunda Volcano that took place in the time of the Old Quarter. In the northern part of this fault, the relative depth is as deep as 450 m, while the southern part is relatively stable fixed in its position. (According to Van Bemmelen 1949 in Somantri S 2008), this fault is formed, a result of the collapse which is the effect of the empty magma space at the time of the great eruption of Sunda Volcano. Lembang fault, still active so need to watch out because it can trigger a big earthquake. Based on the geological information on (Figure 1) the authors then narrow the geological coverage of the study area according to the distribution of gravity measurement points as seen in (Figure 2).

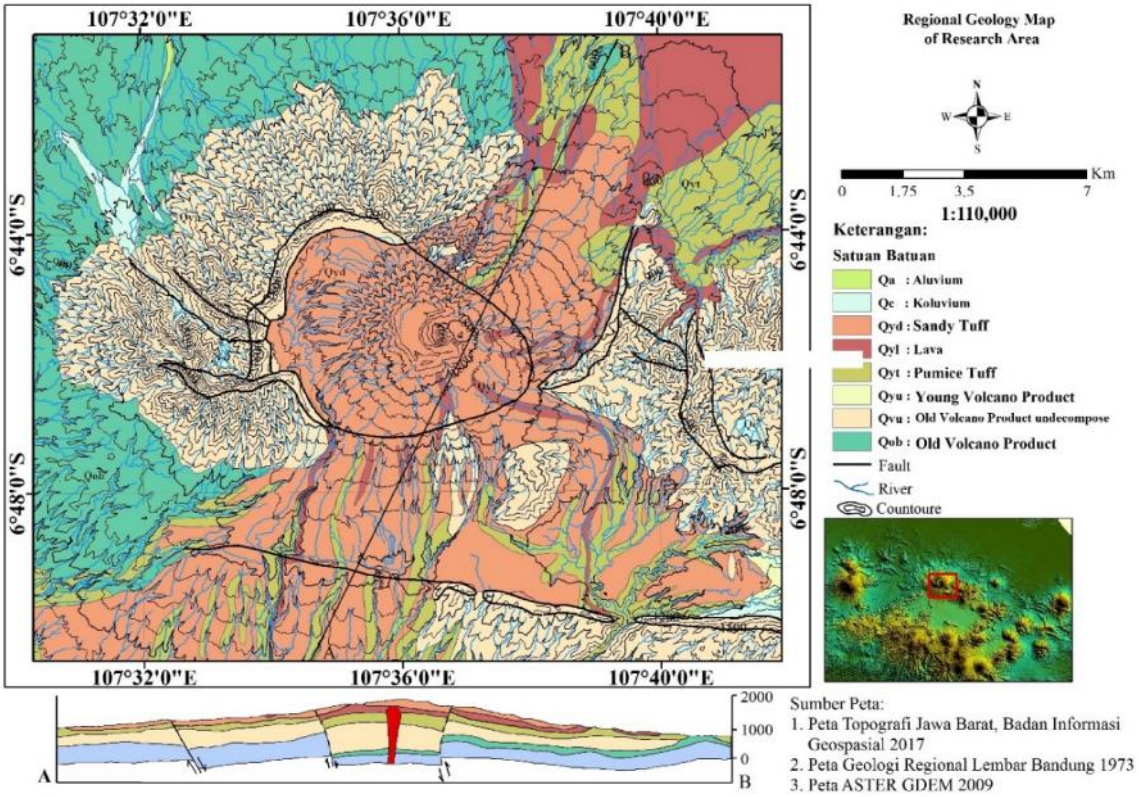

Figure 1. Regional geological of map (data source: P.H. Silitonga, 1973)

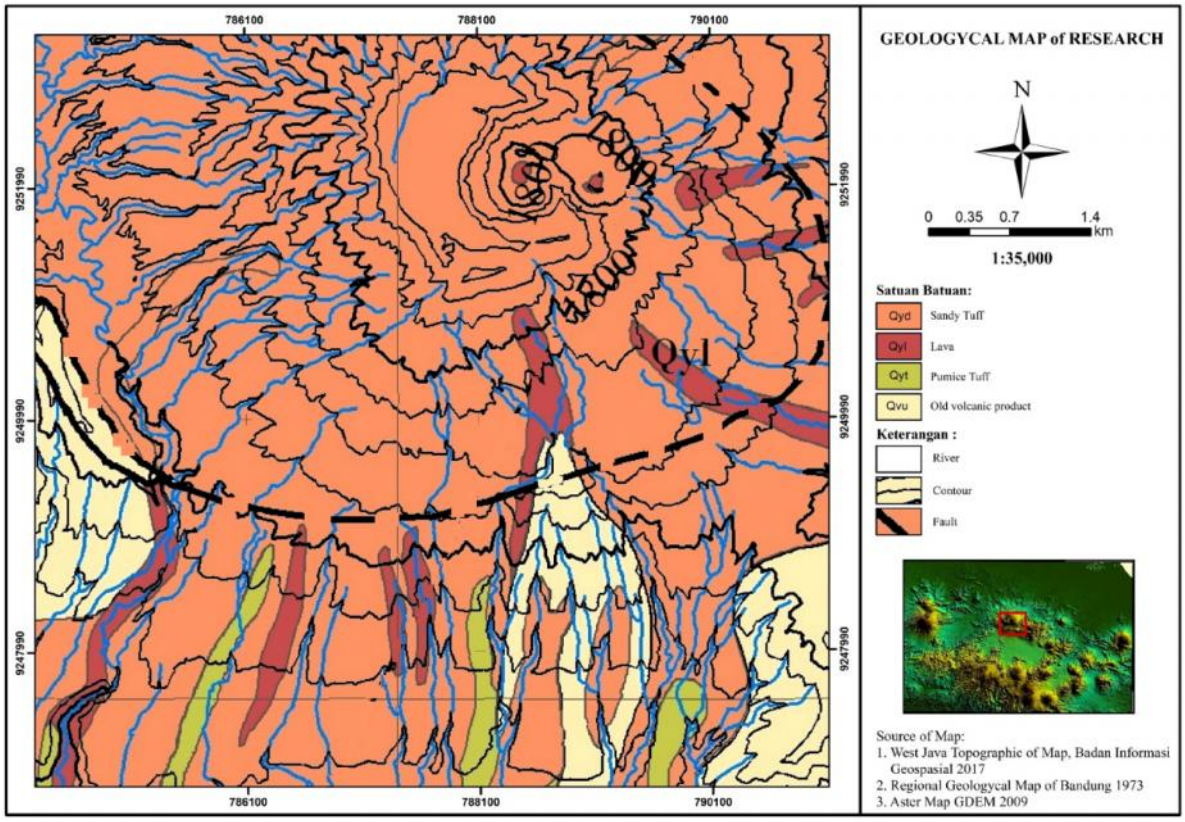

Figure 2. Local geological of map (Data source: P.H. Silitonga, 1973)

2. Materials and Methods

Source of gravity data obtained is data of direct acquisition in the field, as many as 35 observation points of gravity data spread randomly from the top of TangkubanParahumountain with dominance of distribution of data in the direction of South

Slope. Stages of gravity data acquisition were conducted by designing a preliminary survey of gravity observation points, with grid patterns using the Google Earth application and then surveyed at each target point location, from the preliminary survey results some of the target points that can not be reached, because they are in a steep ditopografi , no access roads, and are in conservation forest areas, so the design of the acquisition point is randomly generated (see Figure 3 and 4) which is in accordance with the real conditions in the field

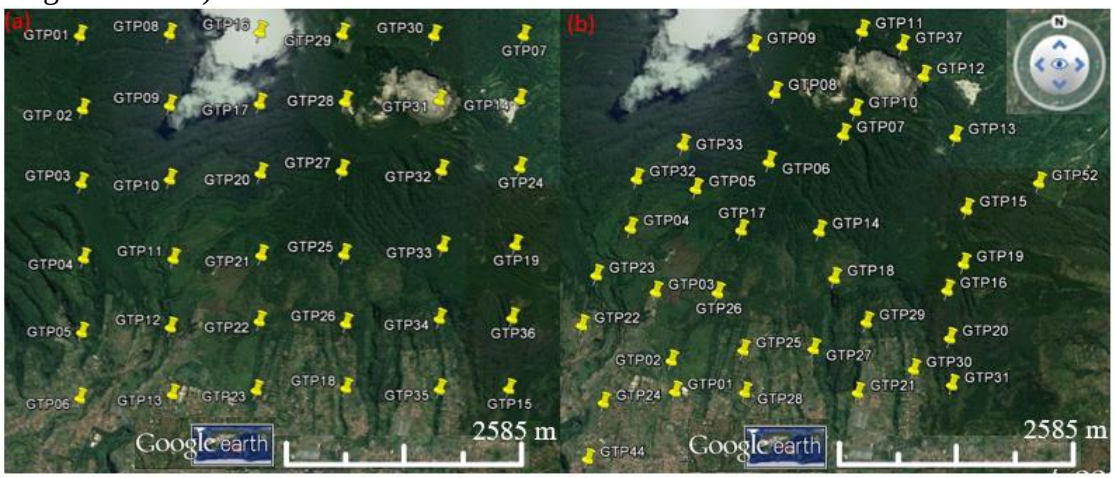

Figure 3. Gravity design observation by Google Earth (a) Preliminary survey (b) Fix gravity design observation

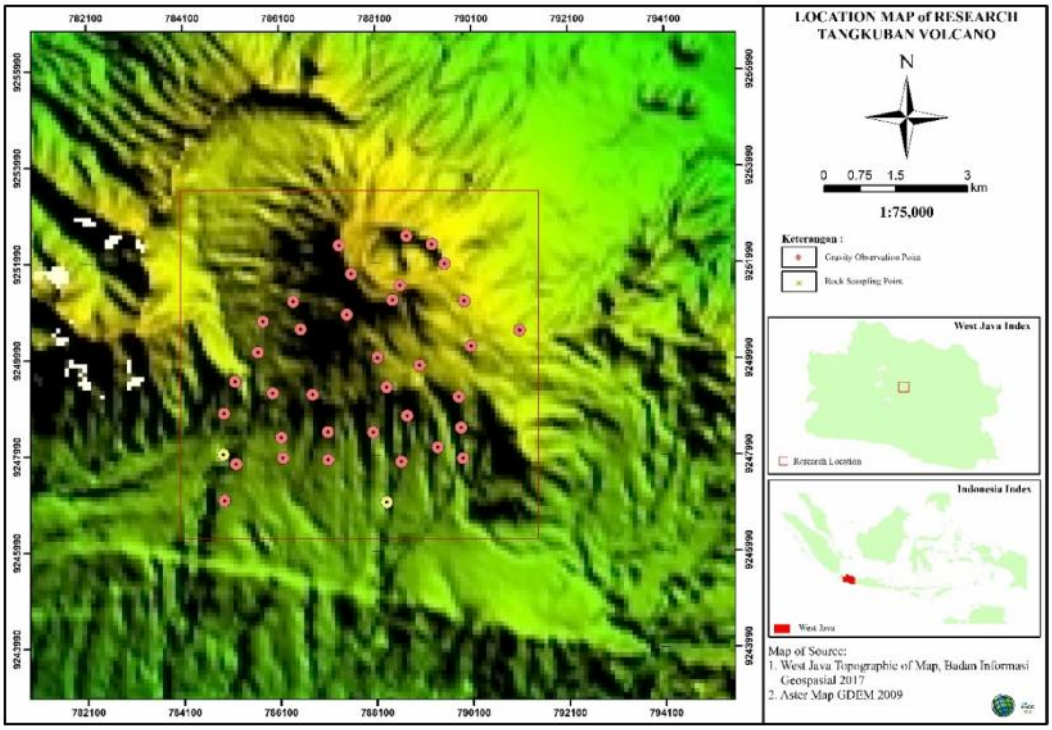

Figure 4. Research location of maps and fix gravity distribution data

The result data of the acquisition, processed to produce a complete Bouguer gravity anomaly map, regional gravity anomaly map, and residual gravity anomaly map. The process begins with applying the tidal correction, drift correction, latitude correction, Bouguer correction, free air correction and topographic correction to produce a complete Bouguer anomaly value. Then the separation of regional and residual anomaly values using lowpas filter method 2D-fast fourier transform anilysis using software Fourpot_1.3b. (briefly shown in the figure The gravity anomaly value is then plotted using the surfer 10.0 software to obtain

a complete, regional and residual Boguer anomaly map (see Figure 5 and Figure 6) .The modeling process is carried out using forward modeling using Encom Vision Model 13.0.

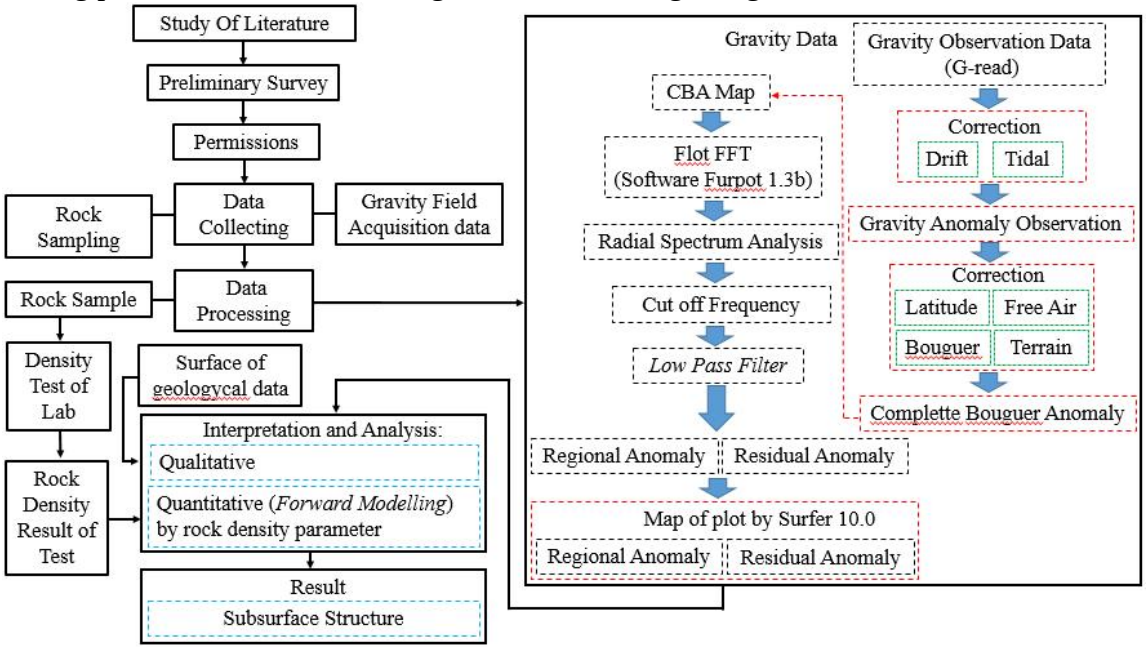

Figure 5. Flow chart of research and data processing

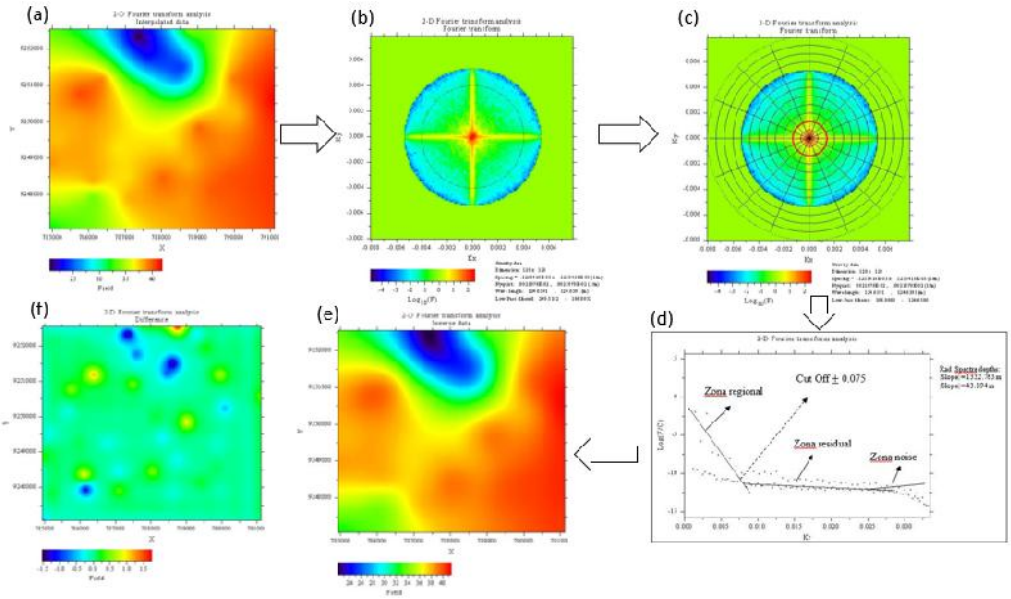

Figure 6. Resume of lowpass filter process (a) CBA data, (b) Plot 2D FFT (c) *Radial spectrum analisis*(d) Cut off Frequency (e) Regional anomaly data (f) Residual anomaly data (sumber: *2D Low pass Filter Software Fourtport 1.*3b (Pirttijarvi, M., 2014)

3. Results and Discussion

3.1 Complette Bouguer Anomaliy Gravity of Map

Based on the data processing that has been done then, map of complete Bouguer anomaly as shown in (Figure 7) Bouguer full gravity maps, high anomalous values ranging from 36 to 41 mGal spread in the East, Southeast, and West. While the low anomalous values are in the range of 20-33 mGal spread north towards the summit of Mount TangkubanParahu, South Southwest, and North West North.

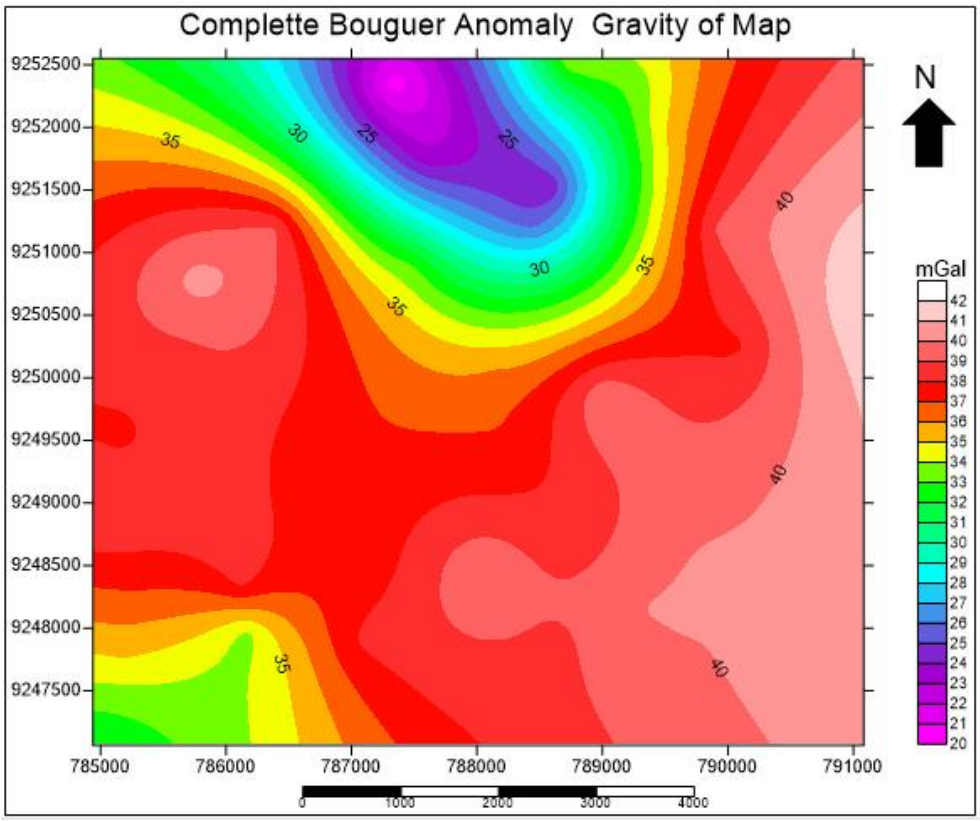

Figure 7.CompletteBouguer anomaly (CBA) gravity of map

3.2 Regional Anomaly Gravity of Map

Based on the data processing that has been done then, the regional anomaly map as shown in (Figure 8) high anomaly scattered in the East to Southeast, and Northwest, while the low anomaly spread to the North leads to the summit of Mount TangkubanParahu . The value of regional anomalies, in general, describes the relatively deep contrast of rock density.

3.3 Residual Anomaly Gravity of Map

Based on the results of the data processing done, the residual anomaly value (See Figure 9) illustrates the superficial density of shallow rocks. The trend of positive residual anomaly values in the range of 1 to 1.8 mGal with a circular contour pattern, spread across the Northwest, the same is true in the North, the positive anomaly values ranging from 1.8 to 3 mGal with a dense and circular contour pattern shape. In the North the anomalous values tend to be negative in the range of -2.2 to -3 mGal with a tight and circular contour pattern leading to the summit of TangkubanParahu Mountain. In addition, in the Southwest, anomalous values tend to be positive 0.5 to 1 mGal with a tightly coiled contour pattern tangent to nearly identical contour patterns but negative values in the range of -0.6 to -1.4 mGal.

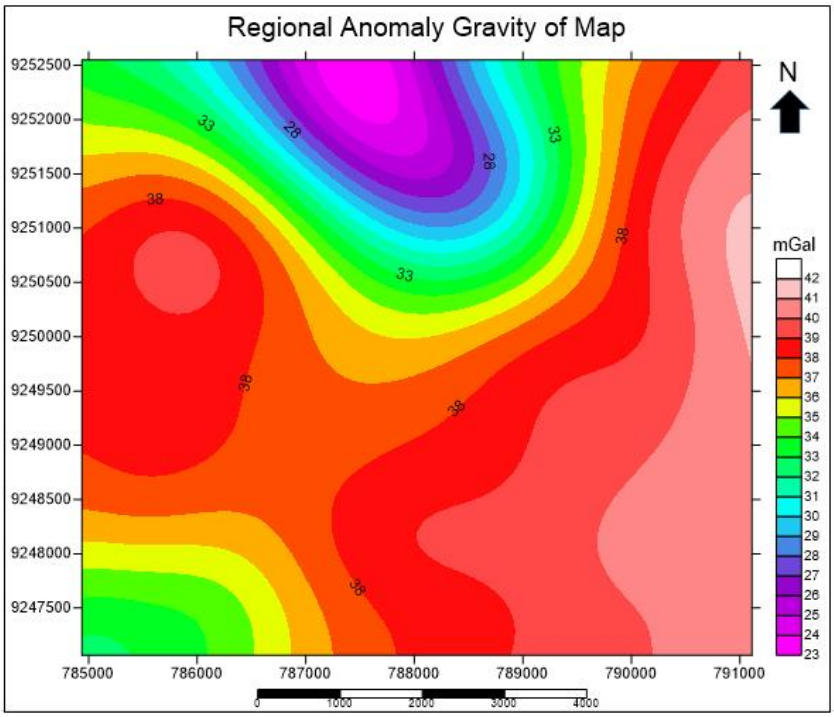

Figure 8. Regional anomaly gravity of Map

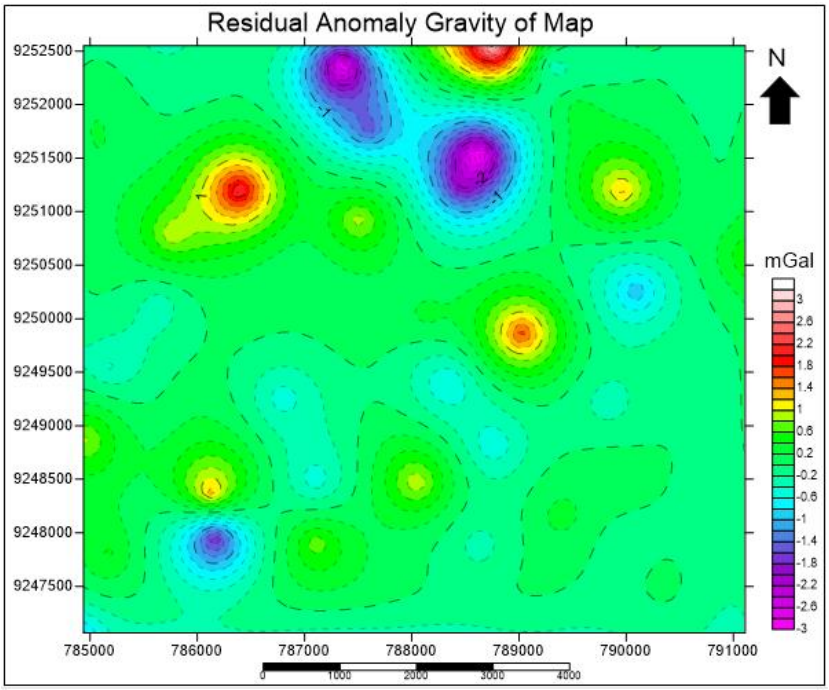

Figure 9.Residual anomaly gravity of Map

To find representative sub-surface geological picture, it is necessary to analyze strongly by modeling of subsurface structure, using parameter of density value of rock sampling test result in laboratory.

3.4 Gologycal Cross Section from A to B

The geological cross section from A to B is directed West (W) -East (E) as shown in (Figure 10) Based on the results of quantitative interpretation through forward modeling, it is interpreted that there is a fracture structure in the North Northeast on a complete Bouguer anomaly map (see Figure 7) this is correlated with anomalies on the completteBouguer

gravity map, which tends to rise in the northeastern part of the Northeast, then decreases in the middle direction of the North. The fracture structure, interpreted as a normal fault, is an inherited part of the decline. This is associated with the direction of the gravity curve of observation from ± 40 mGal to ± 27 mGal. While on the rise, has anomaly values tend to be stable in the range of ± 40 mGal.This is confirmed by the variation of rock density used in the modeling process, (see Figure 11) spread evenly laterally from the highest density of 2.99 gr / cm3 (Ti or Lava 1 Tangkuban Parahu) which is the unit of rock from the easy volcanic product of Lava Basalt. Up to the lowest density of rocks is 1.646 gr / cm3, (Sap or flow of Sunda Piroclastic) which is the unit of rock from old volcano products in the form of Sunda Piroklastik with the dominant rock composition of Skoria and Batuapung.

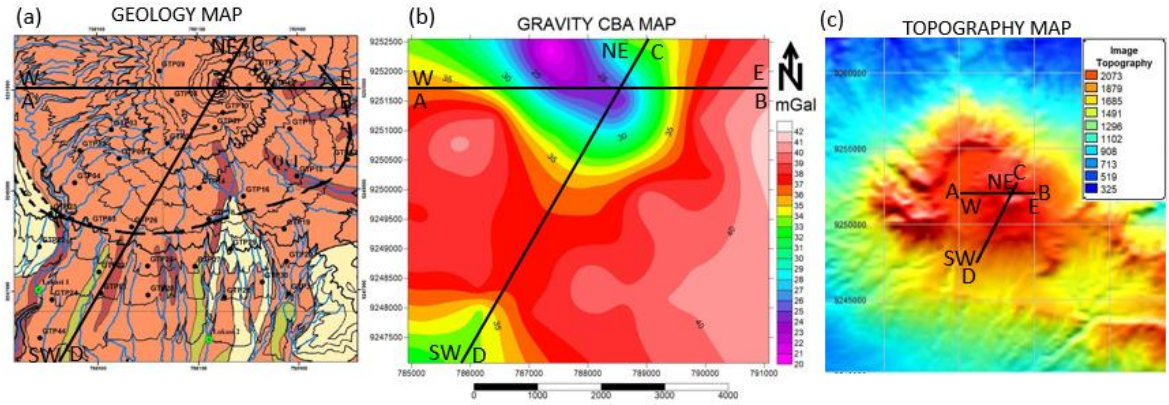

Figure 10. Direction of Section (a) Geology of map (b) CBA of map (c) Topographic of map

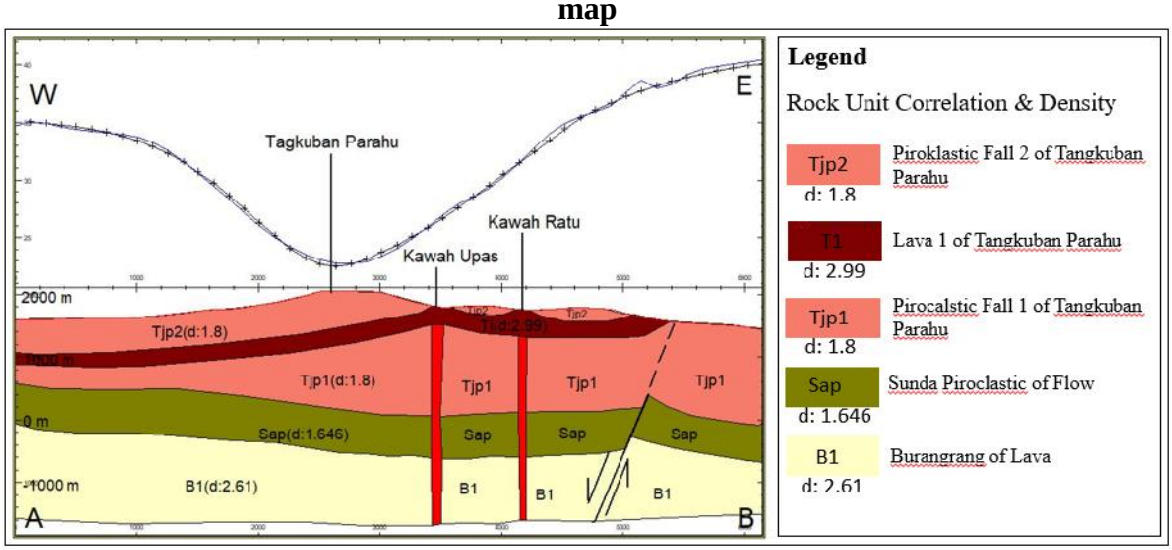

Figure 11. Geologycal Section of subsurface from A to B

3.4 Geologycal Cross Section from A to B

Geological section C to D directedfrom North East (NE) to South Southwest (SW) as shown in (see Figure 8). Based on the forward modeling results, the resulting geological model as seen in (see Figure 10) of the results is interpreted to be a normal fracture structure with an ascending portion associated with a complete Boguer gravity anomaly value stability in the range of 37 mGal, while the falling portion is associated with subduction a full Bouguer gravity anomaly curve complete from ± 37 mGal to ± 26 mGal. This correlates with anomalies on the full Bouguer gravity map, which tends to increase in the Middle Southwest in the range of 40 mGal, then low in the Middle North section around 38-31 mGal. This is confirmed based on the variation of rock density used in the modeling process, (see figure 9) spread evenly laterally from the highest density of 2.99 gr / cm3 (Ti or Lava 1

TangkubanParahu) which is the rock unit of the easy volcano product of lava Andesite. Up to the lowest density of rocks is 1.646 gr / cm3, (Sap or flow of SundaPiroclastic) which is the unit of rock from old volcano products in the form of SundaPiroklastik with the dominant rock composition of Skoria and Batuapung. From the results of sub-surface geological modeling (Figure 9 and Figure 10) can be interpreted layers of rock that make up the TangkubanParu volcano, from the surface down to the subsurface in sequence, namely Piroklastik Fall 2 TangkubanParahu (Tjp2), Lava 1 TangkubanParahu (Ti) 1 TangkubanParahu (Tjp1), SundaPiroclastic Flow (Sap), and the lowest layer of Lava Burangrang (B1)

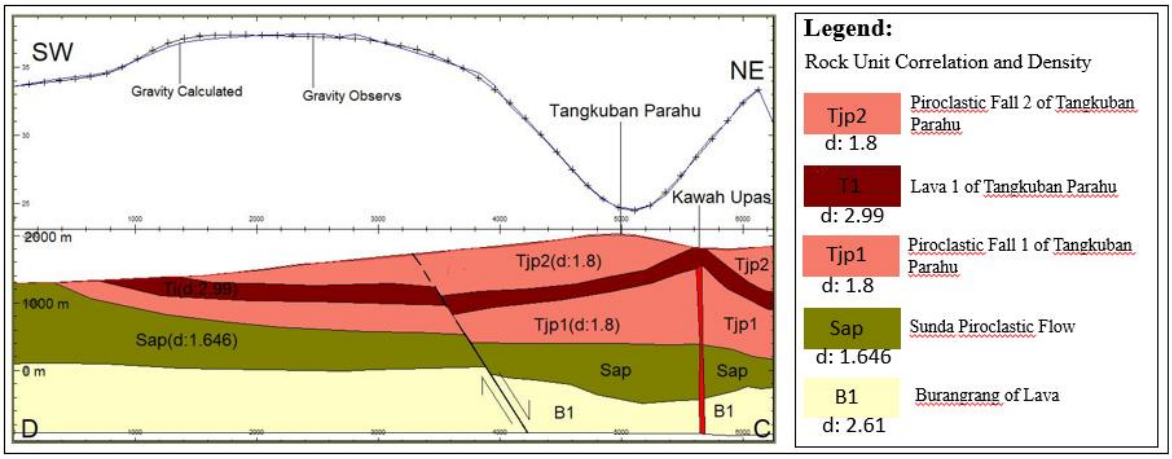

Figure 12. Geologycal Section of subsurface from C to D

4. Conclusion

This study provides a better understanding of the subsurface structure of the Southern Slope of TangkubanParahu Mountain, based on the A to B cross section and the C-to-D cross-section there are two normal fault structures that occur below the surface, in general the research area is composed by two rock units, namely the old volcano units and units of young volcanoes.

5. Acknowledgements

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The Importance of Early Maturing Hybrid Maize in The Limited Rainfall Areas to Anticipate Climate Changes

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Abstract

Corn is the second important commodity after rice in Indonesia. The national production in 2016 was 23.5 million tonnes and expected to increase to achieve self-sufficiency. West Nusa Tenggara (WNT) Province is one of the corn production centers in Indonesia. Corn growing area in this province reached 210,000 ha in 2017. Farmers are predominantly planting high yield hybrid corn with longevity. Corn is not only cultivate in high rainfall areas, but also in short or limited rainfall, therefore short age hybrid corn is more suitable for the limited rainfall areas. This research aim to explore new short age hybrid corn with high yield. The research was conducted in West Lombok District of WNT Province from June to September 2013. The experimental design was Randomized Complete Block Design consist of 12 cultivars and varieties with three replication. Treatments consist of 8 cultivars (CH1, CH2, CH3, CH4, CH5, CH6, CH7, and CH8) and 3 high yield varieties (Bima-3, NK-22, and Bisi-2) as well as 1 short age variety (Gumarang) as comparison. Results showed that CH-2 cultivar had significantly higher seed yield (9,562 kg/ha) compared to 7 other cultivars (seed yield range of 7,421 - 8,862 kg/ha) as well as compared to NK-22, Bisi-2 and Gumarang with seed yield of 7,333 kg/ha,7,807 kg/ha, and 7,980 kg/ha respectively. However, seed yield of CH-2 cultivar was not significantly different compared to Bima-3 (9,162 kg/ha). In addition, CH-2 cultivar is also potential as a short age corn as shown no significant different of moisture content (24.1%) compared to Gumarang (24.3%) and significantly lower than other 7 cultivars (26,70 - 28,16%) and 3 varieties (28,3% - 30,1%). These results indicated that CH-2 cultivar is a potential as new superior high yield and short age variety.

Keywords: Maize, hybrid ,early maturing.

1. Introduction

Corn is one of the important food commodity considering the demand continues to increase, along with the increase of the population. Optimal land shrinkage become obstacles in the procurement of corn. In addition to the main food commodities, corn as well as suppliers of raw materials of vegetable energy. It is reflected in the still high demand for corn from some countries importers like India and China. United States, and Australia, the world's largest corn producer, are currently not able to meet the needs of corn in their country (Prayitno 2009, Haryono 2012).

In Indonesia, corn is a cereal crop. demand is increasing every year, export opportunities are increasingly open, because corn-producing countries such as the United States, Argentina, and China limit its export due to their increasing corn requirements, including for industrial bioetanol. In Indonesia, corn is the main source of raw material for poultry industry (± 50%), forage feed quality (80-100 t/ha), the staple food for most communities in eastern Indonesia, and as the second largest contributor after rice in gross domestic income. Therefore, the increased production of maize in the country needs to continue to be attempted.

In an effort to increase production of maize, the Government has projected a corn self-sufficiency program in 2007. To speed up the program, the Government is providing incentives to farmers in the form of subsidies for fertilizers, seeds, and fiscal policy (2009 Wikrama). Another policy is needed in the development of the investment incentive policy is corn, institutional finance and capital, technologies that are ready to be applied in the airy,

improving the quality of human resources, institutional sustainability, support marketing, regulation, and legislation (Djoko et al. 2005).

Maize self-sufficiency program initiated in 2007 quite successfully to increase production of maize in the country. It can be seen from the development of production in 2006 (11.61 million tons) was down 7.3% compared to the year 2005 (12.52 million tons). But in 2007, corn production increased 7.2% to 12.45 million tons. Although national corn production increased in 2007, but the target is not reached production amounted to 15.9-16.5 million tonnes. At the time of production declines, the demand for corn in 2006 thus increased, so also in the year 2007. The average increase in the needs of corn in the period 2005-2007 is 1.3%. Corn production has continued to increase to 16.3 million tonnes in 2008, 17.6 million tons in 2009, and 18.3 million tons in the year 2010, but decreased in the year 2011menjadi 17.4 million tons (Central Institut of Statistics, 2012).

Demand for corn from year to year increasing in line with the growing needs of the food industry raw materials, feed, and biofuels as renewable fuel which is alternative energy. The current world food situation appears to be headed for a crisis resulting from food supply to the world market tends to be reduced. This is one of the driving factors to spur maize production in the country

The main barriers increased production of maize is arable land conversion for the benefit of the nonpertanian continued, such as business, industry, housing and infrastructure. Consequences is the need of land for agriculture can only be met through the utilization of the land-the land of suboptimal outside Java are generally poor hara and often hit by drought. In addition, global climate change (climate change) is one of the threats to the survival of the production of corn. Climate change will affect the increase in temperature (global warming) followed by an extreme drought and flood. Other changes that will affect the activities of agricultural cultivation is shifting the distribution of rain that is increasingly difficult to predict, so the timing of cultivation is difficult and the risk of failed harvest the larger (Balitbang Agriculture 2011, Adger et al. 2005).

Dry land is one of the agroecosystem has great potential for agricultural food crops (Abdurachman et al. 2008). The dry land area surly in Indonesia reached 99.5 million hectares (Hidayat and Mulyani Agustina in 2002 at al., 2010). Development of corn in the new area will be much less exploit dry land fertile. Development of corn hybrids age genjah will guarantee the success of the program increased production of maize on dry land. In general dry land constraint is the limited supply of water for plant growth (Swardi, 2013)

West Nusa Tenggara (WNT) is one of the producers of maize in Indonesia. The potential of the dry land on the WNT reached 1.2 million hectares, and a potential area for planting corn area of 626,034 ha, and land that can be cultivated only an area of 210,000 ha (BPS WNT, 2016). Corn grown in Irrigated land and dry land, there are about 70% corn plants are on dry land. Where it is known that the dry land in particular that is on Sumbawa Island has very limited rainfall, very eratik climate, so that if the development of the corn will be done at this location so that the corn is to be prepared have early maturing and high yield potential.

Corn crop was early maturity needed farmers, especially on dry land that is often experienced drought on the charging phase of the seed. In a State of drought will lower the yield seeds, heavy cob, slow down the time of flowering and enlarge the flowering interval (the difference between a male seed discharge and discharge of hair cob), shortening the crop and enlarge the plant is barren. The variety of early maturity maize required many farmers to adjust cropping patterns and the availability of water. In Irrigated land, corn plants are usually grown after harvest of rice, so that was need early maturity of mize (Azrai, 2013)

This research aims to gain a corn hybrid age genjah with high yield potential, particularly for areas that have restricted water availability as well as efforts in anticipation of global climate change

This research aims to get early maturity hybrid maize and high yield potential, to an area with limited water and to the anticipation of global climate change.

2. Materials and Methods

The experiment was conducted in irrigated land, Lembar village, Lembar Sub- district, West Lombok Regency, from June to September 2013. The treatment used a Randomized Complate Block of Design (RCBD) with three replicated. Treatment consists of eight early maturity hybrid maize genotype (CH1, CH2, CH3, CH4, CH5, CH6, CH7 and CH8) and four varieties of the comparison, i.e. Gumarang (early maturity), Bima-3, NK-22, and Bisi 2 (high yield potential). Experimental plots measuring 3 m x 5 m, with planting distance 75 cm x 20 cm, one plant per hole so there are 25 plants per line.

The seed was planted with planting distance 75 cm x 20 cm, one plant per hole for planting. The first fertilization was done at age 7 days after planting (DAP) with rate of 135 kg N 45 kg P2O5 K2O 45 kg/ha. The second fertilization at age 30 DAP with a rate of 90 kg N/ha. Plant maintenance include weeding, watering and controlling pests and diseases.

Results for seeds on water content 15%, converted to units of tons per hectare with the formula (Priyanto,2015):

$$\text{Seed yield (t/ha)} = \frac{10.000}{VH} \times \frac{100\text{-}WC}{100\text{-}15} \times B \times R$$

VH = Vast Harvest
WC = Moisture content at the moment of harvest (%)
WP= Weighting peelings (kg)
R = Rendemen (%)

The observed variables include; Plant height, the height of cob, Age 50% tasseling , age 50% silking, height a cob, Cob diameter, number of rows per cob, number of seeds per cob, moisture content and seed yield of corn. The data were analyzed using Analysis of Variant (Anova), when there is a real difference between the treatment then tested further by the use of Duncan 5%.

3. Results and Discussion

From the anova analysis results (table 1), for higher plants there are 5 genoitpe (CH2, CH3, CH6, CH5, CH7 and) plant height above 200 cm (range 201-213 cm) that is not significant with the comparison of varieties with Bisi-2 and NK-22 (203-207 cm). There are 1 genotype (CH1) that have high crop under 200 cm (194.53 cm) that is not significant with the comparison of varieties with Bima-3 and Gumarang (range 186-188 cm).For 6 genotype above have the potential to become a new hybrid corn because it already has a high plant with the comparison of varieties. There are 2 genotype (CH4 and CH8) had lower plant height (168.67 177.47 cm and cm) from comparison of varieties Bima-3 and Gumarang. For both of these genotypes potentially as corn hybrids suitable expectations developed on the site of the development of corn that has a pretty tight so that the wind is not easily fall.

For high Cob show that there are 6 genotypes (CH1, CH2.CH3, CH 5,CH 6,and CH7) have high cobs (range 94-116 cm) that is not significant with comparison of varieties with Bima-3, Bisi-2 and NK-22 (range 94-110 cm). There are 2 genotype have cobs (range 90-92 cm) that is not significant with comparison of varieties Gumarang (88 cm). This indicates that all genotypes tested had high normal because the high cob did not significant with comparison of varieties. So that all genitipe have the same opportunities to be a new corn hybrid.

There are 6 Genotypes (CH1, CH2, CH3 .CH5 CH.6 CH7) which has the age tasseling is no significant with comparison of varieties Bisi-2 (56, 67). The six genotype has age tasseling longer if the comparison with the Gumarang varieties. There are 2 genotype (CH4 and CH8) which has the age tasseling is no significant with the comparison varieties Bima-3 and NK-22. This showed that no genotype that has age tasseling of the faster such as varieties of Gumarang. Where Gumarang is one of the early maturity varieties.

For the variable age silking shows that there are 5 genotype (CH1, CH2, CH5, CH6, CH7) that have age siliking is not significant with comparison of varieties Bima-3 and Bisi-2, but significant with comparison of varieties Gumarang (early maturity maize). There are 2 Genotyping (CH2 and CH8) that have aged silking are not significant with the comparison of varieties NK-22 (54.32). Only 1 Genotype (CH4) that have aged siliking are not significat with the comparison of varieties Gumarang (early maturity maize) and significat with genotype and other comparison of varieties. CH4 Genotype is one genotype of maize hybrids as early maturity potential.

Table 1. Plant height, the height of cob, age 50% tasseling, age 50% silking on genotype hybrid maize in West Lombok, 2013

Genotype	Higher Plants (cm)	High Cob (cm)	Age 50% tasseling (day)	Age 50% silking (day)
CH-1	194.53 abc	97.60 abc	56.33 abc	57.67 ab
CH-2	201.93 ab	100.07 abc	56.33 abc	57.00 abc
CH-3	204.07 ab	99.33 abc	55.67 abc	55.00 bcde
CH-4	168.67 c	90.13 bc	53.67 d	53.33 e
CH-5	213.27 a	116.33 a	56.33 abc	56.33 abcd
CH-6	210.27 a	112.73 ab	57.00 ab	58.00 a
CH-7	211.13 a	110.47 abc	57.33 a	57.33 ab
CH-8	177.47 bc	92.67 bc	54.33 cd	54.00 de
Bima-3	188.53 abc	94.67 abc	55.00 bcd	56.33 abcd
Bisi-2	207.67 ab	110.20 abc	56.67 ab	55.33 abcde
Nk-22	203.73 ab	101.87 abc	53.33 de	54.33 cde
Gumarang	186.33 abc	88.07 c	51.67 e	53.00 e
CV	7,50	9,68	1,92	2,57

Description: a number that is followed by the same letter in the same column shows not significant at 5% level

From the results of the analysis of anova (table 2.) show that all genotypes have a length of cob that is not significant with the comparison of varieties Bisi-2, NK-22 and, Bima-3, but significant with the comparison of varieties Gumarang. This indicates that the 8 genotypes have adaptation and the establishment of cob are better than compared to the varieties of Gumarang.

Cob diameter for all geotipe not significant with comparison of varieties Bima-3 and NK22. The 8 genotip have a cob diameter larger than comparison of varieties Bisi-2 and Gumarang. This shows that the all genotypes have a better potential if the compared with the vareietas Bisi-2 and Gumarang.

Table 2. The length of the cob, Cob diameter, number of rows per cob, number of seeds per Cob corn on genotype of hybrid maize in West lombok, WNT.2013

Genotype	The length of the Cob (cm)	Cob diameter (mm)	Number of rows / Cob (rows)	The number of seeds/Cob (grain)
CH-1	15.71 ab	4.67 abc	13.20 a	431.28 abc
CH-2	15.79 ab	4.56 bc	13.20 a	468.03 a
CH-3	15.97 ab	4.59 bc	13.33 a	460.35 a
CH-4	15.08 ab	4.73 ab	10.93 b	375.17 c
CH-5	16.21 ab	4.86 a	13.20 a	453.09 ab
CH-6	16.79 a	4.63 abc	13.07 a	480.00 a
CH-7	16.39 ab	4.55 bc	12.93 a	441.28 abc
CH-8	14.96 ab	4.56 bc	12.93 a	435.12 abc
Bima-3	14.73 bc	4.77 ab	13.47 a	426.67 abc
Bisi-2	16.08 ab	4.41 c	12.53 a	461.67 a
Nk-22	15.82 ab	4.71 ab	13.20 a	431.04 abc
Gumarang	13.26 c	4.42 c	13.07 a	385.23 bc
CV	5,03	3,12	5,39	8,94

Description: a number that is followed by the same letter in the same column shows not significant at 5% level

For the number of rows per Cob, there are 7 genotype (CH1, CH2, CH3, CH5, CH6 CH7 CH8) does not significant with 4 comparison of varieties (Bima-3, Bisi-2, NK-22 and Gumarang) but significant with CH4. Genotype. This show that the 7 genotypes have the same potential with comparison of. Varieties.

For the number of seeds per Cob it is known that there are 7 genotype does not significant with the comparison of varieties Bima-3, Bisi-2 and NK-22. This indicates that the 7 genotype has the potential to generate a higher seed. Only the CH4 genotype has seeds per Cob most low and did not significant with the Gumarang.

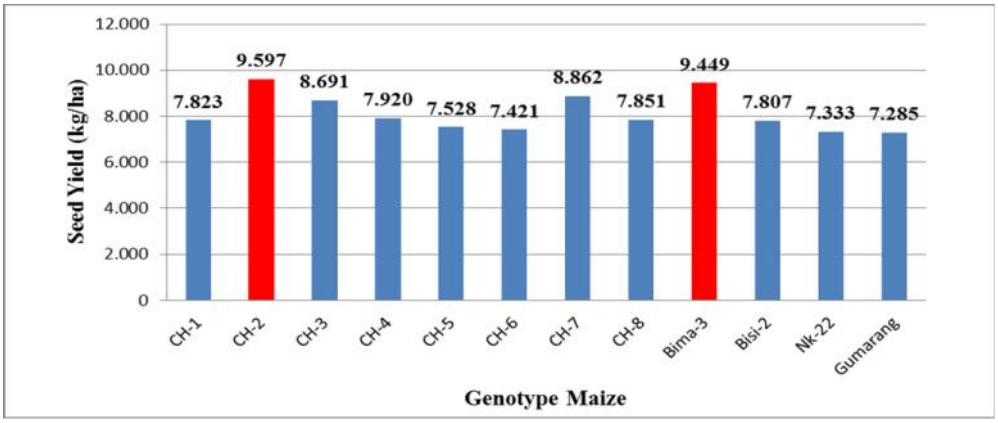

Figure 1. Seed Yield of maize in some gontipe in West Lombok, WNT. 2013

From Figure 1, it is show that the CH2 genotype has the highest seed yield (9.597 t/ha) that is not significant with the comparison of varieties Bima-3 (9.449 t/ha), but significant

with genotype and the other comparison varieties. BIMA-3 is one of the varieties that have a high yield potential. This shows that the CH2 Genotype is potentially high yield.

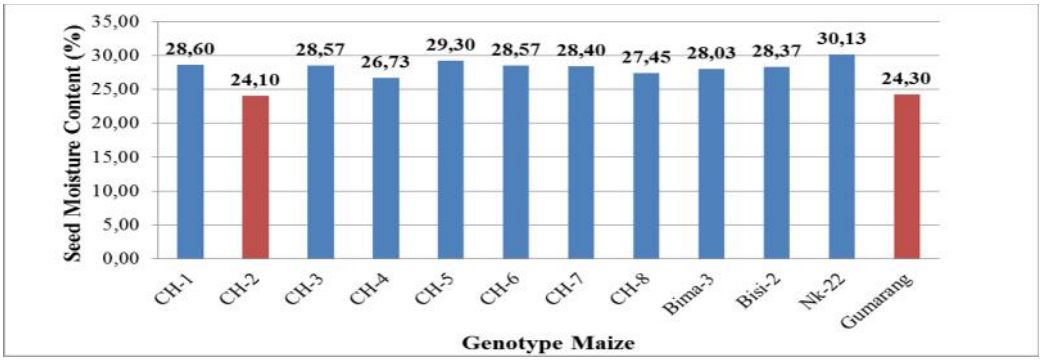

Figure 2. Seed Moisture content in some genotypes of maize in West Lombok, WNT, 2013

For variable seed moisture content (Figure 2.) shows that the CH-2genotype has a seed moisture content of harvest (24.10%) did not significant with the comparison of varieties Gumarang (24.30%), but significant with the genotype and the other comparison of varieties. The Gumarang is one of early maturity of maize, so the CH2 is one genotype potentially for early maturity and high yield.

4. Conclusion

CH2 Genotype has a high yield potential (9.597 t/ha) and early matirity, so very suitable for to be new varieties and developed on the water limited area for anticipated global climate change.

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Thank you I say to Mr. Dr. Andi Takdir M, as a Breeder and have this testing material and over his confidence Research Institute of Cereals Crop, South Sulawesi, Indonesia to put this research in West lombok WNT. Hopefully this will be testing can be beneficial to the community in particular and for the community of NTB (Corn farmers) in Indonesia.

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A Neural Network Model for Indonesia's Foreign Reserves Model

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Abstract

Foreign exchange reserves is one of the important indicator of the macro of the country's economy, including the State of Indonesia. Based on the results of previous research, the foreign exchange reserves is influenced by several factors such as exports, imports, exchange rates, inflation rate, and foreign debt. In this research, the amount of Indonesia's foreign exchange reserves is modelled based on some variables which are exports, imports, exchange rates, and external debt using the neural network model. The performance of neural network model was developed is guaranteed by two indicators are mean of squarer error (MSE) of trainning process and the coefficient of determination. The results of the performance of neural network model are 0.00288 for MSE of trainning indicator and 99.70 % for the coefficient of determination forecasting model indicator.

Keywords: neural network model, foreign exchange reserves, export, import, exchange rate, foreign debt

1. Introduction

Indonesia is one of the countries that are being actively doing development. At this time, Indonesia has been able to become one of the developed countries in the G-20. The success is determined by the success of the nation and state of Indonesia in the development and application of appropriate technology to improve the welfare of the community. In the implementation of development, a very determining factor whether or not a development program is a funding factor. One indicator of the ability of the government in terms of funding is determined by the size of the foreign exchange owned by the state.

In macro economics terms, the country's foreign exchange reserves are one of the important indicators related to the country's ability to conduct international trade. In addition, the country's foreign exchange reserves are also a strong indicator or weak fundamentals of the country's economy, specifically related to the ability to pay imports and state debts, as well as to determine the strength of the exchange rate. In fact, several factors that determine the country's foreign exchange reserves include exports, imports, exchange rates, inflation, foreign debt.

Some researchers have produced a mathematical or statistical model that illustrates the relationship between factors affecting the country's foreign exchange with the country's foreign exchange reserves, especially in Indonesia (Agustina and Reny, 2014; Febriyenti, Aimon, and Azhar, 2013; Sulastini, 2017). However, in the three researchs, the resulting model is a model that considers dependent factors to give a linear influence to the country's foreign reserves, namely Agustina and Reny (2014) using multiple linear regression, and Sulastini (2017) using partial least square method.

On the other hand, the neural network is one of the soft computing techniques that began to be developed around the year 1994 which is a computational technique. Neural network (NN) is a form of deliberately created network that is motivated by the workings of the human brain. This model was originally developed by Warren McCulloch and Walter Pitts in 1943 (Kriesel, 2005: 8; Fausett, 1994: 22). In practice, the NN method is also used in time series analysis for reasons of simple calculation, high interconnection rates, and interaction between adaptive elements (Smith, 1996).

The issue of foreign exchange reserves can be viewed as praying for a problem related to time series data. Therefore, in this study the relationship between predictor factors with the country's foreign exchange reserves is modeled using neural network model.

2. Concept of Neural Network Model

Neural network (NN) is a form of network that deliberately created and motivated by the workings of the human brain (Arbib, 2003:4-6). Information from a number of neurons (inputs) will be sent to a particular neuron. Then by the receiving neuron, the information will be added proportionally based on the value of the connection weights. The sum result will compare with a certain threshold value through the activation function. The Neural network model can be described as in Figure 1.

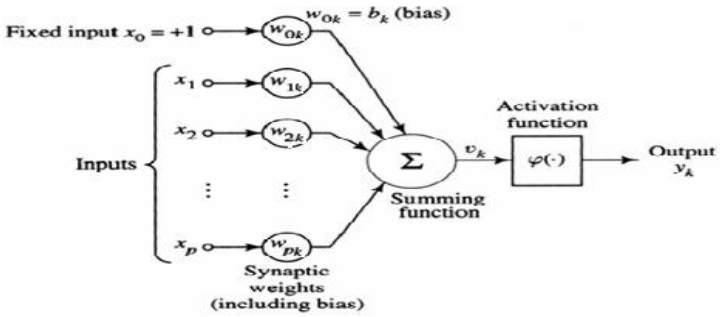

Figure 1. Simple Neural Network Model

The output of the NN model is given by

$$y_k = f(x_1, x_2, \cdots, x_p) = \ddot{} (g(x_1, x_2, \cdots, x_p)) \tag{1}$$

with $g : R^n \to R$ which is defined as

$$g(x_1, x_2, \cdots, x_p) = v_k = \sum_{j=1}^{n} w_{jk} x_j \tag{2}$$

if $= w_{0k} x_0$ represents the network bias then Equation (2) becomes

$$v_k = g(x_0, x_1, x_2, \cdots, x_p) = \sum_{j=1}^{n} w_{jk} x_j + \quad = \sum_{j=0}^{n} w_{jk} x_j \tag{3}$$

and

$$y_k = \ddot{} (v_k) \tag{4}$$

Activation function $\ddot{} : R \to R$ is a function that determines an activated neuron or not, through a process comparing with a certain threshold value. There are basically three basic types of activation functions:

a) The function of the threshold (step function), defined as follows:

$$\varphi(u) = \begin{cases} 1, & \text{jika } u \geq 0 \\ 0, & \text{jika } u < 0 \end{cases} \tag{5}$$

b) *Piecewise-linier function* defined as follows :

$$\varphi(u) = \begin{cases} 1, & \text{if } u \geq \frac{1}{2} \\ u, & \text{if } -\frac{1}{2} < u < \frac{1}{2} \\ 0, & \text{if } u < -\frac{1}{2} \end{cases} \tag{6}$$

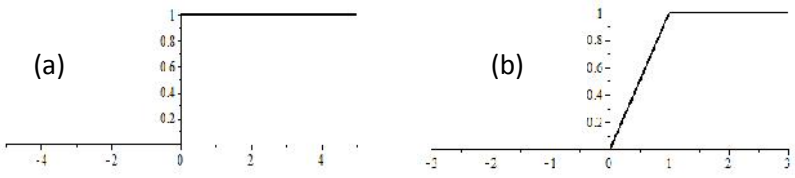

Figure 2. (a) Step Function (b) Piecewise-Linier Function

c) S*igmoid Function*. Function $f : \mathbb{R} \to [0,1]$ is the sigmoid function if it satisfies the following properties: $f \in C^{\infty}(\mathbb{R})$

(i) $\lim_{x\to\infty} f(x) = 1$ dan $\lim_{x\to-\infty} f(x) = 0$

(ii) f is strictly increasing function on $\mathbb{R}$

(iii) f has one inflexion point c with

a. f 'is a strictly increasing function on intervals $(-\infty, c)$

b. $2f(c) - f(x) = f(2c - x)$

Some examples of sigmoid function are logsin, tagsin and purelin. The graph of the three sigmoid functions is given by Figure 3.

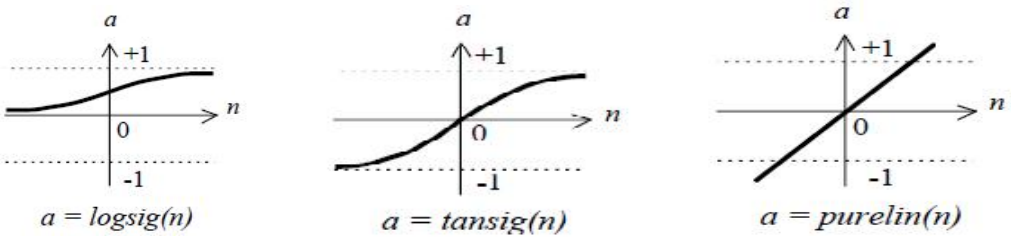

Figure 3. Graph of sigmoid function that serves as an activation function

The architecture of NN model is a graph or chart that represents a learning procedure performed by an NN model. The development of the model of NN architecture illustrates the feed forward process of learning the NN model from the input until the output value is obtained. This architecture shows the structure of the NN model of how many hidden layers, and the number of neurons on each layer of the input, output, and layer layers. In addition, this architecture also shows the process and type of activation function on each layer. The type of architecture of the NN model was developed based on the researcher's interest, ranging from simple to complicated architectures form.

3. Materials and Methods

The Indonesian foreign exchange reserve model shows the relationship between predictor factors (independent variables) and Indonesian national reserves (dependent variable) using neural network model. Data on dependent and independent variables were obtained from Bank Indonesia, the Central Bureau of Statistics, and the World Bank for the period 1975-2016.

The NN model developed is an NN feed forward model consisting of five layers, with three hidden layers. In the first hidden layer (second layer), the activation process uses sigmoid tangent hyperbolic (**tansig**) function. In the second hidden (third layer) use the logarithm sigmoid (**logsig**) function, and on the third hidden layer (fourth layer) using the linear (**purelin**) activation function (Default MATLAB).

4. Results and Discussion

4.1. Architecture of Neural Network Model Proposed

The neural network model architecture for modeling the country's foreign exchange reserves is designed to be five layers, one for each input and output model, and three layers for the hidden layer as shown in Figure 4.

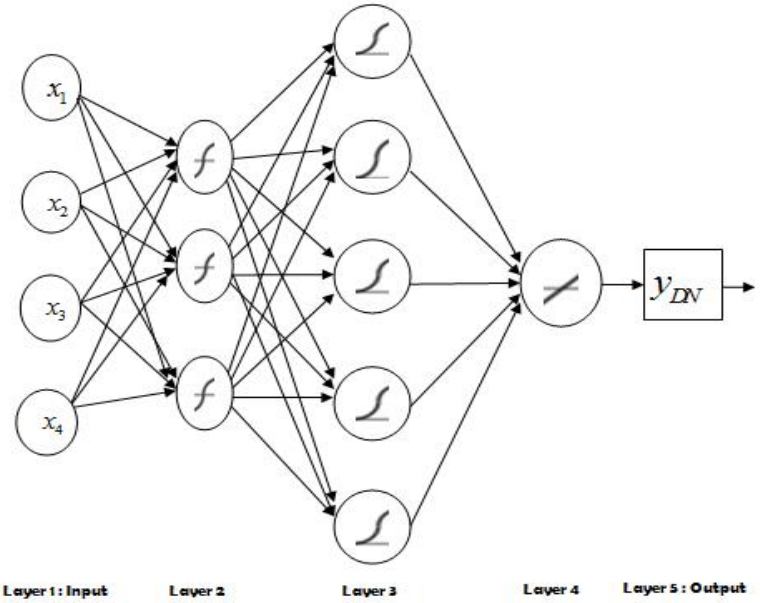

Figure 4. Neural network model architecture for modeling the country's foreign exchange reserves

In Figure 4, it is seen that the NN model architecture for modeling the country's foreign exchange reserves is arranged in five layers:

Layer 1: consists of four neurons representing the number of model inputs, which are export variables, imports, exchange rates, and foreign debt.

Layer 2: consists of three neurons representing the number of clusters of data determined by using substractive clustering method. In this layer, the result of the weighted input value values associated with the first cluster is activated using the sigmoid tangent hyperbolic (tansig) function is:

$$TS(x) = \frac{\exp(x) - \exp(-x)}{\exp(x) + \exp(-x)}. \tag{7}$$

Layer 3: consists of five neurons that are the weighted sum of the second output layer and then activated using the logarithm sigmoid (logsig) function is:

$$LS(x) = \frac{1}{1 + \exp(-x)} \ . \tag{8}$$

Layer 4: consists of a layer which is the weighted sum of the third layer output and then activated using the linear (purelin) function is:

$$PL(x) = ax \ , \tag{9}$$

for some a constant $a \in \mathbf{R}$.

Layer 5: is the value of the foreign exchange reserves of the country which is the ouput model of neural network,

$$y_{DN} = PL\left(LS_j\left(TS_k\left(WX\right)\right)\right), \ \ j = 1, 2, .., 5 \text{ and } k = 1, 2, 3. \tag{10}$$

4.2 Learning Parameters of Neural Network Model

The model of NN proposed is trained by using the type of supervised training. Training NN is done to minimize the cost function (Bahri, Widodo, and Subanar, 2013) :

$$E = \frac{1}{2}\left(y_i - y_i^t\right)^2, \tag{11}$$

with y_i indicates output of the NN model and y_i^t indicates output targets. By using the gradient descent algorithm with momentum, the weight parameters w_{ij}, u_{ij}, and v_j will be updated using equation (12) - (14).

$$w_{ij}(t+1) = w_{ij}(t) + \eta_w \frac{\partial E}{\partial w_{ij}} \tag{12}$$

$$u_{ij}(t+1) = u_{ij}(t) + \eta_u \frac{\partial E}{\partial u_{ij}} \tag{13}$$

$$v_j(t+1) = v_j(t) + \eta_v \frac{\partial E}{\partial v_j} \tag{14}$$

with η_w, η_u, and η_v indicates learning rate parameter for the weight parameters w_{ij}, u_{ij}, and v_j. The value of partial derivatives in equation (15) - (17) are given by the following equations.

$$\frac{\partial E}{\partial w_{jk}} = \frac{\partial E}{\partial y_{DN}} \frac{\partial y_{DN}}{\partial LS_i} \frac{\partial LS_i}{\partial TS_k} \frac{\partial TS_k}{\partial w_{jk}} \tag{15}$$

$$\frac{\partial E}{\partial u_{ij}} = \frac{\partial E}{\partial y_{DN}} \frac{\partial y_{DN}}{\partial LS_i} \frac{\partial LS_i}{\partial u_{ij}} \tag{16}$$

$$\frac{\partial E}{\partial v_i} = \frac{\partial E}{\partial y_{DN}} \frac{\partial y_{DN}}{\partial v_i} \tag{17}$$

Selection value of learning rate parameters to ensure convergence of WNN model are determined by Banakar et al (2008) that is the value of learning rate parameter in equation (12) - (14) which ensures convergence WNN model is

$$0 \le \eta_\circ < \frac{2}{\max_t \left(\frac{\partial y(t)}{\partial \circ (t)} \right)^2}, \quad \circ = w, u, \text{ and } v. \tag{18}$$

4.3. Results and Discussion

The training of NN model with gradient descent with momentum of 20000 epoh gives model performance based on indicator mean squarer error equal to 0,0028815 as in Figure 5.

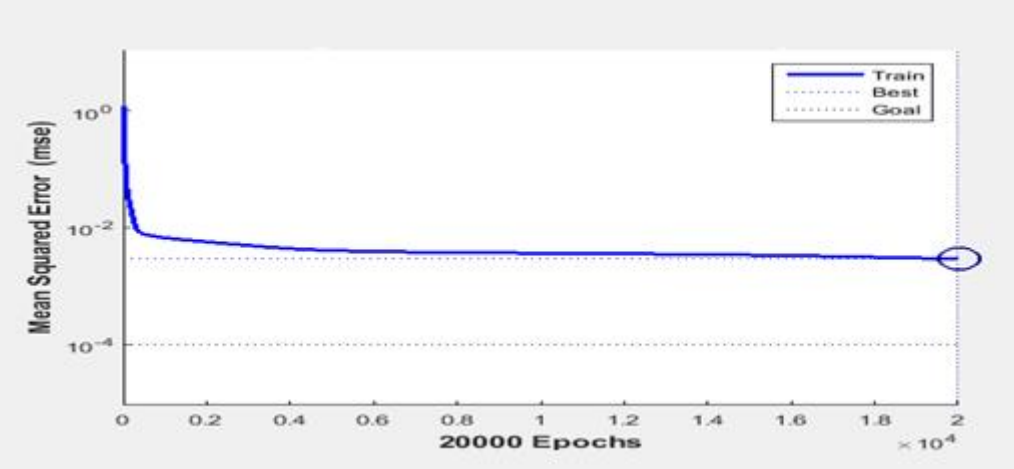

Figure 5. Performance of Model NN is 0.0028815 at epoch 20000.

Figure 6 shows the output regression of the NN model to the actual data of Indonesia's foreign exchange reserves. Based on Figure 6, the coefficient regression of this model is 0.99852, or the coefficient of determination forecasting model is 0.997042.

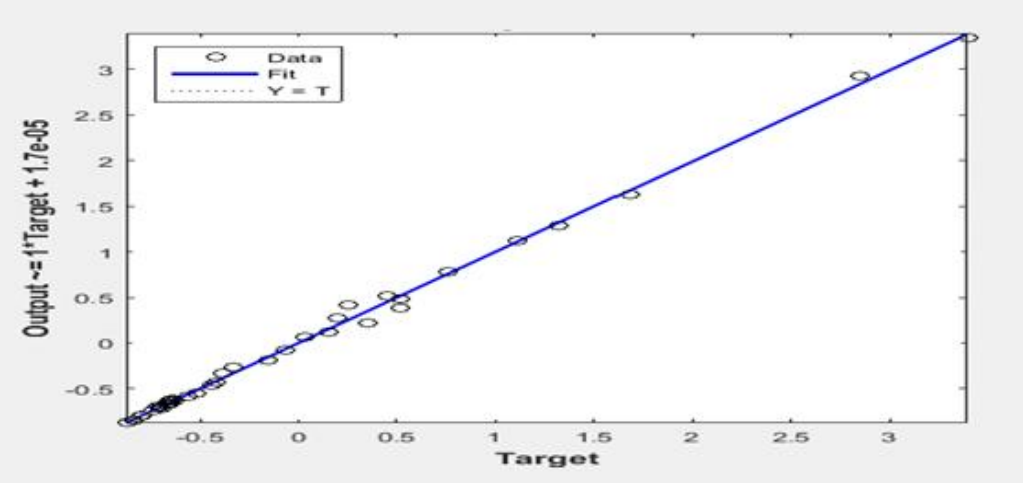

Figure 6. Plot of output regression of NN model with actual data of foreign exchange reserves of state

Compared with result of Sulastini (2017) which produce model forecasting of foreign exchange of state using technique of Partial Linear Square (PLS) with model:

$$CDN=41.218 + 0.528\times X_1 - 2.021\times X_2 - 0.00448\times X_3 + 0.313\times X_4 \ , \quad (19)$$

with CDN indicates foreign exchange reserves of the country, and X1, X2, X3 and X4 respectively states exports, imports, exchange rates, and foreign debt.

Comparing the result of this research with the Sulastini model shown by the Graph of Figure 7.

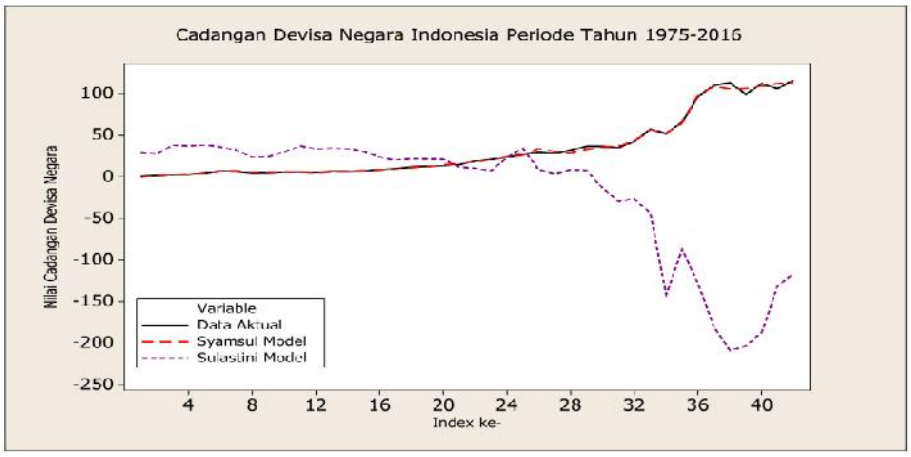

Figure 7. Comparing of the result of NN model in this researh versus Sulastini model.

Based on Figure 7, the forecasting model generated in this study is more accurate than that of Sulastini (2017) using the PLS technique. The performance of the NN model developed in this study is given by Table 1.

Tabel 1 Performance of Neural Network Model Proposed

Characteristic of Model	In-Sample Data					Out-Sample Data			
	Min	Max	MSE	RMSE		Min	Max	MSE	RMSE
	-0.6438	110.12	1.8977	1.3776		99.39	116.36	30.2197	5.4972

Based on Table 1, the NN model performance developed in this study provides accuracy based on the indicator of MSE is 1.8977 or RMSE = 1.3776 for in-sample data, and MSE for out-sample data is 30.2197 or RMSE = 5.4972.

5. Conclusion

The model of forecasting of foreign exchange reserves using the exports, imports, exchange rates, and foreign debt variables generated in this study provides a fairly good accuracy, which is shown by the coefficient of determination forecasting model is 0.997042. Numerically, the performance of the developed model provides accuracy based on the indicator of MSE is 1.8977 for in-sample data and MSE of out-sample data is 30.2197. Graphically, the NN model output developed is quite accurate as shown in Figure 7.

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The Use of Near Infrared Technology for Rapid Measurement of Soil Nitrogen in Rice Paddy Field of Lombok Island

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Abstract

Nitrogen (N) is the vital macro nutrient for plant growth. The adequate amount of this nutrient in rice paddy field is one of the key factors for obtaining the optimum yield. However, measuring soil nitrogen using conventional analysis (kjedhal method) takes time and expensive. This research is aimed to test wheather soil N in Lombok island rice field able to be predicted by near infarared (NIR) technology. To do this, soil samples from Lombok Island rice field were collected, including the coordinates of the samples. The dried, ground, sieved samples were divided into two parts; one parts were anaysed in laboratory for N-total (Kjeldhal method), and another parts eere scanned using NIR spectroscopy for collecting spectral data. A Partial Least Square Regression (PLSR) calibration model was developed using soil spectral data and laboratory-analysed soil N data. Results showed that soil N in Lombok Island rice field of was measured moderately successful by the PLSR model. This shows us that the NIR technology was robust enough for rapid measurement of soil N concentration in rice paddy soils.

Keywords: soil, nitrogen, rapid measurement, near infrared spectrsocopy

1. Introduction

Nitrogen (N) is the vital nutrient needed for plant grow. It is an essential element of amino and nucleic acid, development of vital plant tissue and cells, formation of chlorophyll, and essential in the process of plant photosynthesis (Barker and Pilbeam, 2015). Its deficiency in soil will severely affect the plant performance and significantly reduce the plant yield (Barker and Pilbeam, 2015). The presence of this nutrient in soil is usually associated with soil organic matter content. Soil with high content of organic matter usually contain large amount of N (Blume et al, 2016). The N availability in soil will increase if there is enough release from organic matter decomposition (Paul, 2016) or from the addition of N fertilizer (Congreves et al, 2017) or fixation by plant-associated bacteria (Regan et al, 2017).

Measurement of total N using conventional technique such as Kjeldhal method is known as a slow procedure. As many sensor technologies have been developing, scientists have been trying to speed up the measurement of soil properties using these emerging technologies. Near infrared (NIR) technology is one of the sensor technologies which has nowdays become important analytical methods (Stenberg et al, 2010). It works using electromagnetic wave by relating the soil properties with the covalent bonds vibrations, such as C-H, O-H, and N-H.

As this technique is recognised as a rapid and non-destructive technique, it has been tested able to measure soil C and N (Kusumo et al, 2008; Kusumo et al, 2009; Minasny et al, 2013; Vågen and Winowiecki, 2013), ammonium N, nitrate N (Kodaira and Shibusawa, 2013), and some other soil properties such as soil moisture content, organic matter, CEC, and root density (Kusumo et al, 2009; Kusumo et al, 2010; Vågen and Winowiecki, 2013).

So far, it is very limited reports found in terms of use NIR technique for measuring total N for Indonesian soils. So, this research is aimed to investigate the accuracy of this technique for soil N measurement of rice field, Lombok Island.

2. Materials and Methods

2.1. Collection of soil samples and spectral data pre-processing

Top soils (150 samples) with 0-10 cm depth, including the coordinates, were collected using soil corer with 2.54 cm diameter and using GPS, from Lombok Island rice field (Figure 1). The samples then were shifted to the laboratory for soil preparation. The dried, ground, sieved samples were divided into two parts; one parts were anaysed in laboratory for N-total (Kjeldhal method) measurement, and another parts were scanned using NIR spectroscopy (ASD FieldSpec 3 V-NIR Spectrometer, ASD, Boulder, CO, USA) for collecting spectral data. The spectral data were pre-processed using a software ParLeS (Viscarra Rossel, 2008); log (1/R) - R transformation, wavelet detrending, Savitzky-Golay smoothing, first convertion, and finally mean centering.

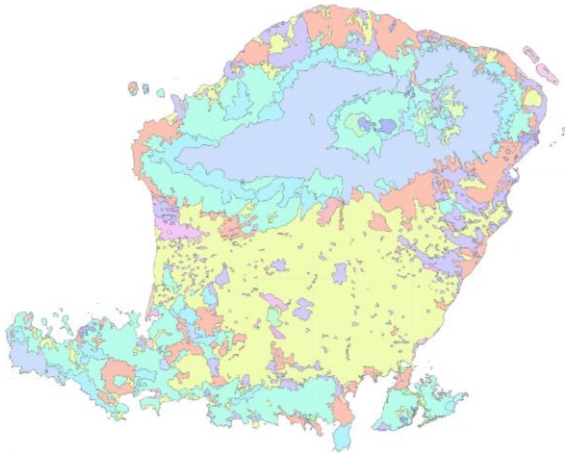

Figure 1. Lombok Island Rice field (yellow colour) is the sample location.

2.2. Developing and testing the calibration models

Calibration models calibration models were built using Partial Least Square Regression (PLSR) of the pre-processed spectral data and analytical soil N data (Kjeldhal method). The number of factors (principal componenets) for model development were determined based on the factors that harvest the smallest RMSE (root mean square error) (Viscarra Rossel, 2008). The leave-one-out cross-validation was used to test the model. There were several statictical parameter for tesnting the model accuracy. Those were: (i) coefficient determination (R^2), (ii) RMSE (root mean square error) between analytical soil N and NIR prediction, and (iii) RPD (ratio of prediction to deviation; SD/RMSE). The best model is showed by the largest R^2 and RPD, and the lowest RMSE.

3. Results and Discussion

3.1. Soil Nitrogen in Rice Field

The soil N data which were resulted from Kjeldhal method were presented at Table 1. The data at Table 1 show that the N contents of Lombok Island rice field vary from low to medium, with low concentration in everage. Of the total soil samples, there was 63% of the samples categorized into low concentration and 37% was classified into medium

concentration. Mostly low soil N contents in Lombok Island rice field of is probably related to the low concentration of organic matter in the soil, which is probably because of (i) small amount of organic waste returned to the rice field, and (ii) small input of organic matter from organic fertilizer (Weil and Brady, 2016). The amount of fresh organic matter from crop residues left in soil, such as leaves, twigs and roots, also affects the nitrogen content in the soil (Weil and Brady, 2016). Soil management that can increase soil organic matter content and then increase soil nitrogen is necessary to be implemented.

Table 1. Soil nitrogen

Soil property	Range		Median	Mean	Variance	Standard deviation
	Min.	Max.				
Total N (%)	0.10	0.34	0.19	0.18	0.05	0.003

Total soil N status in various soil orders of Lombok Island is showed at Table 2. Two soils contain low average of total N; Mediteran and Regosol. While the average of total N in Grumusol, Latosol and Alluvial soils is medium.

Table 2. Soil N status based on soil orders

	Soil order	Range		Average	Status
		Min	Max		
Total N	Grumusol	0.14	0.34	0.23 (medium)	Low - Medium
	Mediteran	0.10	0.29	0.17 (low)	Low - Medium
	Regosol	0.10	0.33	0.20 (low)	Low - Medium
	Latosol	0.16	0.30	0.23 (medium)	Low - Medium
	Alluvial	0.21	0.23	0.22 (medium)	Medium

3.3. NIRS accuracy for Soil N Measurement

Prediction values of soil N are depicted at Table 3. There was a moderate accuracy of total N prediction in the Table 3. This was indicated by RPD (2.00) and R^2 (0.75). This level of accuracy is classified by Chang et. al. (2001) into moderately successful because of the RPD between 1.4 and 2.0 and R^2 between 0.5 and 0.8. In addition, if the accuracy which is showed by the RPD (1.75 - 2.25) and R^2 (0.7 - 0.8), Malley et. al. (2004) classifeld it into moderate accuracy. Several factors may affect the NIRS accuracy prediction as NIR soil reflectance can be influenced by many chromophores such as soil organic matter content, water, particle size, clay and non-clay soil minerals, iron oxides, and carbonates (Ben-Dor et al, 1999).

Table 3. Soil N prediction using NIRS

Properties	Prediction values (resulted from leave-one-out cross-validation)		
	R^2_{CV}	$RMSE_{CV}$	RPD_{CV}
Total N	0,753	0,026	2,01

3.4. Relationship between conventional measurement and NIR prediction

The relationship between soil N data measured by Kjeldhal method and predicted by NIRS is depicted at Figure 4. Moderate successful of NIRS prediction to the soil N (R^2_{CV} 0.75; RPD_{CV} 2.01) indicates that this technique was robust enough for soil N measurement in rice field of Lombok Island. For further use when dealing with large number of samples and mapping soil

properties, this technique will be very useful and efficient. Moderate accuracy of N prediction in this research was also informed by Kusumo et. al. (2008) for New Zealand soils and Chang et. al. (2001) for American soils.

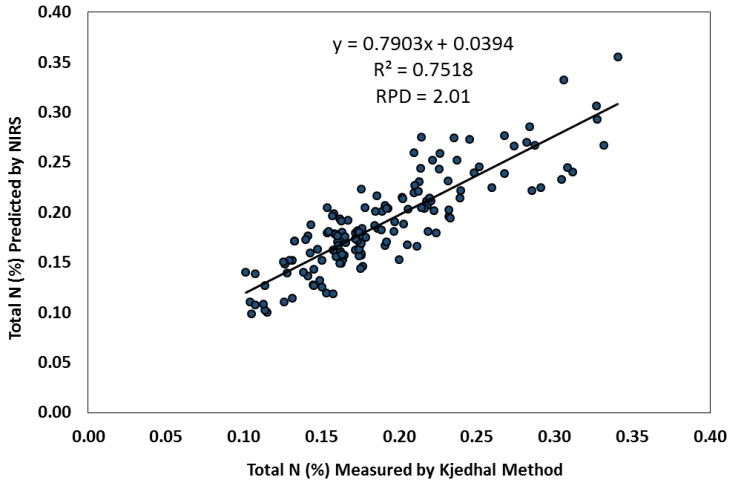

Figure 4. Correlation between soil N measured by Kjeldhal method and predicted by NIRS.

3.5. Important wavelengths to the Model

Very important wavelengths supporting to the PLSR model in predicting soil N is depicted in Figure 5. Wavelengths with greater VIP scores contribute more significant role to the PLSR model (Viscarra Rossel, 2008). The wavelengths around 1420 nm and between 2100 – 2500 nm play more significant role than other wavelengths in developing soil N prediction model.

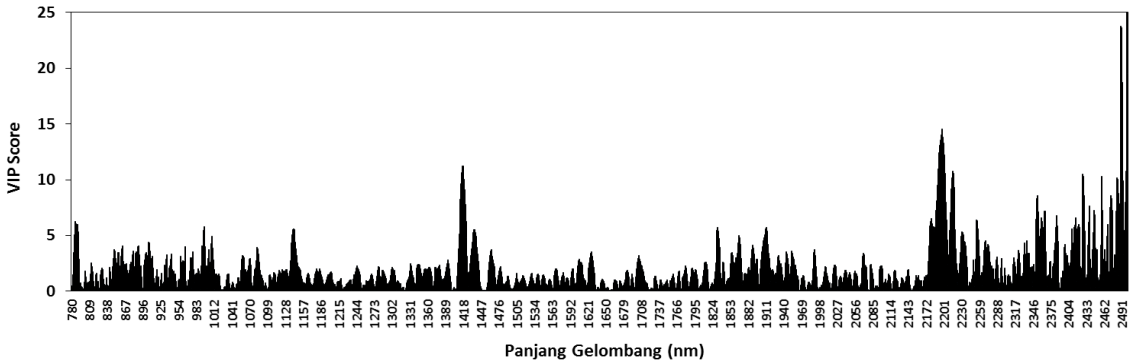

Figure 5. VIP scores of wavelength to the model.

4. Conclusion

Soil N contents in Lombok Island rice field are distributed from low to medium. Most of samples contain low soil N, and only 37% samples contain medium N concentration. Soil N can be predicted successfully using near infrared technology in the study area. This technology may be then used to rapidly map of soil N status in Lombok Island rice field, and the map may be further used as a guidance for fertilizer application.

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Sea Horse (*Hippocampus* sp.) Broodstock Culture in Controlled Tank

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Abstract

The culture of sea horse broodstock is essential fo conservation and for economic purposes. The aim of this research was to know the sea horse broodstock culture in controlled tank. The research was done from July until August 2017. The method of this research was descriptive analysis for different shape of the tanks (round tank and box tank). Seahorse broodstock come from Ekas Bay, Ekas Buana Village, East Lombok. The ratio of male and female in box tank was 2:3, and in round tank was 1:1. Broodstock were fed by artemia. The aeration system used for the cultivation of the broodstock. Water exchange was done every 2 days. The result showed that the survival rate were 100% for box tank and 89% for round tank. The precentage of giving birth were 50% in box tank and 75% in round tank.

Keywords: sea horse, broodstock, culture, tank

1. Introduction

Sea horse is used for Traditional Chinese Medicine (TCM) (Woods, 2007; Cartagena, 2014). The demand of seahores for TCM is gained from catch and fisihing that make the population declines. Sea horse is classified as Appendix 2 of The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 2002 (Cartagena, 2014). It means that the trade of the sea horse must manage wisely to make sure the persistence of the sea horse in wild population (Foster and Vincent, 2004). The culture of sea horse is essential to prevent the lost of sea horse population. The object of this study was to know the sea horse broodstock culture in controlled tank to support the conservation of the sea horse.

2. Materials and Methods

The research was conducted in Labuapi, West Lombok from July until August 2017. The method used in this research was descriptive analysis for the survival rate and percentage of giving birth with different tanks condition (round tank and box tank).
The survival rate is based on Effendi (1997):

$$SR = \frac{N_t}{N_o} x100\%$$

SR is survival rate (%), Nt is the number of sea horse at the end on cultivation, and No is the number of sea horse at the first of cultivation.
The percentage of giving birth is the percentage of the male broodstock wihich giving birth in the cultivation. The percentage of giving birth is counted with the formula:

$$\text{The percentage of giving birth (\%)} = \frac{\text{the number of giving birth (ind)}}{\text{the number of male's broodstock (ind)}} x100\%$$

with 'ind' is individual.
Materials used in this research were sea horses, round and box tanks, aerator pump, sea water, artemia. The broodstock of sea horses were collected from Ekas Bay, Ekas Buana Village, East Lombok. The artemia used as feed for sea horse. The artemia were given ad libitum. Aerator pump used to give aeration for the sea horse culture.

3. Results and Discussion

(a) (b)

Figure 1. The broodstock of the sea horse (a) male with brood pouch, (b) female

The picture showed the broodstock of the seahorse used in this research. The differences between male an female seahorse is that the male sea horse has brood pouch (figure 1) and female sea horse doesn't have a brood pouch. But the sperm is in the male and the ovum is in the female seahorse. The female will transfer the egg to the brood pouch of the male. Fertilizatiion happen in the male's brood pouch (Foster, 2004). The male's pregnancy duration is vary from 9 to 45 days (Foster and Vincent, 2004).

In this research, the ratio of male and female in box tank was 2:3, and in round tank was 1:1. The seahorse's broodstock were cultivated with mass cultivation.

(a) (b)

Figure 2. Tanks for culture of sea horse (a) round tanks, (b) box tank

Table 1. Survival Rate and Percentage of Giving Birth

Parameter	Round tank	Box Tank
Survival rate (%)	100	89
Percentage of Giving Birth (%)	50	75

Table 1 showed that the broodstock of the sea horse could live in the box and round tanks. Woods (2013) showed that the broodstock of sea horse had survival rate 100%. The succes of culture sea horse due to the water and quality of food (Salas and Bustamanthe, 2006).

The male sea horse could give birth in both round tank and box tank. The percentage of giving birth was 50% in round tank and 75% in box tank. For the round tank, 50% male seahorse could give birth from totally male sea horse cultivated in round tank.The percentage of giving birth in box tank is higher than in round tank.

Acknowledgements

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Analysis on Heat Energy Utilization on White Copra Drying using Solar Energy Tray Drier

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Abstract

This research aimed to analyzed energy utilization during drying, that consist of input energy, utilized energy, saved energy, and output energy. Drying was conducted until 9% moisture content achieved, observation and calculation data then analyzed to be further showed on graphic. This research conducted using experimental method in the field using solar energy drier. Calculated variables were material weight, moisture content, drying air temperature, ambient temperature, output air temperature, material temperature, relative humidity, solar radiation intensity. From the result obtained input energy was 723.445,51 KJ, utilized energy was 5.933,50 KJ, saved energy was 3,601.63 KJ and output energy was 713.910,38 KJ.

Keywords: Drying, copra, energy utilization

1. Introduction

Indonesia is a country rich in plantation commodities. One of the largest plantation commodities in Indonesia is coconut. Coconut is one of the most widespread commodities because it can grow intentionally by humans and naturally in less populated areas (Amin, 2009).

West Nusa Tenggara (NTB) is a potential coconut producing area in Indonesia with planting area of 63.853,57 ha and total production reaches 56.481,15 tons. North Lombok Regency planting area was 10.673,74 ha and total production reach 12.643,14 ton (BPS, 2010). Some coconuts are shipped to Java, some local communities process coconuts into copra and others used them to produce traditional coconut oil.

Generally, copra drying method can be divided into three types, *i.e.* drying under the sun, drying with fogging, and drying with hot air generated from a dryer. Each method used will determine the quality of the copra produced. Natural drying under the sun is the cheapest but takes very long time (between 4 - 5 days to reach water content of 6%), highly dependent on weather conditions especially the intensity of solar irradiation, and often produces low quality copra. While drying with fogging will produce dark copra, smoke smell, and sometimes charred. Although the most widely practiced by the community, both ways have major problems since they produce low quality copra (Triyono et al, 2008).

As the weaknesses and deficiencies of natural or traditional drying methods has been identified, it is necessary to apply appropriate technology using a tray dryer that utilizes solar energy as a source of heat energy. The use of solar energy as a source of heat energy in the dryer using solar collectors was to produce higher heat than the direct drying and also the temperature can be controlled. One of the most important factors here was the utilization of solar thermal energy used in the drying process. By knowing the utilization of heat energy generated on the dryer we can maximize the drying process. Therefore conduct research on the analysis of the utilization of heat energy in copra drying using the Greenhouse Effect (ERK) is necessary.

2. Materials and Methods

2.1 Material and Instrument

1. Material: Basic material used in this research was coconut of hybrid variety aged 300 days and weight approximately 3-4 kg.
2. Research instrument: Instrument used were solar energy tray dryer, CC (Cooper Constant) CA Termochopel, digital weight, analytical scale, HHF 152 Anemometer propeller, OMEGA Model, Yoko Gawa FX 106 – 1-2 Model Data Logger, drying chamber; glass, desicator, watch, Aluminium foil, 10 pieces termometer °C. Beside 10

2.1 Research Parameter

Measured parameter in this research was mass weight of 5 kg material that divided to several ties that weighed each 0.250 kg, temperature (^oC), and relative humidity (%RH).

1. Material moisture ratio (%*bb* and %*bk*) calculated using equation as follow (Fekawati, 2010):

   Ka *(%bb*) = $\frac{m_i}{m_i+m_s}$×100%

   Ka *(%bk*) = $\frac{m_i}{m_s}$×100%

2. Solar irradiation (*Ih*)

Solar irradiation was measured using *Lightmeter*, by direct measurement near the drying tool, *i.e.* at place that exposed by direct solar radiation. Total daily irradiation (*Ih*) could be mathematically calculated using Simpson method (Purcell and Vanberg, 1999).

$$Ih = \frac{\Delta t}{3}\left[I_i + 4\Sigma I_{tgl} + 2\Sigma I_{tgf} + I_f \right] \quad \text{.....1)}$$

3. Required energy that is used in the drying process, solar energy received by the dryer (ERK) (Fekawati, 2010)

$$Q1 = 3{,}6.I_R\, A_p(\tau\alpha).t \quad \text{.....2)}$$

4. Heat used for evaporating water on the dried product Pcould be calculated using Siebel equation (Helman and singh 1984),

$$Q_3 = m_u \times h_{fg} \quad \text{.....3)}$$

$$M_u = m_0.\left(\frac{M_o - M_f}{100 - M_f}\right) \quad \text{.....4)}$$

$$H_{fg} = 2502 - 2{,}3775\ T \quad \text{.....5)}$$

5. Heat received by air in the dryer

$$Q_3 = m_{ud}.C_{ud}.(T_R - T_I).3600t \quad \text{.....6)}$$

6. Heat loss on transparent wall

$$Q_{l4} = A_d.U_d.(T_R - T_a). \quad \text{.....7)}$$

7. Heat used for increasing product temperature

$$Q_2 = m_0.C_p.(T_2 - T_1) \quad \text{.....8)}$$

$$C_p = 0{,}837 + 0{,}034.M_0 \quad \text{.....9)}$$

8. Efficiency of the drying system

$$\eta = \frac{Q_t}{Q_T} \times 100\% \quad \text{.....10)}$$

2.3 Data Analysis

Research method used in this experiment was experimental. Data analysis was conducted using mathematical approach to solve mathematical calculation that processed using Microsoft Excel.

3. Results and Discussion

3.1 Drying Temperature (T)

Temperature is an important factor in drying process. Relatively high temperature is required to evaporate water contain in the dried product. Evaporation rate of water during drying is affected by temperature increased. The higher temperature different between the drying media and the dried product, the faster heat transfer rate to food product, more water evaporated from the dried product. The higher the drying air temperature, the faster the drying period.

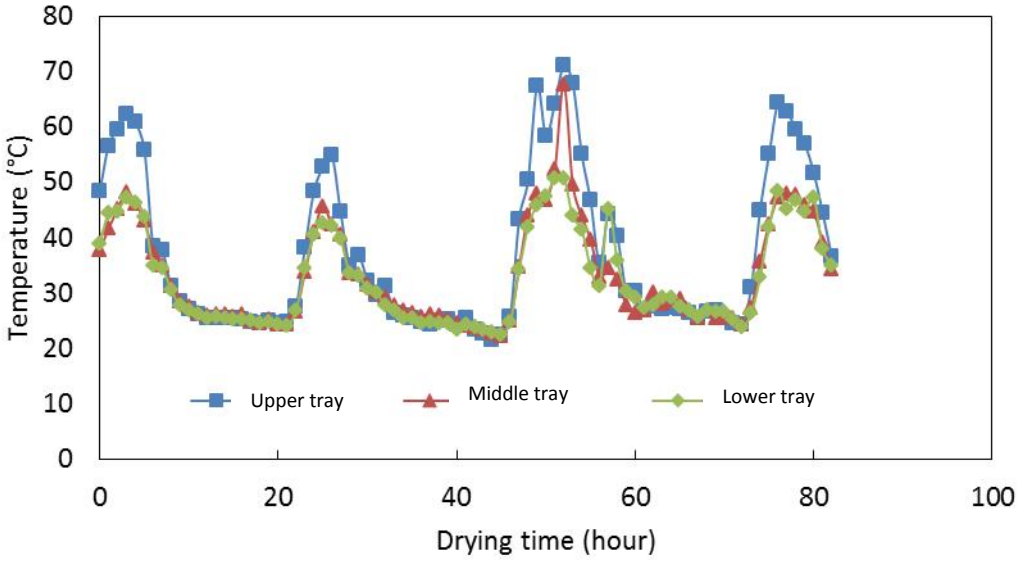

Figure 1. Graphic of drier temperature during copra drying

Graphic on Figure 1 showed relationship between drying time and temperature at the drier. The drier temperature show changed during drying. At day-time, temperature increased along with the increasing drying period. Whereas at night-time, the temperature decreased. This condition affected by solar intensity, as the heat collector received solar radiation only at noon until the evening. Therefore, source of energy at day-time was primarily from solar radiation, therefore the drying chamber is relatively high. Since the source of energy at night only from the saved (remained) energy inside the drier, its temperature lower at night time.

3.2 Relative Humidity (RH)

Relative humidity is ratio of water vapor in the air and maximum water vapor at corresponding temperature in percentage. Drying process is a process of heat and mass transfer that occurs simultaneously. This process is affected by conditions of relative temperature and humidity of the drier air. The graph of relative humidity to the drying time is shown in figure as follows.

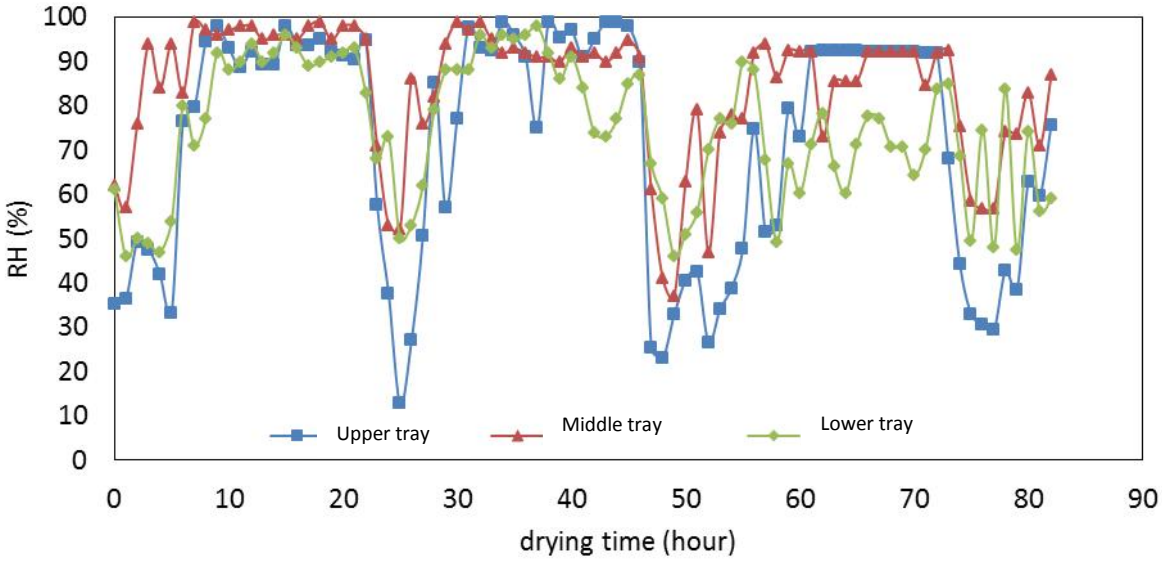

Figure 2. Graphic of relation between relative humidity (RH %) and drying time (hour) on drying chamber

The relative humidity of the dryer air shows the air's ability to absorb moisture (Murad, et al, 2014). The hot air inside the drying chamber will slowly heat and vaporize the mass of water in the copra. High temperatures the saturated water vapor pressure will increase, therefore the relative humidity, as the ratio between the partial pressure of water vapor in air with the saturated vapor pressure at the same temperature, will be lower. The highest temperature was obtained in the top tray and the lowest temperature was obtained in the bottom tray. The highest RH level was obtained in the bottom shelf and the lowest RH in the top tray. RH in the drying chamber also fluctuates with changes of the solar radiation conditions. Moreover, RH conditions in the drying chamber was not conditioned, so that the RH trends, especially at night, was similar to RH environment, *i.e.* above 70%.

3.3 Moisture content (%)

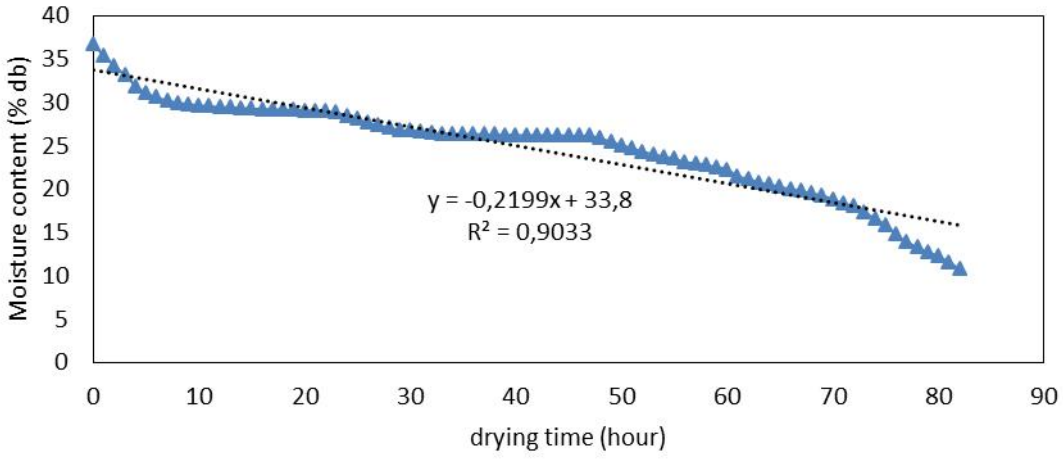

Figure 3. Graphic of relation between drying time (hour) and moisture content reduction (%)

Initial moisture content of copra ranged from 34 to 37%, where treatment in this drying similar with the thin layer method, therefore the moisture contents were high. Figure 3 showed that moisture content was decreasing during the drying period. The longer the drying period, the higher the moisture content. Tanggasari (2014) stated that high temperature inside the drying chamber caused fewer decreased on mass weight, this affect the outside layer dried first and tightened the material pores, which caused the deeper moisture content hard to be evaporated. Therefore, too high temperature is not good for drying.

3.4 Total Thermal Energy during Copra Drying

Copra drying using flat plate solar collector was highly affected by solar intensity. The white copra dried during 4 days, where at night the dried copra kept inside the drier; where temperature, RH, and each copra's sample weight still monitored. Solar trend during drying showed by Figure 4, fluctuation solar radiation during copra drying was very affecting thermal stability or temperature inside the drier. Total thermal energy during the drying was calculated using Simpson method. Thermal energy from first to fourth day was respectively 13,360 kJ; 11,620 kJ; 8,639 kJ; and 11,995 kJ.

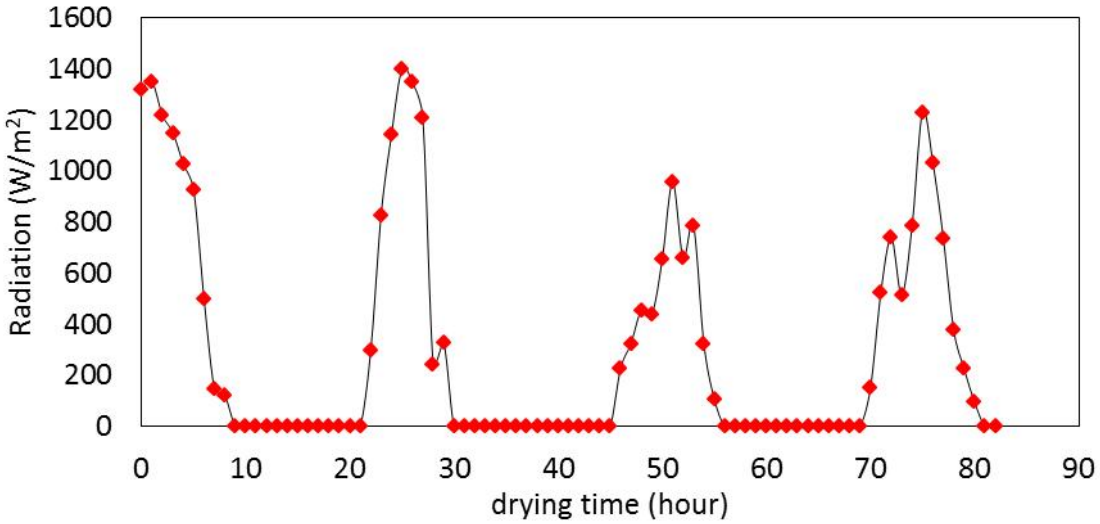

Figure 4. Graphic of relation between drying time (hour) and total solar radiation (kJ)

Total energy calculation illustrated using second day drying showed as follow:
Solar radiation intensity measured using light meter:

$$I_{total} = \int_{07.30}^{16.30} I\,(t)dt$$

= 13,713 w/m^2
= 4,113,900 J/m^2
= 4.1 MJ

Solar radiation energy collected by the collector:

$$Q_{radiation} = I_{total} \times A_{collector}$$

= 4,113,900 J/m^2 x 2.1 m^2
= 8,639,190 J
= 8.6 MJ

Solar radiation intensity during drying process was highly fluctuated, at third and fourth day was rain. However, the drying process still conducted until copra's moisture content achieves approximately 10% dry weight at fourth day.

3.5 Energy Analysis during White Copra Drying

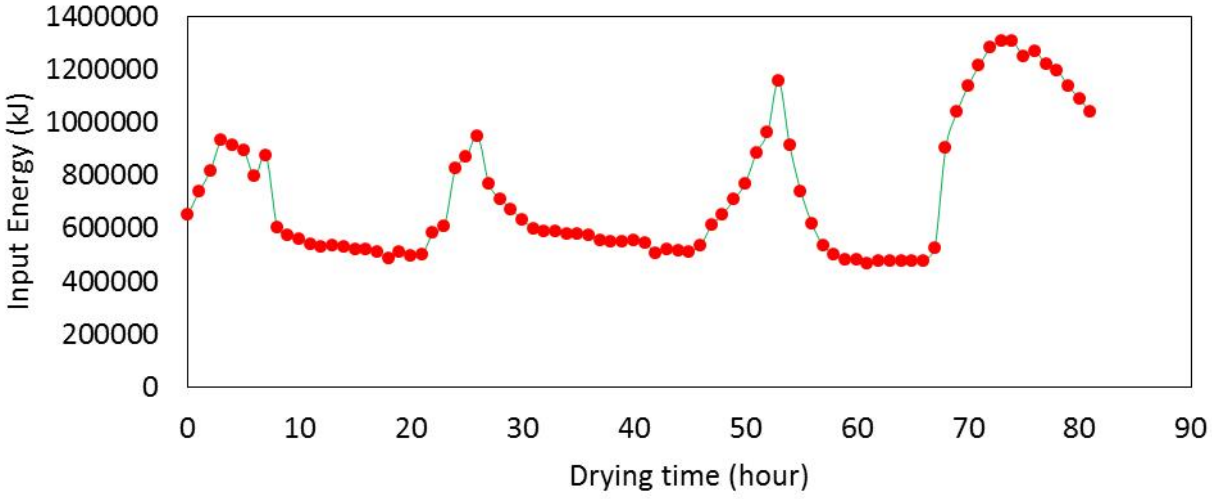

Figure 5. Graphic of relation between drying time (hour) and input energy (kJ)

Figure 5 showed relationship between drying time and input energy during copra drying, the input energy was increased and decreased during drying. The higher the drying room temperature, the higher the input energy. This showed by total input energy at first hour drying of 651,596.7 kJ increased to 894,729.8 kJ after dried for 6 hours. Then decreased and increased along with the decreasing and increasing temperature inside the drier during 82 hours drying.

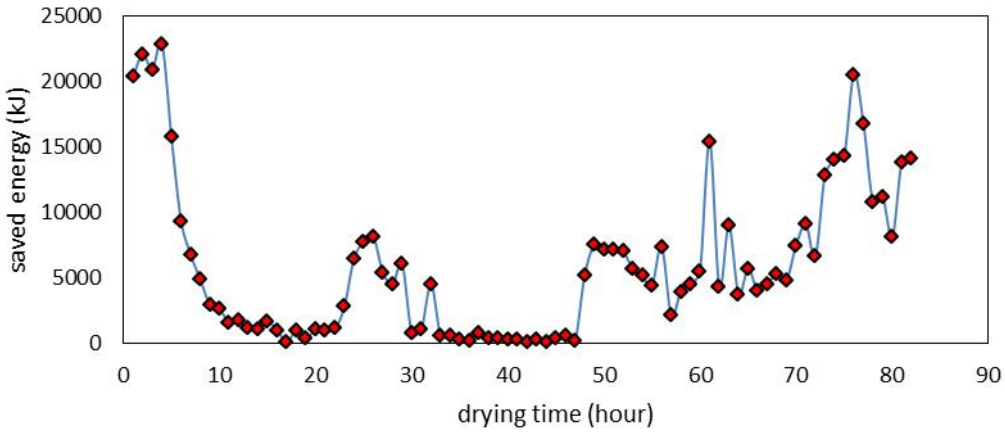

Figure 6. Graphic of relation between drying time (hour) and utilized energy (kJ)

Figure 6 showed relation between drying time (hour) and utilized energy (kJ) during copra drying. Utilized energy was energy that used for drying copra during drying, the amount was less than the input energy of 20,393.3 kJ at the first hour and decreased until 1,680.0 kJ after 15 hours drying, then increased and decreased during drying. This affected by the amount of evaporated water from copra. The more water evaporated, the higher the utilized energy and vice versa.

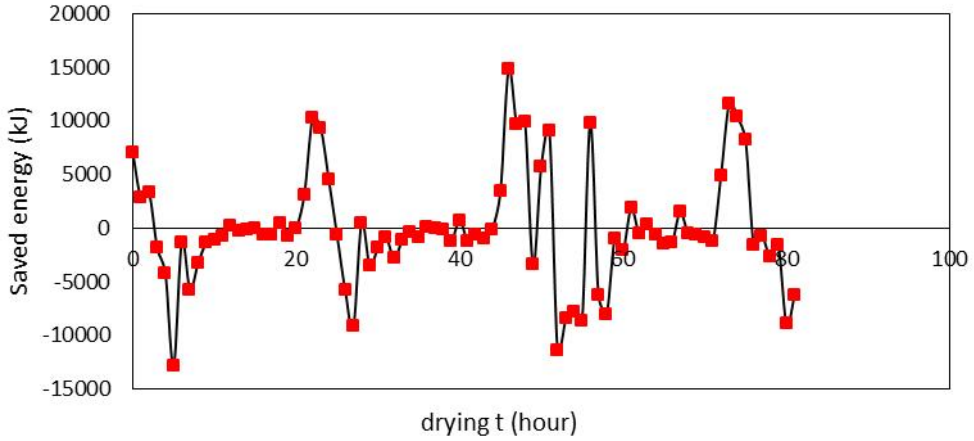

Figure 7. Graphic of relation between drying time (hour) and saved energy (kJ)

Figure 7 showed relation between drying time (hour) and saved energy (kJ) during copra drying. Saved energy indicates the energy that was not utilized for evaporating water inside the product. Saved energy in the system depend on the specific heat at constant pressure and average temperature. The difference of saved energy depends on temperature changes inside the drier. Figure 7 showed fluctuation of saved energy during the drying, therefore steady state condition was not achieved. Steady state achieved when the rate of saved energy is zero or constant saved energy is occurred.

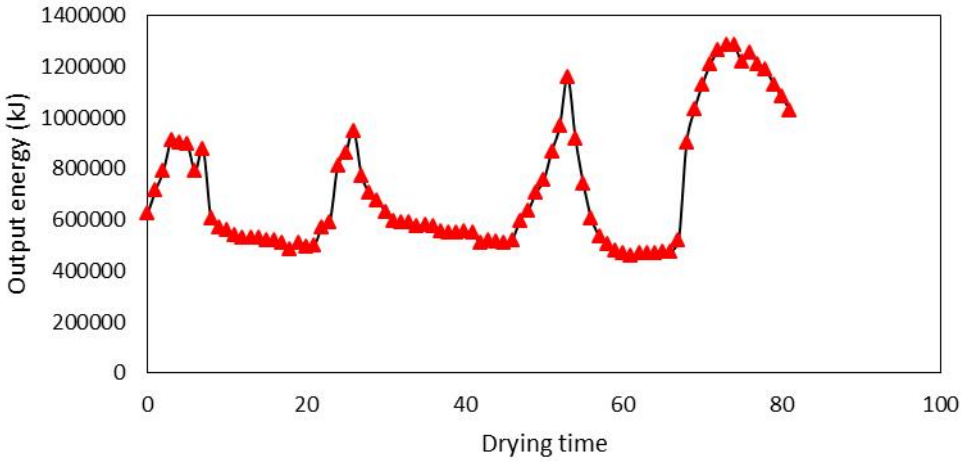

Figure 8. Graphic of relation between drying time (hour) and output energy (kJ)

Figure 8 showed relation between drying time (hour) and output energy (kJ) during copra drying. Output energy was increased and decreased, with affected by the amount of input energy and utilized energy. The more the input energy, the lower the utilized energy; therefore, the output energy (not used energy) was higher.

4. Conclusions

Based on analytical result and discussion, it could be concluded that:

1. Average temperature distribution ranged 30-60°C and RH distribution ranged 50-90%.
2. To achieved 10% moisture content required 80 hours drying time.

3. The amount of input energy 800.000 KJ, utilized energy 5000 KJ, and output energy 600.000 KJ.

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Application of Hydrological Water Supply Model to Calculate Discharge of Maronggek River in East Lombok

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Abstract

This research aimed to apply modeling on water supply to calculate water discharge of Maronggek River at East Lombok. Water supply model used in this research was compilation of Mock and Reservoir rain flow model. Equipment used was personal computer to conduct simulation, calculation process, model calibration, model verification, and parameter sensitivity test. Data used were secondary data, *i.e.* rainfall data, measured river discharge, evapotranspiration, and land use (paddy field, dry land, and village). Parameters used in the model were calibration and estimation. Data analysis was conducted using Powersim software program to predict natural water discharge of the river. Three suitability criteria, *i.e.* water volume deviation (VE), relative error between calculated and measured water discharge (RE), and relation coefficient (R) were used in this research. Four years data of 2012-2015 were used for calibration. Result showed that percentage error of modeled volume was 2.587%, relative error 0.028%, and correlation coefficient value 0.98885. This result indicates that the simulation output accuracy was relatively high. Further verification then applied using 2006 and 2007 data, as result 0.876 and 0.668 correlation coefficients were obtained respectively. In order to determine sensitivity level of each model parameter, sensitivity test was conducted. Result showed that B1 (constant of subsurface flow) was the most sensitive and kal (field capacity) was the least sensitive. In order to apply this model in another water catchment area (DAS), model calibration is required.

(Keywords: hydrological model, model calibration, discharge analysis)

1. Introduction

Water is source of life in nature. Water availability in quantity always become a problem for human being. In one time, insufficient water can be a problem, but to many water also bring danger for human and other living things. Water related problem is getting more complicated. To increase agriculture productivity, water availability in river is very important to be studied, as its determine area of the developed region (Gunadi S, 1995).

One option to overcome water uncertainty in a watershed system is by increase water availability in a dam accurately and dynamically. Calculation of water availability in a dam requires suitable hydrological model to be applied in a subjected irrigation area. Some researcher shows that a complex model not always give the best result, even it could give less accurate result compere with the simple one (Sudjarwadi, 1992).

One simple model of a rain stream that developed in Indonesia is Reservoir and Mock Model. These model have been applied to predict, especially for a long duration stream data, for example two weeks or monthly. The output of these model from previous research showed decent output calculation result, therefore it is feasible to be applied.

The previous application of simple hydrological model has been proven could predict water availability in a free intake installation. Therefore, using combination of these two model, Reservoir and Mock Model were chosen to be applied in Maronggek Watershed at East Lombok to determine water discharge of Maronggek River.

Hydrological analysis of water availability, from precipitation and river discharge, is required for preliminary design. Hydrological data from river as water source to fill the watershed is investigated for 10 years. Maronggek Watershed is one Sub Unit of River Basin in East Lombok. It is cover area of 2403 ha with main river length of 17.48 km.

2. Materials and Methods

This research was conducted on January 2016 at upstream side of Maronggek Watershed, Lendangnangka Utara Baru Village, Masbagik District, East Lombok. Materials which used in this research were secondary data, obtained from related agencies that record hydrological data, *i.e.* Regional Irrigation Office of Sikur and Information Centre of Water Resource Region of West Nusa Tenggara Province.

Secondary data used in this research are daily precipitation, area of watershed, topography, land use, water discharge, and climate data. Personal computer was used for built the computer program, calculation process, model calibration, parameter sensitivity test, model verification, model simulation, and composing report.

Model used in this research was developed by Sudjarwadi (1992), which comes from the assumption of Reservoir model process combined with Mock model process.

The detailed formulated model are as follow:

1. Precipitation

$$R = \frac{A_1 \cdot R_1 + A_2 \cdot R_2 + \cdots + A_n \cdot R_n}{A_1 + A_2 + \cdots + A_n}$$

Note:
A_1, A_2, A_n= area of surrounding rain station
1, 2, …, n = number of rain station
R_1, R_2, R_n = precipitation in station 1 ,2, …n
R = average precipitation of an area

2. Interception

$Y_1 < ICP < Y_2$
$Y_1 = e^{0,48}$ (hujan)^{0,85} (797)^{0,12}
$Y_2 = e^{0,48}$ (hujan)^{0,85} (424)^{0,12}
AICPW = COICP × ICPD
COICP = $\sum_{i=1}^{N} DCi \times PJLPi$
Note :
Y_1 = lower limit of daily interception capacity (mm)
Y_2 = upper limit of daily interception capacity (mm)
ICP = daily interception capacity (mm)
ICPD = 0,5 (Y1 + Y2)
AICPW = daily regional interception capacity (mm)
ICPD = base interception value (mm)
COICP = regional interception coefficient
DCi = coverage density
PJPLi = percentage of land use
N = number of land use

3. Surface rain

HUPER = Hujan – AICPW
Note:
HUPER = surface rain (mm)
AICPW = regional interception value (mm)
Hujan = daily precipitation (mm)

4. Run off

HUPER > AIA, ALPER = (HUPER – AIA)^2 / (HUPER + 0,8 * S)
S = ((2,54 * 10000) / CN) – 254
HUPER < AIA, ALPER = 0

ALIMPER = C × ALPER

Note:

ALPER = surface run off

HUPER = surface rain (mm)

S = potential difference between rain and surface run off, starting when rain started AIA = initial abstraction; 0.2 S (mm)

C = run off coefficient

CN = curve, depend on soil characteristic and land use

ALIMPER= water surface (mm)

5. Evapotranspiration

$$ET = \frac{408\ \Delta\ (Rn - G) + (\frac{900}{T+273})\ U2\ (ea-ed)}{\Delta + \gamma(\ 1 + 0{,}34\ U2\ )}$$

Note:

ET = potential evapotranspirastion (mm.hr^{-1})

Rn = net radiation on plant surface (MJ.$m^{-2}hr^{-1}$)

G = flux of soil heat (MJ.$m^{-2}hr^{-1}$)

T = average temperature (°C)

U2 = wind velocity (m. det^{-1})

(ea – ed) = vapor pressure loss (KPa)

Δ = curve of vapor pressure gradient (KPa°C^{-1})

γ = Psychometric pressure (KPa°C^{-1})

900 = conversion factor

6. Infiltration

AINF = HUPER – ALIMPER – ET

Note:

AINF = infiltration water (mm)

HUPER = surface rain (mm)

ALIMPER= surface run off (mm)

ET = evapotranspiration (mm)

7. Water flow

TIT 1 = TAMWAL 1 +AINF – ET1 :

TIT 1 ≤ Kal : ALIMP 1 = 0, PERCO = 0

Kal < TIT 1 ≤ KTAMP 1:

ALIMP 1 = A1 × (TIT 1 – A1)^{B1}

TIT 1 > KTAMP 1

ALIMP 1 = A1 × (KTAMP 1 – Kal)^{B1}

ALIMPER = C × ALPER + (TIT – KTAMP 1)

Note:

ALIMP 1 = water flow (mm)

TIT 1 = water height in reservoir 1 (mm)

TAMWAL 1 = first reservoir in reservoir 1 (mm)

AINF = infiltration water (mm)

A1 = constant of water flow

ET 1 = evapotranspiration on reservoir 1 (mm)

B1 = constant of water flow

Kal = field capacity (mm)

KTAMP 1= capacity on reservoir 1 (mm)

Ilustration on reservoir 1 explain about calculating the value of water run off on reservoir 1 (ALIMP 1). Previously, value of height of water in reservoir 1 was measured (TIT 1). After calculating TIT 1 value, then choose 3 options to calculate the value of water run off, *i.e.*:

a. If TIT 1 value ≤ field capacity, then ALIMP = 0, PERCO = 0
b. If field capacity (kal) < TIT 1 ≤ KTAMP 1, then, ALIMP 1 = A1 × (TIT 1 – A1)^{B1}
c. If TIT 1 > KTAMP 1 then, ALIMP 1 = A1 × (KTAMP 1 – Kal)^{B1} and ALIMPER = C × ALPER + (TIT – KTAMP 1)

8. Percolation

   PERCO = KS × ((TIT 1 – Kal)/ (Kaj – Kal))^{3,3}
   TIT 1 ≤ Kal : PERCO = 0 : ¯
   STITA 1 = TIT 1 – ALIMP 1 – PERCO TAMWAL 1 = STITA 1
   Note:
   PERCO = percolation (mm)
   KS = hydraulic conductivity on saturated condition in reservoir 1 (mm)
   Kaj = saturated capacity in reservoir 1 (mm)
   STITA 1 = remained in reservoir 1 (mm)

9. Basic flow

   TIT 2 = TAMWAL 2 + PERCO – ET 2
   PERCO ≤ 0 : ALIMP 2 = A2 × (TIT 2)^{B1}
   TAMATTA = 0
   PERCO > 0 : ALIMP 2 = A2 × (TIT 2)^{B2}
   TAMATTA = TIT 2 × AKATTA
   TIT 1 ≥ 0,0 : ET2 = 0,0
   TIT 1 < 0,0 : ET2 = ET1 :
   STITA 2 = TIT2 – ALIMP 2 – TAMATTA TAMWAL 2 = STITA
   Note:
   ALIMP 2 = basic flow (mm)
   TIT 2 = water height in reservoir 2 (mm)
   A2 = constant of basic flow
   B2 = constant of basic flow
   TAMATTA = reservoir aquifer in activated (mm)
   STITA 2 = remained in reservoir 2 (mm)
   TAMWAL 2 = first reservoir in reservoir 2 (mm)
   ET 2 = evapotranspiration in reservoir 2 (mm)
   AKATTA = constant of aquifer in activated

The ilustratition of water balance in reservoir 2 describe about calculating basic flow 2 (ALIMP 2) and value of reservor in activated (TAMATTA). Previously, water height in reservoir 2 was calculated (TIT 2). The value of ALIMP 2 then could be determined:

a. If Perco ≤ 0, then, ALIMP 2 = A2 × (TIT 2)^{B2} and TAMATTA = 0
b. If Perco > 0 then, ALIMP 2 = A2 × (TIT 2)^{B2} and TAMATTA = TIT 2 × AKATTA

10. River discharge

    Q = (DRO + BSF) × F
    DRO = (ALIMPER + ALIMP 1)
    BSF = ALIMP 2
    Note:
    Q = river discharge (m^3/detik)
    F = watershed area (m^2)
    DRO = discharge of direct run off (mm/hari)
    BSF = discharge of basic flow (mm/hari)

Estimated parameter and calibrated parameter that used in this research could be seen in Table 1. To simplify the calculation, reference of preliminary constant value on Reservoir Model were determined as seen in Table 2.

Table 1. Number and Type of Parameter used in Modelling

Number of Parameter	Estimated Parameter	Calibrated Parameter
14	Luas DAS, CN, DSA, SWH, TGH, HTN	TAMWAL 1, TAMWAL 2, KS, Kal, B1, B2, A1, A2

Table 2. Reference of preliminary constant value on Reservoir Model (Source: Ministry of Construction, Japan International Cooperation Agency)

	Reservoir 1	Reservoir 2	Reservoir 3	Reservoir 4
Constant of Outlet Run Off	0.1 – 0.5	0.03-0.10	0.005 – 0.05	0.0005 – 0.005
Outlet height (mm)	Up: 30 – 60 Low:10 - 20	0 – 50	0 -30	10

Research Procedure

1. Collecting secondary data of precipitation of the last 10 years (2006 - 2015).
2. Collecting secondary data of river discharge in Maronggek Watershed in the upstream of the last 10 years (2006 – 2015)
3. Collecting the last 10 years evapotranspiration data (2006 – 2015), except 2009.
4. Collecting data of land use in the watershed (farm, forest, village, tile).

To simplify the hydrological process in nature, some assumptions were applied as follow:

1. There is no variability on place for precipitation; the rain distributed equally in the watershed.
2. Value of base interception is the average one
3. Surface rain is precipitation reduced by the interception value.
4. Infiltration is distributed equally in the watershed.
5. Percolation distributed equally in the watershed.
6. Water intake in the upstream side is not taken into the calculation.

Powersim program was used in the data analysis to obtain the output model which is approaching measured discharge in nature, as it is simple and easy to understand. Furthermore, this program could shorten or simplify the instruction to solve the calculation. Although it is simple, it could be applied to any problem related to water resource. Microsoft excel was also used to determine half month or average value of water discharge.

On analyzing data to evaluate model calibration result, three appropriate criteria were used, *i.e.* the difference of water volume (VE), relative error between measured and calculated discharge (RE), and correlation coefficient (R). Limit of accuracy for VE and RE is 10%. Whereas for correlation coefficient (R) is 0.7. The equation used to evaluate the accuracy is as follow (Abdullah, S.H., 2000):

$$VE = \frac{\sum_{i=1}^{N} Qt^i - \sum_{i=1}^{N} Qh^i}{\sum_{i=1}^{N} Qt^i}$$

$$RE = \frac{1}{N} \frac{\sum_{i=1}^{N} \left| Qt^i - Qh^i \right|}{Qt^i}$$

$$R = \frac{{}^1/_N \sum_{i=1}^{N} (Qt^i - Qr)^2 - {}^1/_N \sum_{i=1}^{N} (Qt^i - Qh^i)^2}{{}^1/_N \sum_{i=1}^{N} (Qt^i - Qr)^2}$$

$$Qr = {}^1/_N \sum_{i=1}^{N} Qt^i$$

Note:
VE = the difference of water volume
RE = relative error
Qt^i = measured discharge of i period (m^3/ s)
Qh^i = calculated discharge of i period (m^3/s)
N = number of data
R = correlation coefficient

In order to determine the suitability, the calibrated model need to be verified. The verified data were different with the one used for the calibration. If the verification show that the output is approaching measured data in nature, then the model is categorized as suitable.

Moreover, a test is needed to be conducted to determine the sensitivity of each parameter on the resulted model, as each parameter has different impact on the designed model. The output could be very sensitive or less sensitive, that cause positive or negative effect. Perseverance and patience are required in this case.

The sensitivity test of model parameter is conducted after the model is calibrated and meet the limited of accuracy that defined previously. The test uses relative error (RE) which is calculated as follow:

$$RE = \frac{Qhb - Qhl}{Qhl} \times 100\ \%$$

Note:
RE = Relative Error
Qhb = the new measured discharge after the change of parameter
Qhl = the previous measured discharge before the change of parameter (calibrated discharge)

3. Results and Discussion

3.1 Description of Research Location

Watershed is a part of land that receive water from rain, which then flow to the main river to lake or sea. Each of watershed are separated topographically by hill, mountain, *etc* (Abdullah. S.H, 2000). In this research, Maronggek watershed in East Lombok, West Nusa Tenggara, had been chosen. Maronggek watershed consist of five irrigation area, *i.e.* Jimse, Borok Lelet, Rungkang, Sikur, and Endut. More detail information about Maronggek watershed is as seen in Table 3.

Table 3. Description of Maronggek watershed

Area (ha)	2403
River Slope (%)	7,20
Water Elevation (m)	620
River length (km)	17,48

Table 4. Land use at Maronggek watershed

Land use	Farm	(ha)	685,5
		(%)	28,53
	Forest	(ha)	1102,5
		(%)	45,88
	Moor	(ha)	275
		(%)	11,44
	Village	(ha)	340
		(%)	14,15

3.2 Result of Model Calibration

The model calibration was conducted using precipitation, discharge, and evaporation data on 2012-2015 using 8 parameters, which consist of first reservoir in resevoir 1 (TANWAL 1), first reservoir di reservor 2 (TAMWAL 2), field capacity (kal), constant of flow (A1), constant of basic flow (A2), constant flow (B1), constant of basic flow (B2), hydraulic conductivity (ks). Output from the model calculation is river discharge in half month. Moreover, error on calculation, in volume and relative error could be informed by this model. Detailed calibration result from January to December 2012-2015 could be seen in Figure 1 below.

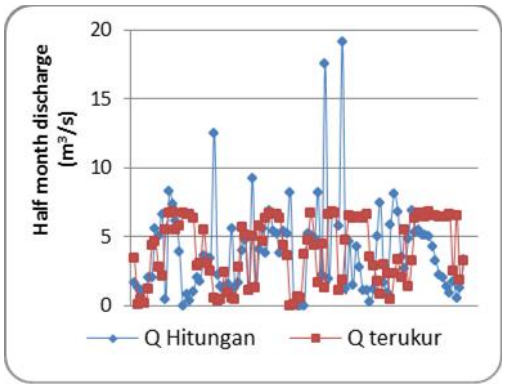

Figure 1. Discharges from model calibration in January - December 2012-2015

Tabel 5. Optimum value of calibrated model Parameter

No	Parameter	Optimum Value
1	First reservoir in reservoir 1 (TAMWAL 1)	400
2	First reservoir in reservoir 2 (TAMWAL 2)	10
3	Constant of water flow (A1)	0,03
4	Constant of basic flow (A2)	0,0005
5	Constant of water flow (B2)	0,005
6	Constant basic flow (B2)	0,7
7	Field capacity (kal)	40
8	Hydraulic Conductivity (ks)	39,7

From these parameters, yearly volume resulted from the model output was 373.368 m^3/s, whereas measured volume was 383.285 m^3/s. Based on these result, percentage of volume error was 2.587% and relative error was 0.028%, which showed accurate result of the output model.

3.3 Model Verification

In order to determine suitability, verification of the model parameter using discharge data from 2012-2015 need to be conducted using another discharge data from different year. Data used were discharge data in 2006 and 2007. If the result of verification model shows that the value of calculated discharge approaching the data of measured discharge, then it would be categorized as suitable and vice versa.

The first verification using discharge data of 2006, show relative error (RE) 0.034% and volume error (VE) 3.257%. These value are less than 10%. Moreover, the calculated discharge is 121.18 m^3/s and the measured discharge is 125,26 m^3/s. Furthermore, the correlation value (R) of the output model is 0.876, show high association.

The second verification using 2006 data, give calculated discharge of 137.90 m^3/s and measured discharge of 131,67 m^3/s. Moreover, it shows relative error (RE) of 0.047% and volume error (VE) of 4.525%. Furthermore, the correlation value (R) of the output model is 0.668, that show relation between measured and calculated discharge.

Based on the verification result, the calculated discharge is approaching river discharge in nature. Therefore, the model could be categorized as suitable. Figure 2 and 3 show the verification result.

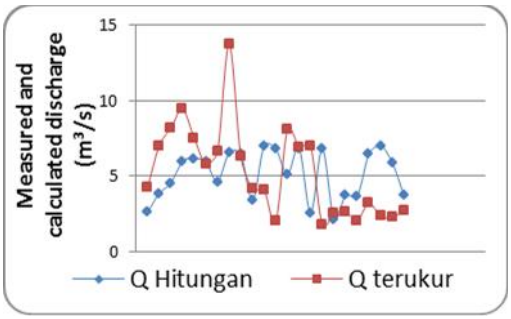

Figure 2. Discharges from verification model in January - December 2006

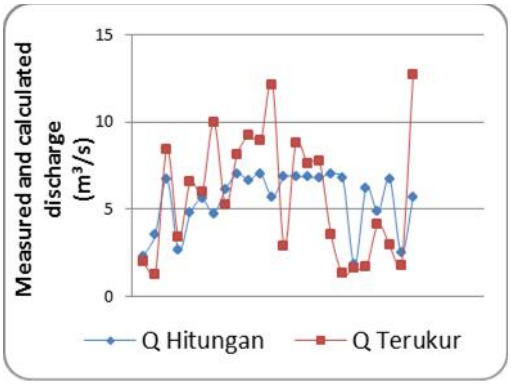

Figure 3. Discharges from verification model in January - December 2007

3.4 Sensitivity Model Parameter

Sensitivity model parameter was determined in order to define level of influence of each model parameter. The result show information that each parameter has different influence and contribution on the output result, which could be positive or negative. Positive when the addition of parameter value contributing on increasing river discharge and vice versa. Moreover, it gives information about the deviation value of the output model (relative error).

The deviation value due to the change of model parameter and characteristic of each parameter show in Table 6

Table 6. Deaviation value due to the change of model parameter

No.	Parameter	Change of Parameter	Deviation value, RE (%)	Characteristic
1	TAMWAL 1	-20 -10 10 20	6,2292 4,7861 1,6355 -0,074242	Negative
2	TAMWAL 2	-20 -10 10 20	3,257 3,2561 3,2544 3,2535	Negative
3	Kal	-20 -10 10 20	-92,038 -20,59 9,0881 13,184	Positive
4	KS	20 -10 10 20	9,3884 6,1634 0,56139 -1,9734	Negative
5	A 1	-20 -10 10 20	175,53 89,649 -82,623 -168,50	Negative
6	A 2	-20 -10 10 20	632478,69 316256,78 -316256,78 -632440,6	Negative
7	B 1	-20 -10 10 20	3,5129 3,5129 -1,1642 5,2608	Negative
8	B 2	-20 -10 10 20	19,066 19,066 -2,0527 -2,605	Negative

Based on the above table, parameter B1 is the most sensitive, while the other are less sensitive. Negative value of the characteristic shows the effect of decreasing river discharge.

4. Conclusions

Based on the calculation and discussion, the conclusions are as follow:

1. Value of discharge from the output of calibration and verification model are approaching the measured river discharge.
2. The most sensitive parameter is B1 parameter.
3. R value of the calculated model is 0.98885, show that the model output could be applied to calculate discharge of Maronggek river for a few years ahead.
4. Reliability of the model could be applied as there is no extreme change in land use on the watershed.
5. If extreme change in land use is occur, calibration should be conducted.
6. When this model will be applied for different watershed, calibration should be conducted.

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Utilization of *Ulva lactuca* to Increase The Growth of *Eucheuma cottonii*

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Abstract

The purpose of this research is to increase the growth of *Eucheuma cottonii* by using *Ulva lactuca* extract. The growth of *Eucheuma cottonii* which is cultivated in West Nusa Tenggara currently tends to decrease, because the seeds used are repetitive seeds so the quality is low. So growth tends to be slow and susceptible to disease. This research was conducted in Ekas bay located in Ekas Buana Village, Jerowaru District, East Lombok Regency, West Nusa Tenggara Province on April 1, 2017 until June 30, 2017. This research applied soaking *Eucheuma cottonii* using *Ulva lactuca* extract. The concentration of *Ulva Lactuca* extract used was 15%. This study used a completely randomized Design Method with different soaking treatments of 1 hour, 2 hours, 3 hours, 4 hours, 5 hours and 6 hours. Immersion is done on *Eucheuma cottonii* seedlings by using *Ulva lactuca* extract in fiber container. *Eucheuma cottonii* cultivated on a bamboo floating raft with a size of 8 m x 8 m. The observed parameters were growth of *Eucheuma cottonii*, carragenan yield, water quality and incidence of pests and diseases. The results of the research were different immersion times giving different results of *Eucheuma cottonii* growth. The best immersion duration produces *Eucheuma cottonii* growth is soaking for 4 hours.

Keywords: *Ulva lactuca*, *Eucheuma cottonii*, extract, immersion, growth.

1. Introduction

West Nusa Tenggara Province is a producer of dried seaweed and in 2014 reached 760 thousand tons of production. Among them can be exported to Vietnam as much as 54 tons. The production is derived from the entire territorial sea of NTB defined as Minapolitan Seaweed area. The areas on the island of Lombok include Pengantab Village, West Lombok Regency, Gerupuk Bay, Central Lombok Regency, Ekas Bay, Serewe, and Awang Bay. Development sites on Sumbawa Island include Kertasari West Sumbawa, Mapin, Kaung Island, Terano and Kwangko,Dompu.

NTB seaweed production is expected to increase from year to year. But there are some obstacles in seaweed cultivation including the quality of seeds and the growing rate of thallus that tends to decline over time. Many of the things that cause these problems, including the availability of limited quality seeds and unpredictable weather conditions throughout the year. Seeds used by the current cultivators are seeds that are repeatedly used. Seaweed center Gerupuk Lombok has succeeded in developing seeds from tissue culture, but the seeds are still not enough to be used by all farmers in Lombok especially in NTB. Therefore it is necessary another effort to improve the quality of the seeds so as to produce optimal thallus growth. These efforts can be done by providing supplemental supplements for seedling thallus. These supplements can be nutrients and hormones that can stimulate thallus growth. The growth hormone does not have to come from a valuable commercial hormone. Growth hormone can be obtained from natural ingredients around the sea itself from the extracts of various marine plants namely *Ulva lactuca*. Sedayu (2014) and Brotowijaya (1984) explained that in *Ulva lactuca* there are growth hormone growers such as, giberlin, cytokinin and auksin that can increase the growth in plants. Therefore it will be examined how the effect of immersion of *Ulva lactuca* extract on the growth of *Eucheuma cottonii*. The purpose of this study was to increase the growth of *Eucheuma cottonii* by using lactuca ulva.

3. Materials and Methods

This research activity was conducted on April 1 to June 30, 2017, located at Ekas Bay, Ekas Buana Village, Jerowaru Sub District, East Lombok Regency, West Nusa Tenggara Province. The tools and materials used in this research are: raft, bucket, rope, lisung, anchor rope, scales, DO meters, refractometer, pH meter, secchidisk, thermometer, camera, ballast, rope, gauze, knife. *Eucheuma cottonii*, *Ulva lactuca* extract, seawater and carrageenic extraction materials comprising (NaOH, 95% Ethanol, and Aquades).

The research method used is experimental method. The treatment used in this research is the duration of soaking 0 hours (without *Ulva lactuca* extract) as control, 1 hour (A), 2 hours (B), 3 hours (C), 4 hours (D), 5 hours (E) and 6 hours (F) with 15% concentration. The determination of 15% extract concentration was carried out in the following manner : A total of 900 ml *Ulva lactuca* mixed with 6 liters of sea water, after mixing thereafter incorporated seaweed that had been tied to the rope.

Sampling was done six times, each at 7, 14, 21, 28, 35, and 42 days after planting. Samples were taken at three sampling points at each rope in the raft at each sampling. Thus, the number of samples at each take is 72 samples of seaweed. Each sample that has been collected is directly weighed wet weight.

The research design used was Completely Randomized Design (RAL) which consisted of one factor, *Ulva Lactuca* concentration with 24 experimental units consisting of 6 treatments with 4 replications. The laying of an experimental unit uses a lottery system, by way of drawing or randomization.
Parameters used to test the results of this study is Absolute Growth, According Effendi (2003),
G = *W*t-*W*0;
G = Absolute Average Growth (gr);
Wt = Seed Weight At End of Research (gr);
W0 = Seed Weight In Research Beginning (gr). Specific Growth Rate (Effendi, 2003),

LPS = (Ln Wt - Ln Wo) / tX 100%;
LPS = Average Specific Growth Rate (%);
Wt = Average weight of seed on ti (g) (I = week I, week II ... t);
W0 = Average weight of seeds in ti-1 (g); t = Observation Period (day). Percentage of Dry Weight% Dry weight = (Dry weight (g)) / (Wet weight (g)) x 100%.

Measurement of water quality parameters in this study include: temperature, current velocity, depth, salinity brightness, dissolved oxygen (DO), and acidity degree (pH).

Carageenan made with the following steps : *Eucheuma cottonii* that has been cut into small pieces soaked with aquades ± 100 ml for 24 hours. After that, washed thoroughly on running water. *Eucheuma cottonii* then put in a beaker glass containing 100 ml aquadest then added 1% NaOH solution to pH 8,5-9. The sample is then heated at 70-90ºC for 3 hours. Next, the solution is filtered with a gauze. The sieve was then added ± 25 ml of ethanol absolute and allowed ± 30 min. After precipitation, filtering is done to remove the ethanol solution. The filter results are fed into a weighted petridish and then heated into an oven at 60-70ºC for 24 hours and thereafter, the cold yield is weighed (Harun et al., 2013). The seaweed growth rate that has been obtained tabulated using microsoft excel and analyzed using Analysis of Variance (ANOVA) and further Tukey test (HSD) if there is significant (significantly different) effect of the test treatment.

4. Results and Discussion

The growth rate of *Eucheuma cottonii* soaked with *Ulva Lactuca* extract based on ANOVA analysis is presented in Table 1. Analysis of Variance (ANOVA) results showed that *Ulva lactuca* extract on specific growth rate and on absolute growth and on percentage of dry weight of *Eucheuma cottonii* harvest which was not significant between immersion treatments but significant with non-immersion treatment.

Table 1. The growth of *Eucheuma cottonii*

Treatment	Growth (gram)
A	203,3333
B	213,3333
C	196,6667
D	216,6667
E	183,3333
F	196,6667

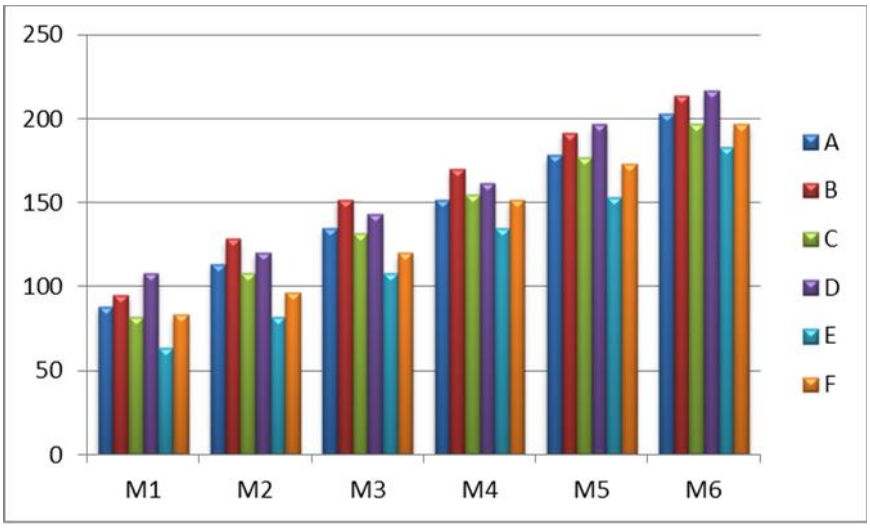

Figure 1. Chart of the growth of *Eucheuma cottonii*

Addition of *Ulva lactuca* extract gave a high effect on the growth of *Eucheuma cottonii*, compared with growth without *Ulva lactuca* extract. The growth of seaweed *Eucheuma cottonii* given the extract of *Ulva lactuca* can grow well. This is due, because the thalus is able to absorb well the growth-promoting nutrients such as cytokines and auxins contained by *Ulva lactuca* extract. So the growth rate of *Eucheuma cottonii*, has a very good growth rate. However, the growth of *Eucheuma cottonii* given *Ulva lactuca* extract, did not give a significant effect ($p < 5\%$) between treatments at specific growth rates, absolute growth and percentage of dry weight of harvest. Nevertheless, the highest growth occurred in 4 hours of soaking (P4) treatment of either the specific growth rate, absolute growth or percentage of dry weight of the harvest. The high growth value at 4 hours immersion due to the adequate intake of nutrients absorbed by the thalus at the time of immersion is done. This is reinforced by Akbar (2016), that 15% extract with 30 minutes immersion and 5% extract with 90 minutes of immersion has a good specific growth value compared to other treatments during 4 weeks maintenance. The use of low extract concentrations with the treatment of long immersion times and the use of high concentrations of extract by shortening the length of immersion time has a higher yield.

Long immersion does not go well for growth, due to soaking more than 4 hours like soaking 5 and 6 hours, nutrient intake absorbed by thalus has an optimal time limit. Immersion that exceeds the optimal time limit, is expected to result in adverse growth effects or growth of *Eucheuma cottonii* will decrease. In addition to the long period of immersion, it is suspected that the inhibiting factors of growth are also caused by environmental conditions of cultivation, due to the presence of plant-eating animals, diseases and currents that are lower or higher, thus disrupting the growth rate of *Eucheuma cottonii*.

Growth rate on seaweed *Eucheuma cottonii* can not be separated from high water quality. Apart from the extract given, water quality also greatly affects the best growth of *Eucheuma cottonii*. Santoso and Nugraha (2008) say that nutrients needed by seaweed are obtained from nutrients contained in water bodies and will grow well in areas with temperatures between 27°C-30° C and seaweed can grow at a maximum pH of water ranging from 6 -9, with an optimum pH of about 7.5-8.0. Dissolved oxygen in marine waters ranges from 11 mg / l at temperatures of 0° C and 7 mg / l at a temperature of 25° C, in natural waters of dissolved oxygen is usually less than 10 mg / l (Mudeng et al., 2015).

Table 2. Water quality

Parameter	Unit	Range
Temperature	^{0}c	32,4
DO	mg/l	5,84
Salinity	Ppt	32
pH	-	7,3
Water current	m/second	14
Brightness	M	2,5

Anggadiredja et al., (2008) states, the optimal water temperature around the seaweed plants ranged between 26-30oC. Because the temperature is very important role for the metabolism of seaweed, because the speed of metabolism increases with increasing water temperature. The temperature value obtained in the study was 32.4° C. The temperature value obtained in this study is not ideal for the growth rate of *Eucheuma cottonii*, but the value is still tolerable for its growth.

The Disolved Oxigen (DO) values obtained in the study were 5.84 mg / l, the DO values obtained were still within the optimal DO limit to support the growth of *Eucheuma cottonii*. Dissolved oxygen is a basic necessity for living creatures in the water. The content of DO to support seaweed cultivation is 3-8 mg / l (Ditjenkanbud, 2008).

The current water is 14 cm / sec obtained in this study is the current speed is not very optimal. So that little seaweed get the nutrients brought by the flow of water. According to Suparman (2014), seaweed is an organism that feeds through the flow of water through it or through the synthesis of foodstuffs around it with the help of sunlight. A good stream can deliver nutrients and clean the thallus from dirt and gluing plants (Rahman et al., 2015).

Salinity 32 ppt is salinity is still in normal condition, because growth of seaweed in salinity is still in normal growth. This is supported by Santoso and Nugraha (2008), water salinity of about 28-34 ppt with a salinity optimum value of about 33 ptt sufficient for thallus fattening.

The value of pH is 7.3 is the optimal pH value in seaweed growth. The pH values obtained in this study can support the best growth of *Eucheuma cottonii*. According to Susilowati (2014), alkaline waters (7-9) are productive waters and play a role in encouraging

the process of change of organic matter in water into minerals that can be assimilated by phytoplankton of marine waters and coastal pH is relatively more stable which is in a narrow range, usually ranging from 7.7 to 8.8. The pH is affected by the buffer capacity ie the presence of carbonate and bicarbonate salts therein.

The brightness level in the study was 2.5 m. The value of this brightness level is at a normal value for the growth of *Eucheuma cottonii*, so that seaweed can utilize sunlight that enters the water for energy and photosynthesis. Seaweed brightness requires light as a source of energy for the formation of organic materials necessary for normal growth and development, the location of seaweed cultivation preferably in clear waters or high brightness of about 2-5 m (Suparman, 2014).

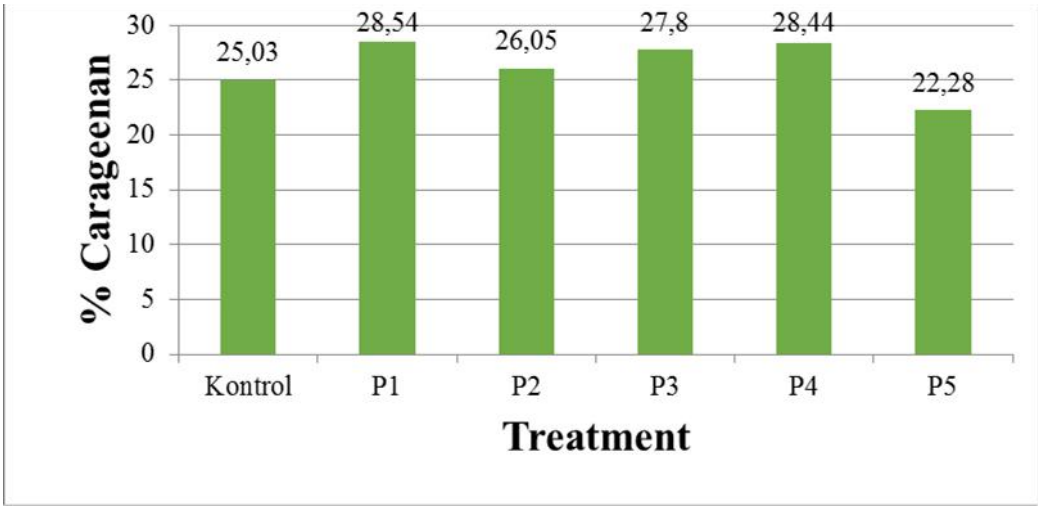

Figure 2. Carageenan content

Based on the data obtained in the graph above, the carrageen produced by *Eucheuma cottonii* with different immersion treatments ranged from 22.28% to 28.54%. Department of Commerce (1989) in Masthora (2016), states that the average value of carrageen yields stipulated by the Ministry of Trade is 25%. So the results of the carrageen content that has been eligible dipeoleh. Carrageen content obtained more than the requirements of the Department of Commerce, allegedly due to long immersion with *Ulva lactuca* extract in addition to giving a positive effect on growth, also gives more carragenan content than the Department of Commerce.

Carrageen content is the carrageen weight contained in dried seaweed and expressed in percent. The higher the carrageen content, the greater the output. In this research, the highest content of carrageenan content was found in 1 hour soaking treatment (A) with carrageen value of 28.54%. While the lowest value found in the treatment of soaking 5 hours (E) is 22.28%. The high value of carrageen content of *Eucheuma cottonii* allegedly due to differences in the time immersion. In addition, the high value of carrageenan content also occurs when the extraction of carragenan content test. Burhanuddin (2012), states that the content of high enough carragenan caused by the absorption process of nutrients is good enough, where the nutrient is needed for the formation of polysaccharides which is the main component of carageenan (karginofit) formation deposited on the cell wall. It is further added that the extent of seaweed extract (carrageen) is usually also influenced by season, habitat, age of plant and method of cultivation. Carrageenan content obtained at 1 hour immersion treatment (A) has fulfilled the requirement of carragenen content determined by Trade Department.

4. Conclusion

The conclusion of this study showed that effective immersion time with *Ulva Lactuca* extract on *Eucheuma cottonii* growth was for 4 hours.

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Sociotechnical Adaptive Water Governance: A Case Study of Water Governnce in Lombok Indonesia

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Abstract

Navigating hydrological change and social-ecological complexity requires adaptive water governance. However, moving from premise to practice has been problematic, particularly in developing contexts. Strategies aimed at translating governance prescriptions into practical planning and sustained implementation are not well articulated nor understood. Thus, this paper examines a water governance paradigm in Lombok, Indonesia with the objective of expounding the dynamics between adaptive water governance and contextual conditions. This case study reveals an innovative pathway toward achieving governance prescriptions. In Lombok, decentralized technical decision-making acts as a fulcrum on which adaptive water governance processes are initiated. Further unpacking this approach suggests it can serve as a context-tailored transformative strategy that balances top-down and bottom-up approaches. Rather than radically alter contextual constraints, this strategy exploits them to produce adaptive governance opportunities. In doing so, it is more likely to overcome the traditional challenges of entrenched interests, high transaction costs, and institutional inertia. These findings underscore shortcomings in our understanding of the interconnection between technological and social dimensions of water governance. The importance of how social and institutional factors affect technical water management outcomes is well understood, however the converse of this dynamic is often overlooked. Therefore, this paper advocates for a more comprehensive integration of the many complex dimensions of water governance.

Keywords: water governance; adaptive water governance; adaptive water management; integrated water resources management; adaptive comanagement

1. Introduction

Global freshwater resources face immense human pressures in the Anthropocene. As climate change drives complex alterations to the spatio-temporal distribution of water, population growth and other demographic shifts intensify demand for the contested resource (Vörösmarty et al. 2010, Allan et al. 2013, IPCC 2014). Water connects social-ecological, economic, and biophysical systems at multiple scales. Thus, such intractable challenges have wide-ranging implications for human societies and ecosystems (Bates et al. 2008, Bogardi et al. 2012). It is now widely acknowledged that anticipating, mitigating, and adapting to the adverse impacts of these changes requires dynamic governance. Governance structures must recognize social-ecological complexity, engage with system interdependencies, and meaningfully embrace emerging opportunities for social and biophysical innovation (Berkes et al. 2003, Folke et al. 2005, Olsson et al. 2005, Bakker, 2012).

These insights have undermined basic assumptions of traditional water management, setting forth a paradigm shift in water governance literature and practice (Pahl-Wostl 2007). This study applies the definition of water governance most widely referenced in the literature and commonly used among water professionals. Water governance signifies “the range of political, social, economic, and administrative systems that are in place to develop and manage resources, and the delivery of water services, at different levels of society” (Rogers and Hall 2003: 7). Whereas traditional water governance conceptualizes water management as a technical challenge, novel paradigms emphasize a transition away from command-and-control approaches in favor of holism, polycentric integration, organizational flexibility,

social learning, and reflexivity (Pahl-Wostl et al. 2007, Lejano and Ingram 2008, Azhoni et al., 2017). The most notable of such approaches thus far have been integrated water resources management (IWRM), adaptive management (AM), and adaptive comanagement (ACM) (Medema et al. 2008, Huitema et al. 2009).

While such adaptive water governance approaches are theoretically sound, moving from premise to practice has been uneven, impractical, and potentially maladaptive (Medema et al. 2008, Huitema et al. 2009, Förster et al. 2017). Adaptive water governance has remained primarily prescriptive because of these implementation challenges. Because implementation is conducted within the constraints of broader social, political, and biophysical systems, capacity for adaptive governance is defined by context (Allan and Gunderson 2010). Implementation strategies that do not recognize such contextual constraints fail (Förster et al. 2017). Therefore, adaptive governance must be "able to 'navigate' the dynamic nature of multilevel and interconnected social-ecological systems" (Galaz et al. 2008:169). However, the dynamic nature and contextual preconditions are not well articulated nor understood (Medema et al. 2008, Munaretto and Huitema 2012, Huitema et al. 2016). Consequently, stakeholders have been slow, unable, and or unwilling to enact the systemic reforms because of high transaction costs, insufficient public participation, entrenched interests, and institutional inertia (Allan et al. 2013, Halbe et al. 2013, Varady et al. 2016).

Yet, these are manmade barriers and therefore malleable and surmountable with concerted effort to move water governance systems toward adaptive water governance (Moser and Ekstrom 2010). Although increasing change and uncertainty are already driving water governance systems to gradually shift toward adaptive water governance, this shift has thus far been inadequate, particularly in the developing world (Allan et al. 2013, Azhoni et al. 2017). Therefore, theory and practice must examine contextual preconditions with a focus on how to translate theoretical contributions into practical planning and sustained implementation (Huitema et al. 2009). In developing contexts, adaptive strategies must also deliver of co-benefits from development projects (Azhoni et al. 2017). Therefore, adaptive water governance scholars and practitioners must develop innovative ways to couple theory with practical applications by articulating clearly beneficial policy opportunities (Huitema et al. 2009). Not only does this improve the relevancy of theory, but it encourages and facilitates policy-makers to enact change.

Thus, this paper examines a case-specific water governance paradigm in order to analyze the dynamic interconnection between contextual conditions and adaptive water governance implementation. The objective in doing so is to articulate context-specific pathways toward adaptive governance implementation. These pathways can serve as practical policy opportunities that facilitate collaboration, coordination, stakeholder participation, and capacity-building. This paper does so by examining the polycentric water governance system in Lombok, Indonesia.

Lombok is undergoing rapid ecological, social, political, and economic change. Its markedly heterogeneous physical and social geographies present an opportunity to glean lessons about adaptive water governance in a wide variety of contexts. Lessons learned may be broadly applicable to contextually-similar social-ecological systems such as rural communities, island geographies, the Indonesian archipelago, tropical Asia-Pacific region, and or developing world more broadly. First, this paper details the theoretical framework and methods used to conceptualize Lombok's water governance paradigm. Second, the paradigm and systems are presented in detail with an eye toward eliciting adaptation pathways. Third and finally, this paper concludes with an analysis of this case study's implications for our understanding of the interconnection between context and adaptive water governance implementation.

2. Methods

2.1. Theoretical framework

To analyze the complex system dynamics of water governance in Lombok, this study follows a two-step approach informed by adaptive governance analysis and water management paradigm analysis. Specifically, this paper draws from the Management and Transition Framework first developed by Pahl-Wostl et al. (2007, 2010) and further developed by Halbe et al. (2013) and then blends it with elements of the adaptive governance evaluation framework developed by Trimble et al. (2015). In doing so, the study integrates dimensions of in-depth systems evaluation and participatory evaluation.

First, this study examines water management systems in Lombok to elicit and analyze the water governance paradigm by examining four components set forth by Trimble et al. (2015); (i) Setting (biophysical, social-ecological, institutional, external drivers); (ii) Process (participation, social relationships, social learning); (iii); Outcomes (social capital, decision-making, social learning and adaptation); (iv) Effects (ecological, social, social-ecological). The fourth component is presented throughout the discussion of the preceding three. Being explicit about paradigms reveal inconsistencies in management and government systems (Halbe et al. 2013). Data from document analyses and focus group discussions are utilized to do so. These initial methods allow for in-depth evaluation and increased validity through triangulation (Trimble et al. 2015).

Second, the governance paradigm elicited then serves as a basis for participatory envisioning and designing of pathways to adaptive water governance implementation. This is done through semi-structured interviews framed to facilitate a process in which multiple stakeholders define the challenges, strengths, goals, indicators, and evaluation methods of moving toward adaptive water governance. Participatory approaches foster transfers of knowledge, social learning, informed decision-making, collaboration, and capacity development (Halbe et al., 2013). Furthermore, participatory evaluation allows for greater external validity, enhanced selection of indicators, organizational learning, and empowerment of disenfranchised stakeholder groups (Plottu and Plottu 2011, Trimble et al. 2015). The data collected from the interviews are triangulated to corroborate and test the validity of previous findings, and then inform the overall conceptualization of Lombok's water governance paradigm.

2.2. Data Collection

First, this paper extracted water-specific scholarly literature on adaptive governance in Lombok from a broader systematic literature review of adaptive governance theory and practice in the province of Nusa Tenggara Barat conducted by Laplaza et al. (2017). Concurrently, in March 2017, three field group discussions (FGDs) were held with water user associations in three villages in North, East, and South Lombok, during which local-level water users (i.e. villages, farmers) could express their perceptions of water governance settings, processes, outcomes, and effects. These perceptions of the 58 participants were audio-recorded, transcribed, and translated into English (see Appendix A of supplementary material). A document analysis of the water-specific scholarly literature and the FGD recordings were used as the basis for the preliminary conceptualization of the water governance paradigm in Lombok and identification of key stakeholders, institutions, and contextual components to be evaluated through interviews.

Thirty-five in-depth semi-structured interviews were then conducted with the various key stakeholders. These included representatives of academic institutions (coded as AI), non-governmental organizations (NG), local government agencies (LG), regional government agencies (RG), and various local water users, typically irrigation farmers (WU) (see Table 1). Water users included upstream, midstream, and downstream water users within all four of

distinct Lombok's distinct ecological topographies (North, South, East, Central) to reflect the marked heterogeneity of Lombok's physical and social geographies. The data collected from the document analyses and FGDs indicated local water users are often marginalized from the decision-making process despite being highly affected by the decisions made. Therefore, the semi-structured interviews allowed for increased representation of local water user perceptions relative to the other stakeholders.

Table 1. Composition of interview participants

Contextual Characteristic		**AI**	**NG**	**RG**	**LG**	**WU**	**Total**
Geographic	Mataram	5	2	5	-	-	**12**
Location	North	-	-	-	1	6	**7**
	East	-	-	-	1	4	**5**
	Central	-	-	-	1	4	**5**
	South	-	-	-	2	4	**6**
Location in	Upstream	-	-	-	1	6	7
Irrigation	Midstream	-	-	-	2	6	8
Area	Downstream	-	-	-	2	6	8
Total		**5**	**2**	**5**	**5**	**18**	**35**

The semi-structured interviews were designed to encourage participatory evaluation of contextual challenges, systemic strengths, and adaptive pathways to overcome these challenges (see Appendix B of supplementary material). The objective in doing so was to facilitate stakeholder envisioning of translating strengths to overcome water-related challenges. The interviews were conducted in Bahasa Indonesia and Bahasa Sasak, audio recorded, then transcribed and translated into English. Once transcribed and translated, an interpretive approach to content analysis was applied to the data set. Informed by grounded theory, this approach elicits themes and subthemes in interview responses by inductively coding the verbatim transcripts (see Appendix C of supplementary material) (Glaser and Strauss 2012). The total number of times respective codes appeared in the transcripts, the total number of respondents' transcripts containing respective codes, and a breakdown of which stakeholder transcripts contained respective codes were than analyzed.

3. Results and Discussion

3.1 Results

3.1.1 Setting

Located in the island archipelago of eastern Indonesia, Lombok's tropical climate features a five-month monsoon season that contributes 80 percent of the island's precipitation (Klock 2007). It is affected by the El Niño Southern Oscillation (ENSO), which can generate drier and/or wetter than average periods. Rising temperatures due to climate change are likely to increase the frequency and intensity of droughts and decrease the predictability of rainfall patterns (Yasin et al. 2007). Rainfall patterns may become concentrated into fewer events (Butler et al. 2014). The orographic effects of the volcano Mt. Rinjani create steep climate gradients across the island. Combined with marked variation in soil types, these microclimates support diverse agricultural systems and livelihoods over a short distance

(Yasin et al. 2007). Therefore, changes in rainfall patterns and impacts will vary widely across the island (Kirono et al. 2016).

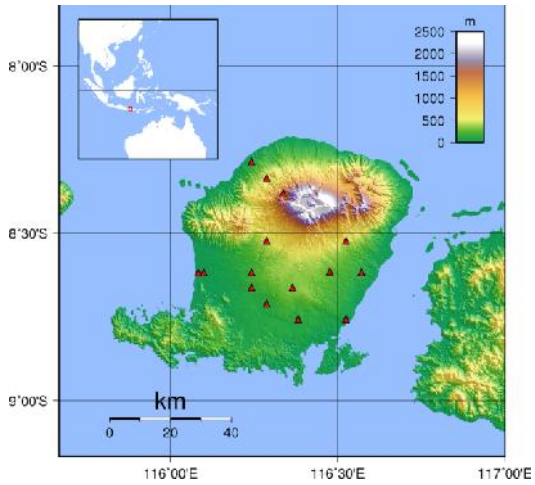

Figure 1. Topographic map of fieldwork sites in Lombok, Indonesia

The volcano Mt. Rinjani captures high-elevation rainfall and concentrates it in a 1,375,000m^3 lake. The water then funnels through the porous volcanic soil and forms hundreds of streams reaching across most the island. Ninety percent of the island's 33 rivers originate from Rinjani (Klock 2007). These rivers and streams are divided into 32 sub-basins for administrative purposes. However, sub-basin boundaries aren't clear as water is diverted out of water basins across the island. Whereas North and West Lombok generally received a surplus of water, Central, East, and South Lombok face chronic shortages. Many of the rivers and streams have been dammed or diverted to serve these areas facing water shortages. However, infrastructure degradation and illegal diversion upstream often lead to water shortages downstream. Furthermore, in the past two decades, over 400 springs have dried up due to illegal logging on the mountain (Klock and Sjah 2011). This deforestation results in chronic flooding during the wet season and chronic water scarcity during the dry season. Tension and conflict between water users are increasing as a result.

The population affected by these spatio-temporal hydrological changes is simultaneously facing rapid demographic changes. Although only 4,725km^2, Lombok's population of 3.1 million (2010) is expected to reach 4.5 million by 2050 (Fachry et al. 2011). The population is characterized as having low human development (0.651 HDI), reflecting low levels of life expectancy, literacy, education, and per capita income (BPS Indonesia 2015). Poverty has been greatly reduced over the past two decades but remains prevalent in rural areas where 58 percent of the population lives (BPS NTB 2016).

Livelihoods on the island are intimately tied to ecosystem goods and services. Freshwater is the primary input to five of the seven identified principal livelihood typologies (e.g. agriculture, aquaculture) (Rochester et al. 2016). Agriculture is dominated by water-intensive rice farming and comprises approximately 80 percent of the island's total water consumption. Industry, tourism, and households comprise the remaining 20 percent. Population growth is increasing demand across these sectors and straining the already contested water supply. This combination of climate and hydrological change, low human development, high water dependency, and rapid population growth leave Lombok highly vulnerable to change and uncertainty, but beset by low resilience and adaptive capacity.

A polycentric water governance system manages these challenges. Polycentric governance is defined as governance systems in which "political authority is dispersed to

separately constituted bodies with overlapping jurisdictions that do not stand in hierarchal relationship to each other" (Skelcher 2005: 89). The 1997 Asian financial crisis catalyzed a process of broad political decentralization that distributed water management authority across government agencies (Bhat and Mollinga 2009). Rural water distribution is managed by the ministries of forestry, public works, and agriculture who assume interrelated roles in conserving, developing, and distributing water resources. Within these agencies, authorities are further distributed by scale. For example, the Ministry of Public Works (MPW), which is responsible for the development and maintenance of water infrastructure, delegates authority of irrigation areas larger than 3000ha to the national level, areas between 1000-3000ha to the provincial level, and areas smaller than 1000ha to the district level. Representatives of the three agencies together form Water Resource Council tasked with coordinating multi-level water management operations (Sjah and Baldwin 2014). Urban and drinking water distribution is managed by *Perusahaan Daerah Air Minum* (PDAM), a public-private utility that supplies households and tourism facilities with tap water for a fee. PDAM sources their water from natural springs, often diverting water from irrigation canals to do so.

External actors, including domestic and international academic institutions, non-governmental organizations, and development organizations provide technical and financial assistance to communities and government stakeholders. Notable programs include a water catchment project led by the UN World Food Programme, a watershed payment for ecosystems services scheme led by the World Wildlife Fund, and a water infrastructure development project led by the World Bank.

3.1.2 Process

National legislation requires government agencies to promote local water user participation in developing and managing irrigation systems (Sjah and Baldwin 2014). Local water users collectively manage tertiary irrigation networks through water user associations. WUAs range in size from 50 to 1000 members, averaging around 300 members (Sjah and Baldwin 2014). WUAs sharing the same water source collaborate through a WUA union as well as a broader umbrella group of various WUA unions. Government agencies facilitate institutional organization of local water users into WUAs. Once established, these agencies empower WUAs to collaborate on tertiary irrigation network management through training opportunities, technical expertise, and financial assistance.

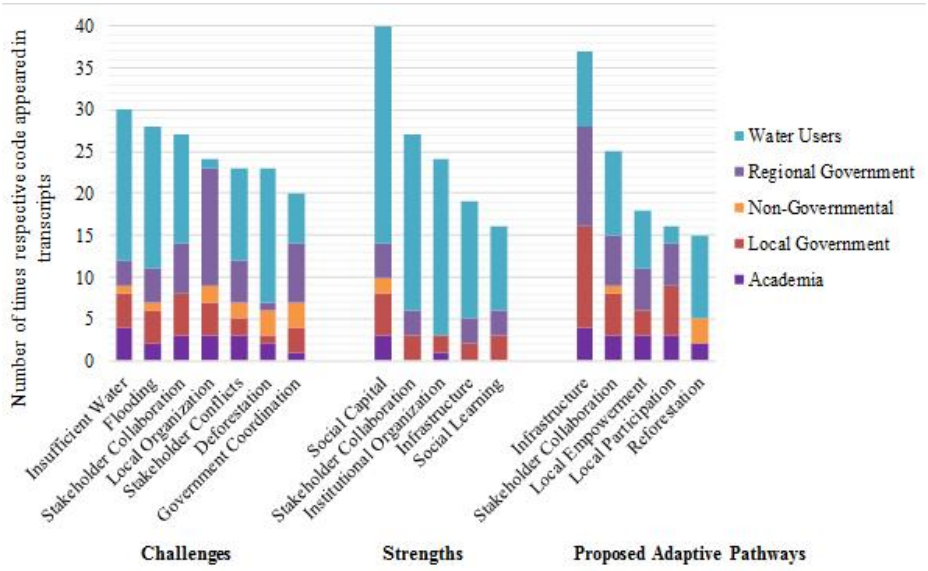

Figure 2. Interview responses on main water governance challenges, strengths, and proposed adaptive pathways

Stakeholders widely reported high levels of social capital that undergirded the institutional organization and operational capacity of WUAs (see Table 2; Appendix C of supplementary material). This is consistent with previous studies of water user associations in Lombok (Klock and Sjah 2011, Sjah and Baldwin 2014). Klock and Sjah (2011), for example, found a positive statistical correlation between the number of mosques in village (indicating social capital) and ability to cope with water shortages (indicating organizational capacity). Interviews further revealed how shared local practices foster collaboration between local stakeholders. Irrigation cooperation is underpinned by a traditional customary belief in collective action for community benefit known as *gotong royong.* Within villages, WUAs meet often to determine water-related decisions such as distribution schedules, fee payments, sanctions, and conflict resolution. The primary decision-making mechanism is a customary consensus-based deliberative process known as *musyawarah.* The process creates a forum in which all stakeholders can participate in decision-making and evaluation. Decisions are codified and recorded as customary laws known as *awiq-awiq.* These laws form the basis of member rights and responsibilities. *Awiq-awiq* are widely reported to be fair, respected, and enforced among water users. *Musyawarah* is also employed by WUA unions when determining equitable and timely water distribution between villages. The laws and decisions promulgated by WUAs and their unions are recognized as legitimate by the government.

Despite this emphasis on local participation, decentralization has offered little opportunity to transition away from agency-dominated water governance (Helmi 2000, Brun 2001). Lombok's water governance system is more polycentric in theory than in practice. Authority across scales remains centralized among government agencies. Interviews with these agencies suggest a degree of paternalism. Water management decisions are frequently made without wide consultation with affected stakeholders (Sjah and Baldwin 2014). This dynamic is best exemplified by the relationship between PDAM and local water users. PDAM often sources its water from natural springs used for irrigation purposes without consulting nor notifying the affected local communities. Many downstream users directly attribute water shortages to PDAM siphoning. PDAM then charges the same users for the provision of drinking water. These fees contribute to the WWF-administered payment for ecosystem services (PES) scheme aimed at reforesting upstream areas to conserve surface water. However, downstream users are unaware of the scheme because of the lack of consultation and correspondence. This significantly erodes trust, produces tension and conflict, and undermines effective collaboration between government and local water users.

3.1.3 Outcomes

The centralization of authority between multiple overlapping agencies often results in inter-agency bureaucratic turf wars (Klock, 2007). Rather than promote resilience through system redundancy, this fragmentation produces a high degree of institutional flux and system complexity that now results in poor coordination and even contradictory planning and development (Butler et al. 2016). The concomitant distribution of government revenue leads to a lock-in of this status quo. Agencies are resistant to integration because they perceive it to be a streamlining of their authority and revenue flows. Such institutional inertia significantly impedes effective coordination, collaboration, and integration across and between stakeholders.

Furthermore, although political decentralization did emphasize a shift from an exclusively technical perspective to a socio-technical perspective, authorities retained a technocratic focus on infrastructure development as a management strategy (Helmi 2000). Regional and local government respondents' diagnosis of water challenges recognized social dimensions such as poor local institutional organization. However, social and political considerations did not readily translate into envisioned adaptive pathways. Local and regional

government respondents instead prioritized further water infrastructure development (see Table 2). Wise et al. (2015) also found that adaptation planning in the province prioritizes incremental strategies aimed at addressing proximate challenges rather than transformative strategies aimed at systemic challenges.

This technocentric approach suggests a reluctance to facilitate systemic institutional changes. Entrenched norms, behaviors, and vested interests have led to an ossification of the status quo. An example of this is PDAM's aversion to wider stakeholder consultation because of the financial benefits from selling drinking water. Government agencies perceive the transactions costs of decentralizing decision-making and increasing stakeholder participation to be quite high, specifically due to the difficulty of reaching collective agreements. Increased coordination could remedy such complexity, however coordination across sectors and scales is already fraught, with difficulty (Huitema et al. 2009, Butler et al. 2016). Poor WUA institutional organization and weak operational capacity further increase transaction costs. In some villages, WUAs are incompetent, inactive, or inexistent. In villages with functioning WUAs, technical and financial capacities for self-management remains low. This results in government reluctance to promote self-management projects which itself creates a self-fulfilling dynamic. In the absence of learning and capacity-building opportunities through management projects, WUA operational capacities further deteriorate when faced with pervasive social and ecological change, thereby increasing government reluctance for self-management.

Notably however, half of WUA representatives interviewed reported robust institutional organization (see Table 2; Appendix C of supplementary material). These same representatives all reported effective collaboration with the Ministry of Public Works (MPW) and credited it with improvements in water management and distribution. WUAs initiate the process by deliberating among themselves and proposing context-specific projects (i.e. small dams, irrigation canals, water catchment facilities) to address spatio-temporal water distribution challenges. Importantly, these proposals include an assumption of partial responsibility on behalf of the WUAs with regards to the planning, construction, operation, and maintenance of the proposed projects. MPW provides the primary inputs (i.e. technical, financial) required to carry out the projects, but also empowers WUAs to meet their responsibilities through training opportunities.

In these arrangements, infrastructure acts as a fulcrum on which processes of multi-scale participation, stakeholder collaboration, relationship building, experimentation, and social learning begin. This arrangement is community (bottom-up) initiated and government (top-down) led. Rather than radically shift the government's technocratic perspective in pursuit of these adaptive pathways, it leverages it thereby maintaining transaction costs low and government willingness high. By providing context-specific knowledge inputs based off intimate understanding of the social-ecological systems in which the projects will be carried out, WUAs actively participate in water governance decision-making. The government then provides the technical expertise and financial resources needed to effectively carry out the project. Such multi-stakeholder cooperation increases the quality of technical decisions (i.e. social and environmental benefits) and decreases the potential for maladaptation and lock-ins (Pahl-Wostl et al. 2007, Huitema et al. 2016). Such effective collaboration fosters trust, relationship building, and capacity-building among and between stakeholders. As social capital between the multiple levels of stakeholders grows, transaction costs and paternalistic reluctance for self-management decrease. Additionally, such arrangements also serve as a form of experimentation and social learning through management. The combination of increased WUA participation, trust between stakeholders, and multi-level collaboration creates a reflective framework in which stakeholders can identify outcomes of management strategies and systematically learn from them.

3.2 Discussion

The case study of Lombok's water governance paradigm reveals three interconnected points of discussion for adaptive governance literature and practice. First, the collaborative model between MPW and WUAs exposes shortcomings within the prevailing narrative concerning the technological dimensions of adaptive water governance. Adaptive water governance correctly identifies that technology is embedded into a broader context of social behavior and institutional structures (Pahl-Wostl et al. 2005). Much discussion has been given to how these social and institutional factors can or should inform technical outcomes of water management (Pahl-Wostl et al. 2005, Huitema et al. 2009, Lejano and Ingram 2009, Allan et al. 2013, Ananda and Proctor 2013, Halbe et al. 2013, Azhoni et al. 2017). However, scant discussion has been given to the converse direction of this complex dynamic. How technical factors can or should inform social and institutional outcomes is less understood. Examining this dynamic is pertinent given the challenge of rigid structures and contextual constraints that prevent shifts from technocratic water governance to adaptive and integrative governance.

Scholars and practitioners struggle to strike an adequate balance between technical and socially determined framings of water (Allan et al. 2013). The traditional water governance paradigm narrowly defines water management in exclusively technical terms (Pahl-Wostl 2007). This paradigm confines decision-making and authority to technical experts within state institutions that design large-scale command-and-control systems without consideration of broader social and institutional contexts (Pahl-Wostl et al. 2005, Pahl-Wostl 2007). When implemented into these contexts, the systems ossify due to lock-ins related to sunk investments, self-perpetuating organizational behavior, and perceived panaceas (Huitema et al. 2016). The conceptual pillars of adaptive water governance – polycentrism, flexibility, and reflexivity – mark a stark departure from this traditional approach. It argues for a more holistic governance approach that integrates environmental, social, and technological dimensions as well as their interdependence (Pahl-Wostl et al. 2005). This wide conceptual paradigmatic dichotomy leads to a reframing of water management by adaptive governance that often overlooks technological interdependence. In other words, in moving water management from an exclusively technical framing to a more multi-dimensional approach, adaptive water governance often neglects the importance of technological dimensions.

Advocating for more in-depth evaluation of technological dimensions neither supports the technocratic approach of traditional water management nor contradicts the integrative multi-dimensional approach of adaptive water management. Rather, it points to the need for more comprehensive integration of the many complex dimensions of water governance. The process by which WUAs leverage infrastructure development to initiate a process of multi-scale participation, stakeholder collaboration, relationship building, experimentation, and social learning, demonstrates the need for a more integrated reframing of water governance's dimensions.

Second, this case study suggests a decentralized socio-technical approach can lead to pathways for adaptive water governance implementation by striking a balance between top-down and bottom-up strategies. This fits well within the arguments of Allan et al. (2013) and Meijerink and Huitema (2010) that adaptive water governance requires context-specific balancing between top-down and bottom-up strategies. Technology and technical decision-making need not be exclusively large scale command-and-control systems as it has traditionally been, but can be decentralized and bottom-up. Importantly though, although decentralized technology and technical decision-making can act as a fulcrum for adaptive water governance implementation, it does not do so in a vacuum. In this case study, social and institutional dynamics underpinned effective collaboration on the bottom-up initiated infrastructure projects. Only WUAs that reported robust institutional organization also reported effective collaboration. These respondents identified high levels of social capital as the determinant of successful local organization. Intuitively then, it would seem effective

collaboration requires high levels of social capital at the community level. However, high levels of social capital were widely reported among WUAs, yet successful local organization was not. Many WUAs remained incompetent, inactive, or inexistent. This paradox implies effective collaboration between WUAs and MPW did not necessitate robust institutional organization underpinned by social capital.

Further unpacking reveals that the identification of social learning opportunities paralleled the identification of effective collaboration. Rather than robust institutional organization producing effective collaboration, robust institutional organization was produced by the social learning opportunities that emerged from effective collaboration. More simply, the presence of collaborative opportunities catalyzed improved institutional organization through social learning. The collective policy entrepreneurship in the form of bottom-up infrastructure project proposals stimulated top-down involvement and relationship-building between scales. This demonstrates how balancing bottom-up and top-down approaches can lead to adaptive strategies. This also supports the findings of Meijerink and Huitema (2010) that collective policy entrepreneurship can be an important transformative strategy by forging links across various scales.

Third, this case study also suggests transformative strategies, such as the collective policy entrepreneurship discussed above, need not exclusively challenge the status quo, but can transform governance from within it. The WUAs strategy to exploit the government's technocratic perspective not only recognizes contextual constraints, but leverages them to advance policy objectives. Doing so avoids the need to radically alter institutional arrangements and counter path dependencies thereby keeping transaction costs low and increasingly the likelihood of achieving policy goals. This strategy can potentially lead to a productive balancing of incremental and transformative strategies. In the case of WUA-MPW collaboration, tackling proximate drivers of vulnerability through the incremental strategy of infrastructure opened pathways to tackle systemic drivers of vulnerability by creating residual opportunities for social learning, collaboration, and integration.

However, as demonstrated by this case study, without the collective policy entrepreneurship from local stakeholders, government agencies would continue to prioritize incremental strategies. If bottom-up participation isn't present or is present without adaptive objectives, it risks the traditional challenges of technocracy (i.e., narrow framing, path dependencies, etc.). Despite this, it is still important to exploit the policy opportunity presented, particularly in developing contexts where adaptation strategies must also deliver development benefits (Lee 1999, Huitema 2009, Butler et al. 2014, Wise et al. 2014, Azhoni et al. 2017). Therefore, context-specific balancing of top-down and bottom-up strategies is required to balance incremental and transformative strategies.

5. Conclusion

This paper broadens the understanding of the dynamic interconnection between contextual conditions and adaptive water governance. The objective in doing so was to expound how to better translate theoretical prescriptions of adaptive water governance into practical planning and sustained implementation. To do so, a case-specific water governance paradigm in Lombok, Indonesia was examined through document analysis, field group discussions, and in-depth semi-structured interviews. These interviews encouraged stakeholder participatory evaluation of contextual challenges, systemic strengths, and adaptive pathways thereby fostering greater external validity, enhanced selection of indicators, organizational learning, and participation of underrepresented stakeholders. The paradigm elicited was then unpacked and analyzed to articulate adaptive pathways and strategies to facilitate adaptive governance implementation.

Lombok's water governance system exhibited both a need for adaptive governance and inflexible contextual constraints that hamper a transition toward it. Despite this, it

revealed an innovative pathway toward adaptive water governance. A decentralized approach to technical decision-making can act as a fulcrum on which adaptive water governance strategies are successfully implemented. In Lombok, local water user associations applied this strategy by recognizing contextual constraints and leveraging them to produce policy opportunities for local participation, stakeholder collaboration, social learning, and capacity-building. These findings underscore shortcomings in the prevailing narrative concerning the interconnection between technological and social dimensions of water governance. The wide conceptual dichotomy between traditional and adaptive paradigms of water governance lead to an unbalanced framing of water. As a result, adaptive water governance correctly examines how social and institutional factors can or should affect technical outcomes of water management, but insufficiently discusses the converse dynamic. This points to the need for further research to understanding of how technical factors and processes can affect social and institutional governance outcomes.

This case study begins to do so by unpacking the decentralized socio-technical approach presented. It suggests this approach can serve as a context-tailored transformative strategy that balances top-down and bottom-up approaches. Rather than radically counter contextual constraints and path dependencies, this strategy exploits them as policy opportunities to achieve governance objectives. Doing so is more likely to overcome the traditional challenges of entrenched interests, high transaction costs, and institutional inertia. Exploiting the prioritization of incremental strategies to achieve adaptive policy objectives produced a balance of proximate development benefits and residual transformative opportunities. In developing contexts such as Lombok, striking such a balance is essential to concerted and sustained adaptive governance implementation.

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Characterization of Rice Husk and Wood Biochars and Their Effect on Soil Chemical and Agronomic Properties of Lettuce (*Lactuca sativa* L.)

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Abstract

A field experiment was conducted to characterized the properties of rice husk biochar (RHB) and wood biochar (WB); and to investigate their effect on the soil chemical and agronomic properties of lettuce. The study employing a Randomized Complate Block Design (RCBD) in the pattern of factorial, which consisted of two factors. The first factor was two types of biochar, namely: rice husks biochar (B1), wood biochar (B2), and the second factor was anorganic NPK fertilizer (F) at four different rates of 0, 100, 200 and 300 kg ha^{-1}, respectively. Both of these factors were combained so that 8 combination treatments were obtained. Each treatment repeated three times. Data collected were analysed statisticly by using analysis of variance at 5% level and significant treatments effect were separated with honestly significant difference at $P \leq 0.05$. The results show that there were no interaction between biochar types and fertilizers rates on soil chemical and agronomic properties. Dealing with the soil chemical properties, the characteristics of RHB and WB did not affect the soil pH, organic carbon, except for phosphorous (P) availability in soil. Meanwhile, anorganic NPK fertilizers (F) application increased all the soil chemical properties were tested. In addition, agronomic properties indicated that application of anorganic NPK fertilizers increased the plant weight by increasing the plant height, leaf numbers and leaf area of lettuce.

Keywords: rice husk, wood, biochar, lettuce, soil and agronomic properties

1. Introduction

Lettuce (*Lactuca sativa* L.) is the most commonly used salad vegetable, cultivated since 4500 BC in the Mediterranean, and today, also cultivated in North America, West Europe and Australia (Marchi *et al.*, 2015). There are many types exist, which is varying in form, size leaf shape, colour and taste. Most of these plant which are consumed as raw leaves, and also be used to make soup as part of the filling for sandwiches, or as wrap for holding cooked meat and vegetable mixed. As a green vegetable, lettuce is a sources of nutrients which are highly required for health, include vitamins, minerals, water and fiber, which are highly required for human health, but essentially no protein or fat. In general, leaves contain Vitamin A 1,900 IU, Vitamin C 18 g; minerals such as Ca 68 g. P 25 g, Fe 14 g and Na 9 g ; water 94-95% and fibber 0,7 g. In addition, lettuce contains lactocin and lactucopicrin that can be improved sleep. Morepver, lettuce also contain antioxidants, the compounds inhibit the formation of carcinogenic substances in the body (Rubatzky and Yamaguchi, 1997).

Lettuce can be grown well in fertile soil that contain organic matter. However, in West Nusa Tenggara, lettuce or vegetable crops in general are mainly grown in sandy soil with very low in production due to the low soil fertility such as low in macro and micro nutrients, low in carbon organic content with less than 1%, low in cation exchange capacity (CEC), poor soil aggregate, decreasing soil bulk density and also low in water and nutrients retention (Mulyati *et al*., 2014b). Therefore, to overcome this constraints, there are several ways can be done to improve the soil quality and increase the lettuce production.

Studies on the use of organic materials become important as the price of fertilizers is increasing. Rice husks, wood/twigs, cocconut shells, tobacco stems, manure and other crop residues are regarded as agricultural waste, recently have been transformed into

biochar for the purpose of carbon sequestration. Biochar is commonly defined as charred organic matter, which is rich in carbon material and obtained from the agriculture waste under the limited oxygen condition, which refer to a solid product that derived from biomass pyrolysis (Lehmann, 2007). Rice husk contains a high content of silicon and potassium, nutrients which have great potential for amending soil, while those with a relatively higher carbon content (e.g. wood or nut shells) are currently used for the production of activated carbon.

The use of biochar can be sustained soil organic carbon sequestration that would improve the soil quality, because biochar is a stable substances and has the longterm effect (Glaser *et al.*, 2002). It possibly due to that biochar contains an aromatic structure, hence it is physically, chemically and biologically more stable in soil and would be resistant to decompose for hundred to thousand years (Woolf, 2008). Moreover, Chan *et al.* (2008) reported that adding biochar into the soil would change the soil physical and chemical properties of soil (Lehman, 2009).

Previous study has shown that incorporation of biochar can be used as soil amendment and significantly improve the soil properties by enchancing soil nutrients availability, soil pH, organic carbon which lead to increase the soil quality (Steiner *et al.*, 2008; Mulyati *et al.*, 2014a).

Research has shown the use of rice husks in the field has been practiced for some timeand incorporation of rice husks can significantly improve soil properties by decreasing soil bulk density, enhancing soil pH, adding organic carbon, increasing available nutrients and removing heavy metals from the system, ultimately increasing crop yields (Williams *et al*., 1972). In addition, studies on soybean and maize have also supported the application of biochar as a way to increase crop yields (Yamato *et al*., 2006). Asia, a principal rice growing region, has abundant rice residues such as rice husk estimated at about 112 million tons of rice husks. Therefore, these residues could be a valuable resource for the production of biochar to improve soil fertility and soil quality.

Carbonized (*incompletely burned*) rice husk consist of a very light material and this carbonization process also can increase the organic carbon, water holding capacity (WHC). In addition the farmers practice of burning rice straw in the field showed that the black carbon from rice burned residues would be an important source of organic material in rice field (Schmidt and Noavk, 2000). The effects of biochar application may vary from soil to soil and crop to crop. So that there is a need to find out the change of soil chemical properties and agronomic properties of of lettuce.

Therefore, this study addresses to examined the effects of rice husk (RHB) and wood (WB) biochars application on the growth of lettuce yield ; and also to evaluate the effects of biochars on the soil chemical properties change during lettuce growth.

2. Materials and Methods

2.1. Experimental Design

A field experiment trial was conducted in Mataram, Lombok Indonesia, from June to August 2017. The design was a Completely Randomized Block Design (CRBD), with consisted of two factors under two different biochars type namely :

B1 = Rice Husk

B2 = wood

Each pot was treated by the same level of biochar (10 kg ha^{-1}) and the second factors was anorganic fertilizers (Phonska =P) rates, which consisted of four rates were as follow :

F0 = without NPK fertilizer

F1 = 100 kg urea ha^{-1}

F2 = 200 kg urea ha^{-1}

F3 = 300 kg urea ha^{-1}

Both of these factors were combined, and obtained 8 treatment combinations. Each treatment combination comprised of three replications, so that 24 plots were obtained. Pots were arranged in a factorial completely randomized design (CRD).

2.2. Biochar Preparation

Organic materials from agriculturial waste were produced from Rice Husk (RHB) and Wood (WB). Woods were chopped into small size, and pyrolysized using a small scale of modified drum at 300-350 °C for 3 hours. Afterward, the carbonized of RHB and WB are extinguished by pouring water to cooling down the biochar (Figure 1). Then, air dry for 3 days and sieve them with 2 mm in diameter. Several analysis for biochar, including pH, CEC, Organic Carbon, total-N, total-P and also total-K.

Figure 1. Biochars process from agricultural waste (fresh rice husk and wood)

2.3. Soil Analysis

Soil samples were collected from 0 -20 cm horizon on Ustipsamment Lombok (USDA, 1998), which typically used for growing vegetable. Sampling were taken after the soil tillage or before applying fertilizers and biochar, then air dried for 3 days and sieved by 0.5 mm in diameter. Soil analysis including Texture, soil pH, organic-C, CEC, total nitrogen, available-P, and exchangeable-K.

2.4. Variable Test

Variable tested were carried out for agronomics and soil properties. Agronomic variables measured were plant height from day 7 until 35 days after transplanting, number of leaf, leaf area, shoor fresh and dry weight and also root fresh and dry weight. The method for soil analysis were pH measured by pH meter, organic-C by Walkley and Black, total-N by Kjeldahl method, available-P was extracted by using Bray I and exchangeable-K by Morgan Wolf method. The data collected were analyzed statistically using the analysis of variance (ANOVA) and the significant difference among the treatments was tested by Honestly significant difference ($P \leq 0.05$) using MINITAB program.

3. Results and Discussion

3.1. Initial Soil properties

Soil that used in this experiment was analyse in the Laboratory of Department of Research and Development Agriculture Technology (BPTP) West Nusa Tenggara. The initial soil properties were as indicated in Table 1.

Table 1. Initial Soil Analysis

Variables	Methed	Values	Chriterium
Texture Sand (%) Silt(%) Clay (%)	Sedimentation	 56,67 32,67 10,66	 Sandy Loam**
pH- H_2O	pH metre	5,82	Acid
Organic-C (%)	Walkley & Black	1,04	Low
Total-N (%)	Kjedahl	0,07	Low
C/N ratio	-	10,2	Mederate
Total-P (%)	Spectrophotometre	0,21	Moderate
Available-P (ppm)	Bray I	20,58	Low
Total-K (%)	AAS	0,54	High
Exchengeable-K (ppm)	Morgan Wolf	42,85	High
KTK (cmol kg^{-1})	Ammonium Acetat at pH 7.0	18,18	Low

Note : * Soil Research Centre (1983)
**United Stated Department of America (USDA) 1998

From the Table 1. above, it can be seen that soil that used in this experiment had low soil fertility, with sandy loam texture with 56.7% sand, 32,7% silt and 10.7% clay. Soil pH was 5.82, low in organic-C (1.04%), CEC 18.18 cmol kg^{-1} and also low in soil nutrients content especially total-N and available-P, but high in exchangeable-K. Possibly, it due to the parent materials of soil derived from volcanic materials which contain abundance of potassium. Therefore, by adding biochar into the soil would be improved the soil fertility. Lehmann and Joseph (2009) reported that when biochar adding to the soil, it may improve the soil properties which would increase the nutrient supply to the plant. From the data above, it seemed that total-P was moderate and total- K was high.

4.2. Characteristics of Biochar

Biochars used in this study were produced from rice husk and wood. The characteristics and the amount of mineral nutrients produced would be different depend on the plant species or plant part that was combusted, that lead to influence the soil properties and plant growth and nutrient uptake by plant (Demeyer *et al.,* 2001). The result of biochar analysis as shown below in Table 2.

Tabel 2. The Characteristics of Rice Husk and Wood Biochars

Variable	Analysis Method	Biochar Types	
		Rice Husk	Wood
pH-H_2O	pH metre	8,18	8,07
Organic-C (%)	Dry ashing	29,34	52,44
KTK (cmol kg^{-1})	Percolation	21,18	16,78
Total - N (%)	Kjeldahl	0,65	0,50
C/N ratio	-	45,14	104,88
Total - P (%)	Spectrophotometre	0,9	1,9
Total - K (%)	AAS	1,85	2,07

As can be seen in Table 2, the characteristics of RHB and WB had very high in organic-C, total-N, P and K also were very high. This characteristics of biochars would increased the soil productivity including soil physical, chemical and biological, and should be maintained the sustainable agriculture production. Therefore, there were important implications to improve the soil quality. In this study, both biochar tested were slightly alkaline. Numerous studies have shown that biochar application are important as a soil amendment (Lehman and Joseph, 2009 ; Mulyati *et al.*, 2014a).

4.3. Effect of Biochars and NPK Fertilizers in Soil Properties

Numerous studies have indicated that biochars application to soils may not only change its physical properties, such as soil aggregation and water holding capacity (WHC) and decreased the soil strength; but also would affect the chemical, such as increase the soil pH, cation exchange capacity (CEC), organic carbon total-N and others nutrients status in the soil and biological (Glaser *et al.*, 2002; Chan *et al.*, 2007 ; Mulyati *et al*., 2014b). In addition, Mulyati *et al* (2014b) reported that using biochars have decreased N fertilizer requirement in maize due to that the role of biochars in water and nutrients retention. Results in Table 4 showed that biochars application (RHB and WB) to sandy loam soil did not significantly affect the nutrients status N, P and K. However, by adding anorganic fertilizer NPK had a significantly affect the total N and available P but not for exchangeable K.

Table 4. Effects of biochar and anorganic fertilizers NPK application nutrients status on the soil after harvesting

Treatment	Soil Nutrients Status		
	Total-N (%)	Available P (ppm)	Exchengeable (cmol kg^{-1})
F0	0,082 a	6,25 a	6,64 a
F1	0,080 a	7,85 a	7,09 a
F2	0,108 b	17,19 b	8,69 a
F3	0,101 b	21,68 c	10,18 a
HSD (5%)	0,016	0,56	-
B1	0.11 a	12.95 a	8.10 a
B2	0.08 a	13.54 a	8.20 a
HSD (5%)	-	-	-

Note : Means followed by the same letter in the same columm are not significantly different by HSD test at 5%.

Table 4 have shown that application of biochars were not a significant different on soil nutrient status. It can be seen that RHB tended to have higher total N compared to WB, and WB had slightly higher in available P and exchangeable K content. The analysis of variance showed that N and P status affected by an-organic fertilizers and not for K.

4.4. Effect of biochar in Agronomic Properties

Lettuce growth characteristics were modified according to the biochar and fertilizers application. The analysis of variance showed that lettuce height data were affected significantly by application of biochars and anorganic fertilizers (Figure 2). Other agronomic

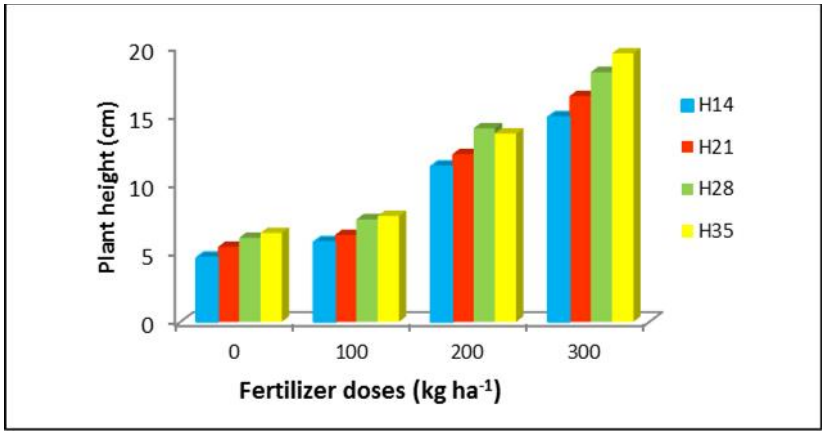

Figure 2. The effect of anorganic fertilizer doses on plant height (cm)

properties of lettuce such as number of leaves, shoot commercial fresh weight and shoot dry weight were affected significantly anorganic fertilizer doses, while application of did not affect the plant growth. From this figure indicated that anorganic fertilizers increased plant height compared to without anorganic fertilizers (Figure 2). The highest plant height was achieved in application of 300 kg ha^{-1} anorganic fertilizers, but did not show a significant different with 200 kg ha^{-1} and the lowest in treatment without anorganic fertilizers. It was indicated that 200 kg ha^{-1} have sufficiently to support plant height, and by increasing the dose of anorganic fertilizers did not significant improve the plant height. Regarding to the number of leaves 300 kg ha^{-1} anorganic fertilizers application resulted in increased the number of leaves (Figure 3).

Application of anorganic fertilizers resulted in the highest of number of leaves. This number of leaves was significantly correlated to the shoot commercial fresh and dry weight of lettuce, which are important characteristics for consumers. Morover, the increase of leaf

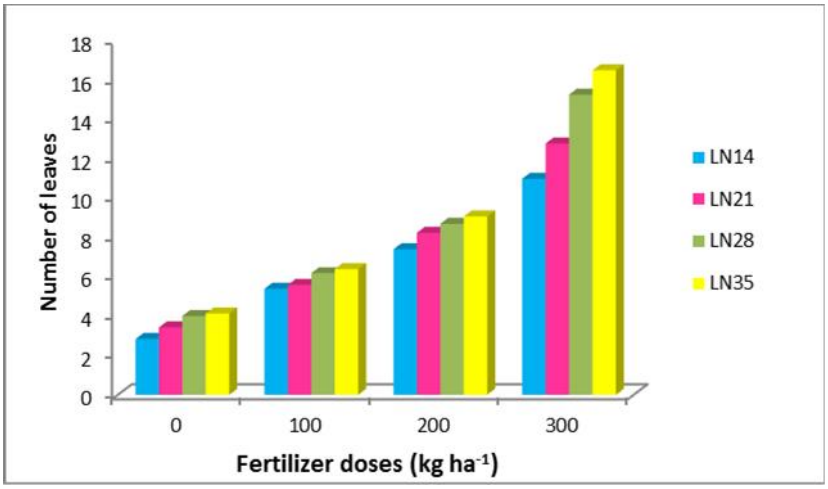

Figure 3. The effect of anorganic fertilizers doses on number of leaves

number following by the wide of leaf area would increase the biomass production of lettuce (Table 5). Data of shoot fresh and dry weight were affected significantly only with fertilizers application, while there were no significant different in root fresh weight and dry weight as affected by biochars and anorganic fertilizers. fertilizers doses did not show significant different on the leaf area (Table 5).

Table 5. The effect of biochars and anorganic fertilizer on several agronomic properties

Treatments	Agronomic Properties				
	Leaf area (cm^2)	SFW (g $plant^{-1}$)	SDW (g $plant^{-1}$)	RFW (g $plant^{-1}$)	RDW (g $plant^{-1}$)
F0	137.01 a	60.75 a	3.98 a	10.31 a	1.30 a
F1	161.38 ab	84.93 b	4.94 b	10.48 a	1.37 a
F2	177.92 b	116.65 c	7.27 c	10.63 a	1.42 a
F3	178.30 b	123.52 c	7.16 c	10.69 a	1.43 a
HSD (5%)	30.66	19.85	0.37	-	-
B1	160.03 a	91.45 a	5.73 a	10.55 a	1.39 a
B2	167.28 a	101.48 a	5.95 a	10.52 a	1.37 a
HSD (5%)	-	-	-	-	-

Note : SFW = shoot fresh weight ; SDW=shoot dry weight ; RFW = root fresh weight ; RDW = root dry weight. Means followed by the same letter in the same columm are not significantly different by HSD test at 5%.

The highest number of leaves was obtained in application of 300 kg ha^{-1} NPK and the lowest number of leaves was found at control or treatment without fertilizers added. The similar results obtained for shoot fresh and dry weights of lettuce. Without fertilizers adding had the lowest weight compared to the high fertilizers adding. There was no significant different on the increase the fertilizers from 0 to 100 kg ha^{-1}, but when the dose of fertilizers added to 200 kg ha^{-1} the leaf area increased significantly, Morover, by added fertlilizers to 300 kg ha^{-1} did not affect the leaf area, shoot fresh and dry weight. The wider the leaf area the higher the weight of shoot. The highest shoot commercial fresh weight achieve application of 300 kg ha^{-1} anorganic fertilizer and the lowest obtained in treatment without fertilizer. However, by adding 200 and 300 kg ha^{-1} anorganic fertilizer did not affect the shoot fresh weight, hence 200 kg ha^{-1} would be suffiecient rate for supporting lettuce growth. Eventhough biochar application had no significant effect on the agronomic properties of lettuce but WB tended to have better growth for lettuce gorw. In relation to root fresh and dry weight, analysis of variance did not affected statisticaly by the treatments.

4. Conclusions

1. The characteristic of rice husk and wood biochars vary substantially according to the typy of agricultural wastes.
2. Biochar application did not affect soil nutrient status including total N, available P and exchangeable K, but anorganic fertilizer had a significant effect on soil jutrient status. Hence, it would improve the soil quality.
3. Application of biochar and anorganic fertilizer also increased the agronomic properties of lettuce namely biomass production by increasing the number of leaves and leaf area of lettuce.

   Based on the conclusion above, it can be concluded that further research need to be done to investigate the residual effects for the next cropping.

Acknowledgement

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Seagrass Ecosystems Monitoring as Related to Coral Reef in Coastal Waters of Sekotong, West Lombok, Indonesia

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Abstract

Coastal waters of Sekotong West Lombok is one of the coastal waters of Indonesia that is set in monitoring the health of coral reefs. However, the sustainability of coral reefs from ecological aspects is influenced by the preservation of other ecosystems, such as seagrass ecosystems. In this case, seagrass monitoring has been conducted in 2015 and 2016. Seagrass monitoring method uses transect and quadratic methods. The results of the monitoring of the entire station was found six species are *EnhalusEnhalus* (Ea), *Thalassiahemprichii* (Th), *Cymodocearotundata* (Cr), *Halodulepinifolia* (Hp), *Halophilaovalis* (Ho), and *Syringodiumisoetifolium* (Si). Abundance of seagrasses has not changed much from 26.58% (2015) to 26.10% (2016). However, in *T. hemprichii* decreased 3.88%, while *E. acoroides* increased 3.23%. Another parameter is an indicator of the value of seagrass cover and has been a decline of seagrass cover occurs in SKTS06 and SKTS10 stations, ie 17.89% and 15.32%. The decline in abundance and covering of value*T. hemprichii* and closing of seagrass was an indicator has been damage to the seagrass. This condition can have a negative impact on the health of coral reefs in the coastal waters of West Lombok. In this case the prevention of damage to seagrass is a very important action to ensure the sustainability of coral reefs and marine life in the coastal waters of West Lombok.

Keywords: Monitoring of Seagrass, Seagrass Abundance and Seagrass cover

1. Introduction

Seagrass is a flowering plant that has adapted to the marine environment, with indicators: (1) seagrass can live in salt water (2) able to function normally in submerged circumstances (3) has a well-developed root systemand (4) capable of pollination and generative cycle in submerged seawater. (Waycott et al. 2007; Marlin, 2011). The geographical distribution of seagrasses has been grouped into two bioregions, namely: (1) bioregion temperate (2) bioregion tropis, andseagrasses in the coastal waters of Indonesia are in the Indo-Pacific bioregion (Waycott et al., 2007)**.** Seagrass has a function as a sediment stabilizer, maintaining clarity of water and holding mud through the river or in other words calledrun-off,primary productivity, shelter, and food chain builders in the marine environment (Thom dan Long, 2001; Nienhuis et al., 2002; Jones et al., 2006), and some other marine biota associated with seagrass such as mollusk, shrimp, crab and sea cucumbers (Tsukamoto et al., 1997).

Tropical marine ecosystems, including mangroves and seagrasses that provide significant economic goods and services and contribute to the livelihoods, food security and safety of millions of people around the world (Conservation International, 2008) and segarss habitat a very important nursery function and implies that the densities of several fish species on coral reefs and degradation or loss of these habitats could have significant impacts on reef-fish stocks in the Caribbean (Nagelkerken et al., 200; Nagelkerken, et al., 2002). Moreover, over 20% of commercial fish species used multiple habitats, highlighting the importance of including different habitat types within marine protected areas to achieve efficient and effective resource management (Honda et al., 2013).

Seagrass is very important in marine ecosystems, its existence is threatened by increased population activity in coastal areas such as port development,transfer of land into industrial area and utilization of seagrass area that tends not environmentally friendly (Dahuri

2003), and has had an impact on the decrease in the area of seagrass ranging from squared meters to hundreds of square kilometers (Willams et al., 2006). In addition, other threats are storms, volcanic activity and global warming (Neckless and Frederick 1999). The continued destruction of seagrass to facilitate development will see a decline in biodiversity, increase incoastal erosion and storm impacts. Therefore, it is important that we protect and conserve what is left of these threatened ecosystems to ensure continued health and sustainability of our coastline and marine resources.

Seagrass and coral reefs in the marine environment, structurally and functionally constitute a unified system of marine ecological systems.This can be seen from the tyipes of interaction between seagraas and coral reef are physical, nutrients,disolved organic matter, particulate organic matter, animal migration and human impact (Thomascik et al, 1997). Therefore, the value of seagrass existence in the marine environment is very important for coral reef health and the sustainability of marine biota using two habitats ie seagrass and coral reefs, so the selection of indicators is conceptually key factor as a tool in conducting monitoring and evaluation (Thom et al. 2001).

In addition, the abundance of seagrass and environmental conditions such as topography, nutrients and sedimentary compositions may form the basis for investigation of interconnected species interactions on a temporal scale, such as between seagrass beds and other ecosystems such as coral reefs in the tropics and ecological indicators of ecosystem structures and compositions can be used to monitor conservation areas (Izumi and Mashiro, 2000; Beyeler and Virginia, 2001). Coral reef health monitoring programs and related ecosystems (seagrass and mangrove forests) in the Nusa Tenggara Barat region are conducted outside conservation areas. Monitoring of seagrass beds in coastal waters of Sekotong Lombok Barat has been conducted from 2015 - 2016. This activity aims to assess community activities on seagrass and mangrove ecosystems that can have a negative impact on the health of coral reefs. The aspects of seagrass monitoring that are the focus of this paper include species diversity and seagrass cover percentage.

2. Materials and Methods

Monitoring of coral reefs and related ecosystems in Kecamayan Sekotong West Lombok is conducted for six months from July to December 2016. The monitoring sites are located in small islands of Sekotong Bay West Lombok, namely Gili Gede, Gili Asahan, Gili Layar, Gili Rengit, Gili Anyaran and some coastal villages in Sekotong sub-district such as Pewaringan and Lenggolong villages, which are part of the mainland of Lombok Island (Figure

1).

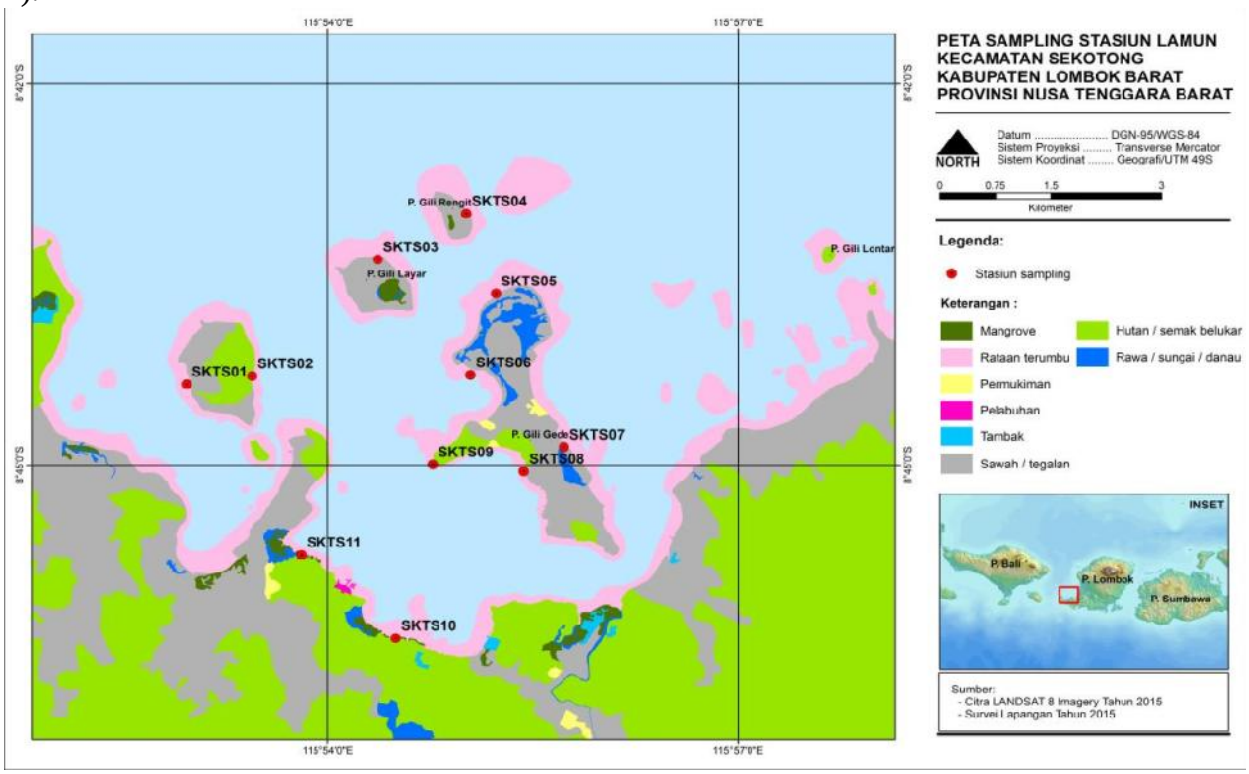

Figure 1. Research Location

The monitoring method used in accordance with the Seagrass Monitoring guide book from the COREMAP-CTI program (Rahmawati, at al., 2014). Seagrass monitoring method uses square transects that are perpendicular to the coastline. Three transect lines (100 m) with each transect spacing 50 m. However, at some locations, the transect distance is adjusted to the width of the seagrass community.The main parameters measured were the diversity of seagrass species and the percentage of seagrass cover in the 50 x 50 cm square. Data were analyzed by using simple descriptive statistics and multivariat, done to see the multi-variable relationship of location (station) and time. The multivariate test used is station groupingand inter-time based on Bray-Curtis analysis of similarities. The data used for the similarity analysis are data of abundance and presence cover of seagrass. Abundance data is more complete in showing similarities than attendance data.

3. Results and Discussion

The number of seagrass species at each location is an indicator of seagrass potential and the number of seagrass species in Indonesian coastal waters is 12 species (Fortes, 1994). In the coastal waters of Lombok Island the number of species of seagrass such as on the east coast lombok 9 species (Syukur et al., 2012) and at the Kute Bay of Central Lombok 8 species (Kiswara *et al*.,1994). Diversity of seagrass species at the study site (Figure 2) lower than the number of seagrass species in several locations in Indonesian waters. In this case, the diversity of seagrass species at a site is strongly influenced by some environmental factors as a limiting factor, such as carbon, temperature, light, salinity, water transfer, nutrient and substrate (Alongi, 2000; Dahuri 2003). However, the light level is not a major factor as the distribution barrier of *Halophila decipiens* in the intertidal region (Koch and Sven, 1996), but the reduction of light on the seagrass can indirectly affect the rate of sulfate reduction and impact on seagrass metabolism (Carlos et al., 2006).

Survey results at all monitoring stations show changes in seagrass community composition in Sekotong. The species diversity remains the same as the previous year, which

is 6 species, consisting of *Enhalusacoroides* (Ea), *Thalassiahemprichii (Th), Cymodocearotundata (Cr), Halodulepinifolia (Hp), Halophilaovalis (Ho), and Syringodiumisoetifolium (Si)* (Figure 2). The abundance of seagrass in general is also not changed much, ie 26.58% (2015) and 26.10% (2016).The proportion of abundance of some species is changing. The community composition experienced slight changes in *T. hemprichii* seagrass which decreased by 3.88% and the seagrass of *E. acoroides* increased by 3.23%.

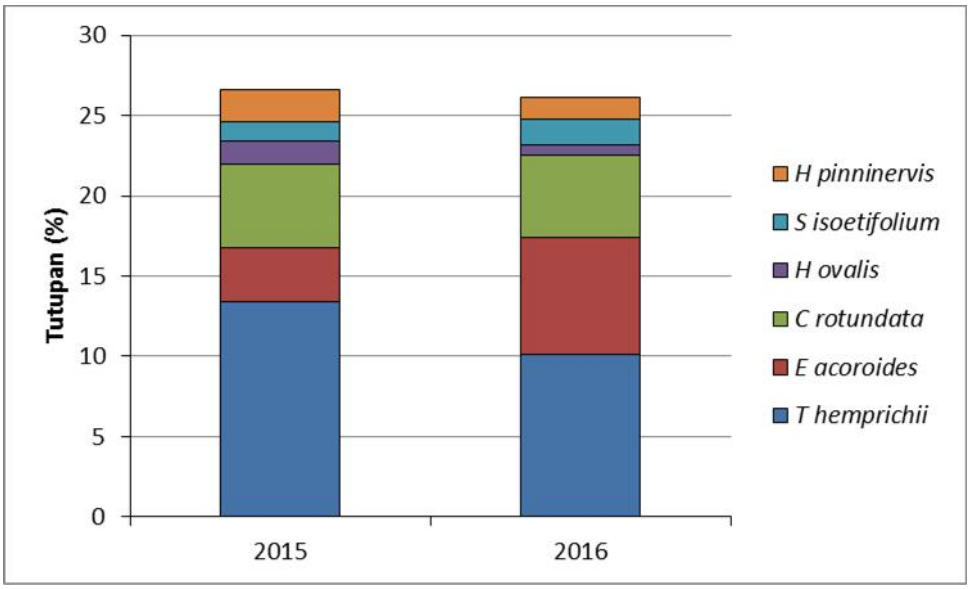

Figure 2. Changes in seagrass cover in a year in Sekotong Bay, West Lombok

Monitoring of the seagrass in the research location for two years with restricted indicator (ex: species diversity, density) compare with standart of monitoring as indicators of potential changes in coastal conditions: 1): total (above-, and below ground) community biomass (seagrasses and algae), 2) relative dominance (above-ground biomass seagrass/above-ground community biomass) of faster-growing seagrasses (classified as "other seagrasses", 3) relative dominance of faster growing fleshy algae, 4) above-ground biomass relative to total biomass of the seagrasses (the most abundant seagrass), 5) productivity of seagrass and 6) shoot density (van Tussenbroek et al., 2014) and the criteria for the classification did not include all relevant parameters that determine seagrass development, in the higher standing crops may be expected at sites with relief and considerable rainfall that supply nutrients for the development of larger plants (Zieman et al., 1997). Although, the results of seagrass monitoring (Figure 3) criteria used by the community are limited, it can be the basis for monitoring changes in seagrass conditions and other ecosystem health protection at study sites such as coral reef ecosystems. Where other studies stress the importance of th e seagrass canopy for shoreline protection, our study on open, low-blomass and heavily grazed seagrass beds strongly suggests th at below ground biomass also has a major effect on the immobilization of sediment (Christianen et al., 2013) and the ecosystem service is expected to becom e even more important in the near future, as storm frequencies are expected to increase and natural coastal protection structures like reefs are under on-going degradation (Hoegh-Guldberg et al., 2007).

Seagrass distribution is almost evenly distributed across observation stations, but there are a number of important changes between the two monitoring years. The change occurs because of the absence of several species from the habitat being sampled (Figure 3). In 2015, *T. hemprichii* and *C. rotundata* are found in all stations. By 2016, *T. hemprichii* are not found at SKTS10 stations and in very small abundance (0.19%) in SKTS11. The abundance of *C. rotundata*fell to very little (0.19%) in SKTS10. Besides that there are two other species of

seagrass that are not found from two different stations. *S. isoetifolium* is not found from SKTS08 and *H. pinnifolia* is not found from SKTS10. It is also on *H. Ovalis* not found in SKTS07, SKTS08 and SKTS10 stations.

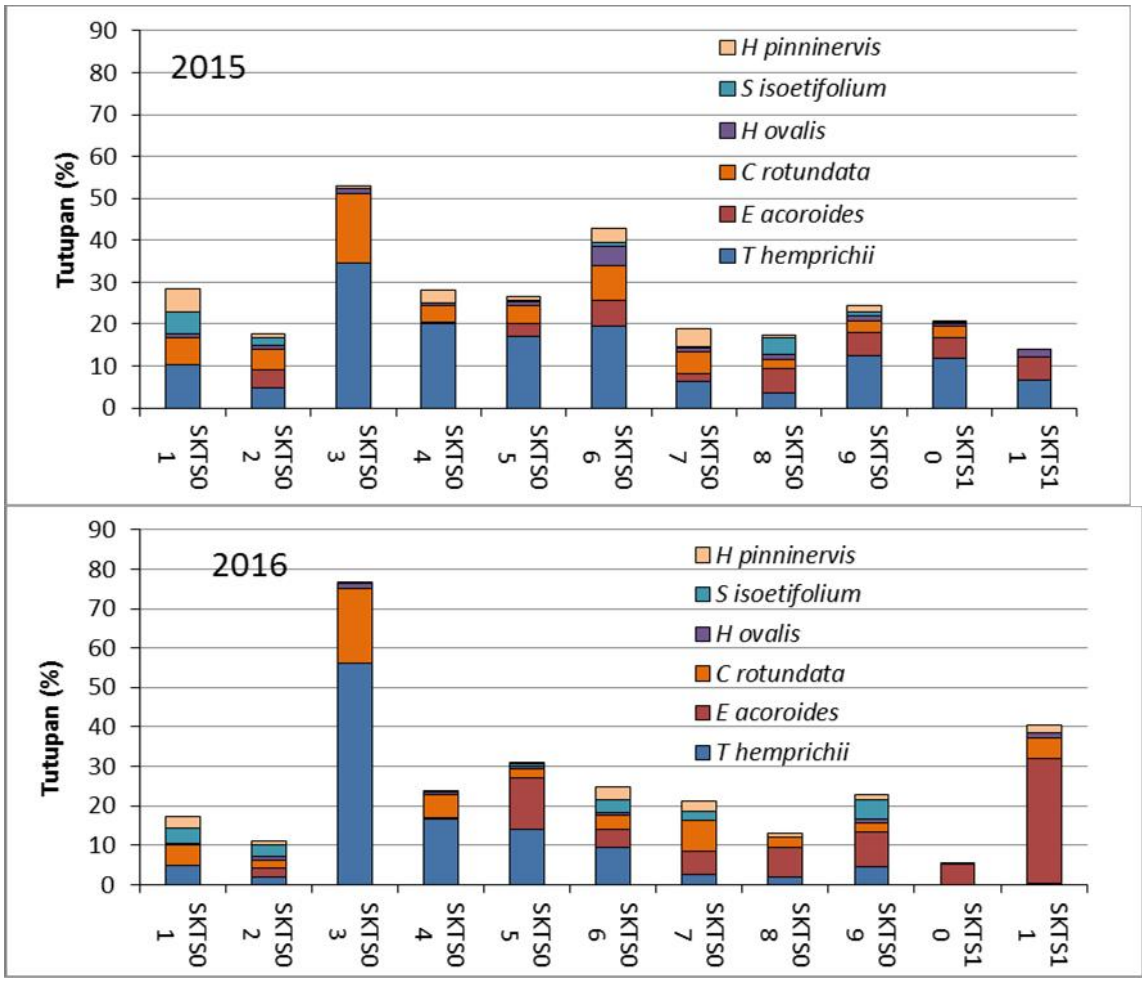

Figure 3. Changes in seagrass cover composition at each Sekotong Bay station

Within a year, in general seagrass cover in each station is relatively constant. The biggest changes occurred at SKTS03 and SKTS11 stations, which increased respectively seagrass increments respectively by 23.80% and 28.03% (Figure 4).The large seagrass cover decrease occurred at SKTS06 and SKTS10 stations, respectively decreasing 17.89% and 15.32%. Changes below 10% are considered meaningless because the standard deviation of each station is between 5-34%. SKTS03 station located on Gili Layar has the highest closing percentage that is equal to 76,83 ± 30,05%.While the lowest seagrass cover was recorded at SKTS11 station in Lenggolong Village. The highest percentage of closure at Gili Layar station and the lowest in Lenggolong Village station was also recorded in the previous year's survey which was in 2015. The lowest seagrass closure located at Lenggolong Village station was due to the very thick muddy substrate due to its proximity to the dense mangrove, thus only certain seagrass species that can grow under these conditions are *E. Acoroides*.

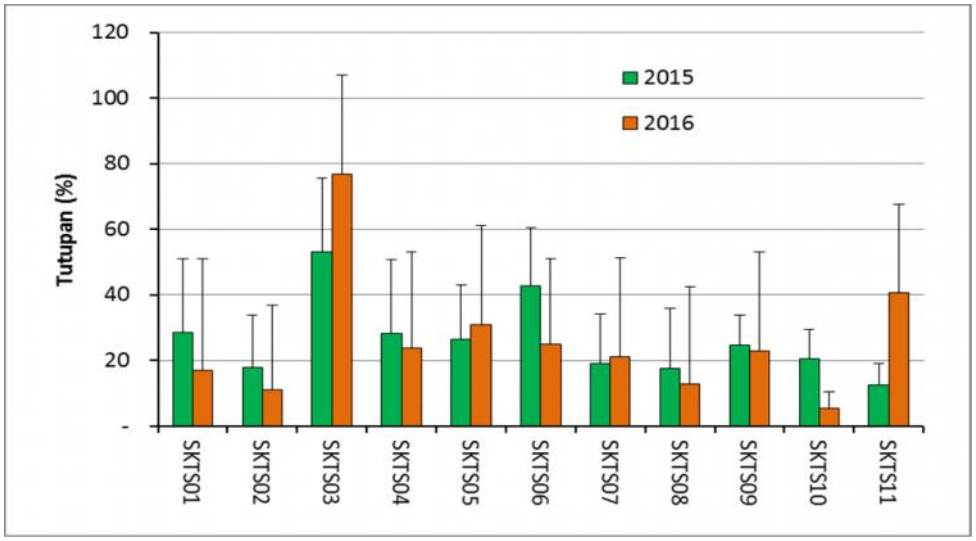

Figure 4. Changes in the percentage of seagrass cover at each Sekotong Bay station

The similarity analysis of seagrass communities in 2015 and 2016 based on the Bray-Curtis method resulted in the dendrogram as presented in Figure 5. The change of seagrass community in Sekotong Bay in the past year can be categorized into small changes (difference of 20%), moderate change (difference 20-40 %) and major changes (difference> 40%). Small community changes occurred at SKTS01, SKTS02, SKTS03, SKTS04 and SKTS05 stations. Changes are taking place on SKTS06, SKTS07, SKTS08 and SKTS09 stations.

The last two stations SKTS10 and SKTS11 are undergoing major changes, so the 2015 and 2016 community similarities are below 60%, or the difference is over 40%. The results of this similarity analysis relate to the location of the observation station. The slightly altered station is located on the outer side of the bay, a medium-changing station located in the mid-bay waters, while the most changing station is inside the bay, on the island of Lombok. The changing pattern of the seagrass community is related to the intensity of human activities in exploiting seagrass resources when the tides are low.

Observations of Enhalus acoroides did not find any particular pattern. The average density of *E. acoroides* was recorded at 2 stands per square meter (2 stands / m^2). This is because the seagrass is not present in all stations, for example SKTS01 and SKTS03 stations are not found in *E. acoroides* seagrass. The amount of seaweed E. acoroides is low in almost all stations. The number of stands of *E. acoroides* is relatively higher only at SKTS10 station which is 9 stands / m^2. The low number of *E. acoroides* stands was also recorded in the 2015 survey.

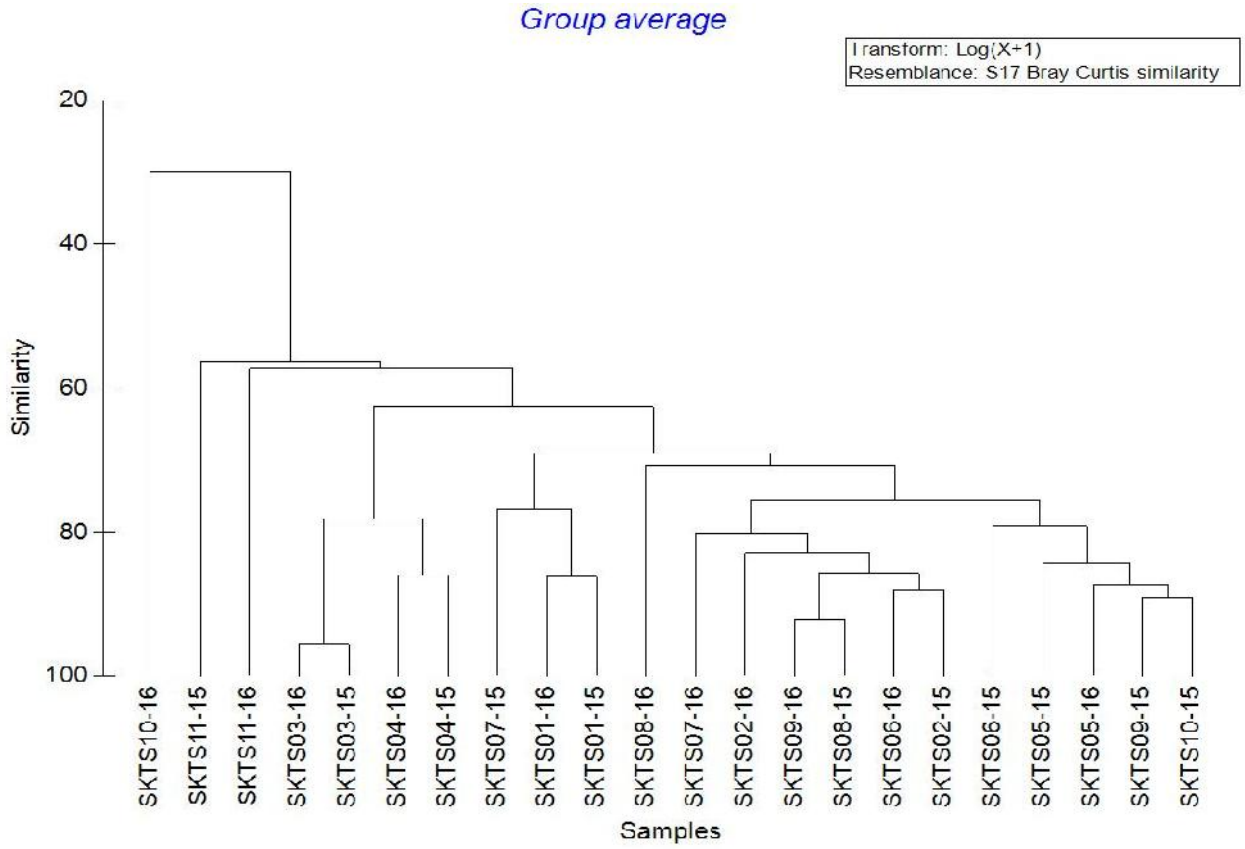

Figure 5.Dendogram analysis of Bray-Curtis resemblance to the abundance of seagrass communities in 2015 and 2016 results.

4. Conclusion

The seagrass community in Sekotong Bay has not changed much. The diversity of seagrass species is the same as the previous year. Changes in the number of species occur at the station level, which is thought to be due to a quadratic squared shift. Seagrass cover increased in 2 stations and decreased at 2 stations.

Acknowledgements

The authors are thankful to the Center for Oceanographic Research (P2O) Indonesian Institute of Sciences (LIPI) and COREMAP-CTI LIPI for providing the funding to carry out this study.

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Fatty acid Composition of Ethanolic Extract of Seahorse (*Hippocampus barbouri*) from Ekas Bay, Lombok Island, West Nusa Tenggara

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Abstract

Seahorse are potential source of bioactive metabolites used as an aphrodisiac in traditional chinese medicine . In this study we investigated fatty acid composition of ethanolic extracts of seahorse (*Hippocampus barbouri*) collected from Ekas bay, Lombok Island, West Nusa Tenggara ,Indonesia. The extraction of seahorse using ethanolic maseration methode and the fatty acid determination was using GC-mass spectrometer (GCMS). Our study revealed the presence of palmitic acid, oleic acid,stearic acid, ethyl linoleate (female seahorse) and cholesterin (male seahorse). Probably the ethanolic extract of male seahorse has the highest potential for its use as aphrodisiac. However, these are preliminary findings and need further studies to identify other useful bioactive metabolites for other health benefit effects.

Keywords : fatty acid , seahorse extract, lombok Island

1. Introduction

An aphrodisiac is an agent that arouses sexual desire, any food or drug that arouses the sexual instinct, induces veneral desire and increases performance. Aphrodisiacs can be classified by their mode of action into three types: increase libido, potency or sexual pleasure. The hunt for supplement from animal and plants is being intensified because of its fewer side effects. Seahorse are potential source of bioactive metabolites used as an aphrodisiac in traditional chinese medicine.

Figure. Sea horse in the market (http://biology.kenyon.edu/stures/Compsnelson/seadepletion.htm)

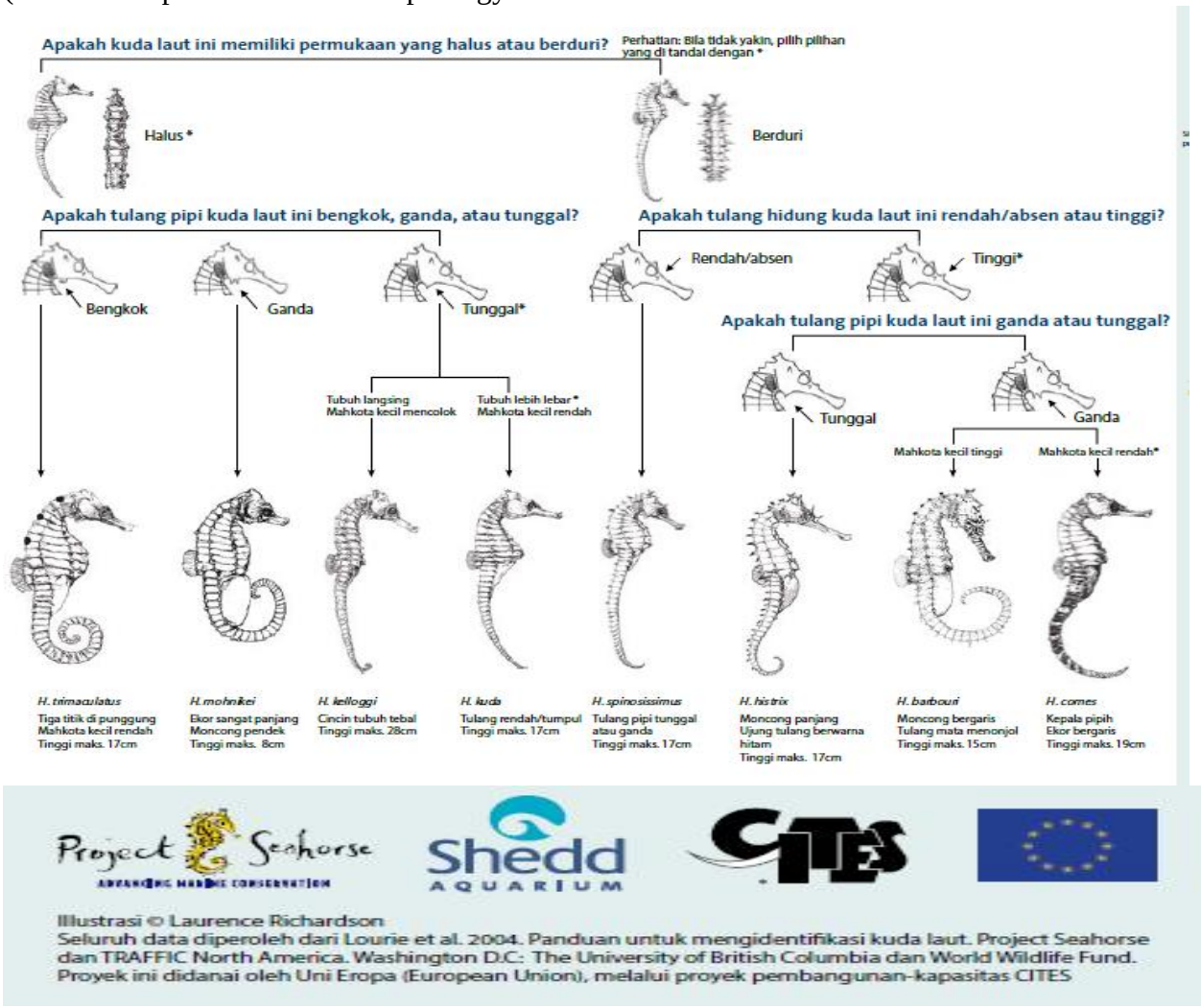
Because of that now the demand of seahorses increases, seahorses were added to CITES Appendix II, for species on Appendix II, member countries have to limit exports to levels that are not detrimental to wild populations and have to ensure that specimens are legally sourced. But the good news is that now people starting to culture the seahorse , example in the philipine and Indonesia (http://www.projectseahorse.org/research-

publications/2016/10/13/seahorses-hippocampus-spp-and-the-cites-review-of-significant-trade)

2. Materials and Methods

2.1 Collection and Identification

Seahorse's species of H. *barbouri* (male and female) were collected from Ekas bay of Lombok Island in juli 2017. Seahorses were identified based on the skeletal characteristics (size and shape and external morphology.



Seahorses were washed with water upon collection, dried traditionally, pulverized as powder and stored under room temperature in closed tube. The samples were extracted with ethanol. The organic solvents from the extracts were evaporated to dryness on a evaporator .Various fatty acid compounds of the extract were determined by GC-MS technique.

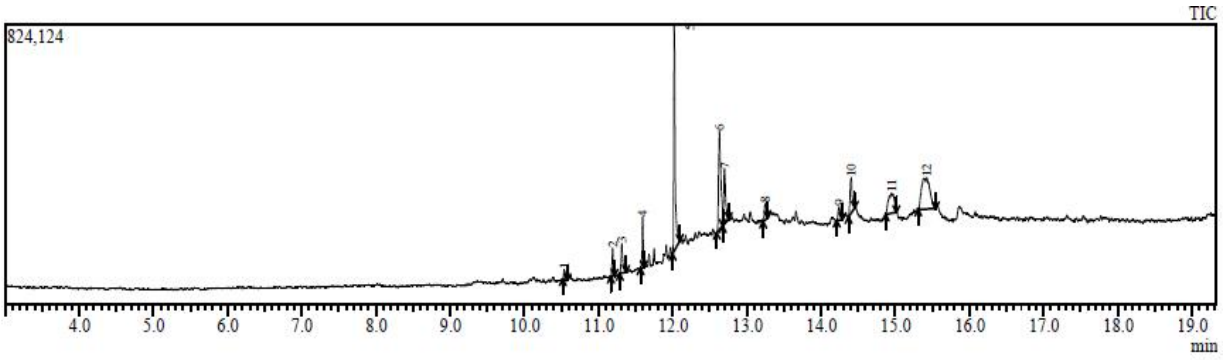
3. Results and Discussion

3.1 Identification of Sea Horse

Figure 2. Female seahorse identified as H. *barbouri* species

Figure 3. Male seahorse Identified as H. *barbouri* species

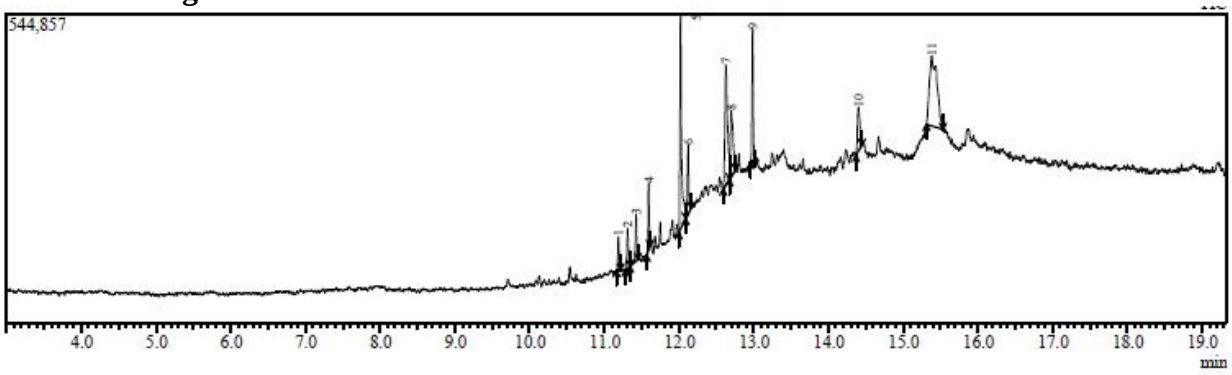
We found that *H. barbouri* species pre dominantly exist in the ekas bay , east Lombok West Nusa Tenggara. The presence of numerous fatty acid was found on screening of ethanol extract of the seahorse. The GC-MS analysis showed 12 peaks (male seahorse) and 11 peaks (female seahorse) of different constituents namely palmitic acid, oleic acid,stearic acid, ethyl linoleate (only in female seahorse) and Cholest-5-en-3-ol (3.beta.)-/cholesterin (only in male seahorse) .



Peak Report TIC

Peak#	R.Time	I.Time	F.Time	Area	Area%	Height	Height%	A/H	Mark	Name
1	10.537	10.520	10.580	51050	1.41	28839	1.60	1.77		Dodecanoic acid (CAS) Lauric acid
2	11.190	11.165	11.215	77041	2.13	81500	4.53	0.95		1-Dodecanol, 3,7,11-trimethyl- (CAS) Hexa
3	11.313	11.285	11.370	134163	3.71	85829	4.77	1.56		Tetradecanoic acid (CAS) Myristic acid
4	11.594	11.565	11.610	146593	4.05	147992	8.23	0.99		2-Hexadecen-1-ol, 3,7,11,15-tetramethyl-, [
5	12.021	12.000	12.095	892289	24.65	664753	36.95	1.34		Hexadecanoic acid (CAS) Palmitic acid
6	12.630	12.595	12.675	625181	17.27	289704	16.10	2.16		HEPTADECENE-(8)-CARBONIC ACID-(
7	12.698	12.675	12.755	299543	8.28	162193	9.02	1.85	V	Octadecanoic acid (CAS) Stearic acid
8	13.247	13.220	13.280	71417	1.97	47501	2.64	1.50		RT:13.245
9	14.243	14.210	14.285	76664	2.12	37716	2.10	2.03		RT:14.245
10	14.405	14.370	14.455	222328	6.14	103411	5.75	2.15		Hexadecanoic acid, 2-hydroxy-1-(hydroxyr
11	14.950	14.870	15.015	310035	8.57	58430	3.25	5.31		
12	15.424	15.310	15.545	713075	19.70	91196	5.07	7.82		
				3619379	100.00	1799064	100.00			

3.2 Chromatogram of extract of male seahorse



Peak Report TIC

Peak#	R.Time	I.Time	F.Time	Area	Area%	Height	Height%	A/H	Mark	Name
1	11.190	11.165	11.215	59378	1.84	58518	3.67	1.01		1-Dodecanol, 3,7,11-trimethyl- (CAS) He
2	11.313	11.285	11.345	106587	3.30	69419	4.36	1.54		Tetradecanoic acid (CAS) Myristic acid
3	11.426	11.345	11.450	109412	3.38	82634	5.19	1.32	V	Tetradecanoic acid, ethyl ester (CAS) Eth
4	11.594	11.570	11.610	103931	3.22	116888	7.34	0.89		2-Hexadecen-1-ol, 3,7,11,15-tetramethyl-
5	12.022	11.995	12.090	586430	18.14	378450	23.77	1.55		Hexadecanoic acid (CAS) Palmitic acid
6	12.122	12.090	12.160	162281	5.02	120095	7.54	1.35	V	Hexadecanoic acid, ethyl ester (CAS) Eth
7	12.630	12.590	12.675	490389	15.17	210769	13.24	2.33		DI-(9-OCTADECENOYL)-GLYCEROL
8	12.701	12.675	12.760	301616	9.33	116965	7.35	2.58	V	Octadecanoic acid (CAS) Stearic acid
9	12.986	12.955	13.020	275720	8.53	238350	14.97	1.16		Ethyl linoleate
10	14.404	14.370	14.450	177125	5.48	77311	4.85	2.29		Hexadecanoic acid, 2-hydroxy-1-(hydroxy
11	15.384	15.315	15.535	859653	26.59	123010	7.72	6.99		
				3232522	100.00	1592409	100.00			

3.3 Chromatogram of extract of female seahorse

These preliminary findings of ethanol extract of seahorse need further studies to identify other useful bioactive metabolites and to evaluates the aphrodisiac potential and acute toxicological effect of *seahorse* extract. According to research done by Deni Satria "ELUCIDATION STRUCTURE OF ACTIVE COMPOUND SEA HORSE (*Hippocampus trimaculatus* Leach.) ON MCF-7 CELL LINE, concluded that the bioactive compound was Cholest-5-en-3-ol (3.beta.)-/cholesterin. The researcher conlude that Based on the result of characterization of isolate it can be isolate KL 1 is cholest-5-en-3β-ol . Isolate can increase at sub G1 phase on cell cycle, inhibition cyclin D 1 expression and increase caspase 9 expression at immunocytochemistry on MCF-7 cell line. It's the same with our research that we found this compound in male seahorse (http://repository.usu.ac.id/handle/123456789/47570)

4. Conclusion

Hippocampus barbouri species pre dominantly exist in the ekas bay , east Lombok West Nusa Tenggara. Probably the ethanolic extract of male seahorse has the highest potential for its use as aphrodisiac with the Cholest-5-en-3-ol (3.beta.)-/cholesterin bioactive compound . These preliminary findings of ethanol extract of seahorse need further studies to identify other useful bioactive metabolites and to evaluates the aphrodisiac potential and acute toxicological effect of *seahorse* extract.

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Effectiveness of *Ulva lactuca* Extract on *Kappaphycus alvarezii* Growth

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Abstract

The purpose of this study is to determine the effectiveness of immersion *Ulva lactuca* extract on growth and yield of carrageenan *Kappaphycus alvarezii*. This research was conducted at Ekas Bay, Ekas Buana Village, Jerowaru Sub District, East Lombok Regency, West Nusa Tenggara Province. *Kappaphycus alvarezii* cultivated on May 8 until July 24, 2017. The research method used was experimental method. The treatment used in this study was the duration of soaking of 0 hours (without *Ulva lactuca* extract) as control, 1 hour soaking time (P1), 2 hours of soaking time (P2), 3 hours of soaking time (P3), 4 hours of soaking time (P4) And 5 hours of soaking time (P5) with concentration of 15%. The research design used was Completely Randomized Design (RAL) which consisted of one factor, *Ulva lactuca* concentration with 24 unit experiment consisting of 6 treatments with 4 replications. Sampling was done six times, each at 7, 14, 21, 28, 35, and 42 days after cultivated to measure the growth. Results of Analysis Of Variance (ANOVA) showed that growth of *Kappaphycus alvarezii* given *Ulva lactuca* extract, did not give significant effect (p> 5%) between treatments at specific growth rate, absolute growth and percentage of dry weight of harvest. Carrageen yield produced by seaweed *Kappaphycus alvarezii* with different immersion treatment ranged from 16,34% to 28,44%. The carrageen content obtained exceeds the requirements of the trade department's carrageen content. The conclusion of this research is the effective immersion time with *Ulva lactuca* extract on growth and yield of *Kappaphycus alvarezii* carrageen for 2 hours.

Keywords: *Kappaphycus alvarezii*, Extract, *Ulva lactuca*, Growth, and Carrageen

1. Introduction

West Nusa Tenggara Province (NTB) is one area that has the potential for the development of seaweed cultivation. The area of cultivation of seaweed in NTB 35,000 ha of marine waters and which can be utilized only 25 per cent, the production value of Nusa Tenggara Barat in 2015 reached 920 710 tonnes (CBS, 2016). Seaweed farming activities *Kappaphycus alvarezii* have been carried out in various coastal areas of West Nusa Tenggara province. But the seaweed cultivation activities in this area, has not produced optimal production. Seaweed cultivation activities have started to decline, due to the cheap seaweed prices, so some of the coastal communities no longer do seaweed cultivation. In addition to the price of seaweed is cheap, seed quality is also a problem in the development of seaweed. The quality of seeds is not good, because the seeds are often used repeatedly.

One of the problems that often occur in seaweed cultivation is the quality of seeds used. Seeds are often used by seaweed farmers are seedlings of vegetative development by way of conducting its own designated *thallus* results. If the use of these seeds is done continuously, it can reduce the growth of *K. alvarezii.* Skills for selecting a good *thallus* by seaweed farmers, can not produce a good quality for seed *thallus* seaweed.

The use of seeds that repeatedly can reduce the growth of seaweed *K. alvarezii.* So that the use of tissue culture seedlings can be used, because the seeds of tissue culture have a good growth rate. Growth of thalus of seaweed resulting from tissue culture is faster than conventional seeds, because conventional seeds are old from vegetative propagation repeatedly (Bujang, 2013). Aside from kuljar result, improved nutrition can be obtained from soaking seeds with organic and inorganic fertilizers to deliver nutrients and hormones trigger the growth of *K. alvarezii.*

One type of organic fertilizer that can be used is derived from extracts of *Ulva lactuca.* Brotowijaya (1984) explains that *Ulva lactuca* are hormone growth promoters, this was

confirmed by Divya (2015) that in *Ulva lactuca* are hormone growth promoters such as, cytokinin and auxin is a hormone used by Plantae (higher plants), enhances growth in higher plants such as *Abelmoschus esculentus.* Based on these descriptions it is necessary to do research to determine the effect of immersion *K. alvarezii* with *Ulva lactuca* extract on the growth and carrageenan produced.

The purpose of this study was to determine the effectiveness of immersion with *Ulva lactuca* extract to accelerate the growth and carrageenan content of *Kappaphycus alvarezii.*

2. Materials and Methods

The research was conducted on May 8 to July 24, 2017, located in Ekas Bay, Ekas Buana Village, Jerowaru District, East Lombok Regency, West Nusa Tenggara Province.

The tools and materials used in this research are: raft, bucket, rope, lisung, anchor rope, scales, Disolved Oxigen meter, refractometer, pH meter, secchidisk, thermometer, camera, ballast, rope, gauze, knife, *Kappaphycus alvarezii, Ulva lactuca extract*, sea water, NaOH, and ethanol.

2.1 Research method

The research method used is experimental method. The treatments used in this study is the soaking time 0 hours (without extract *Ulva lactuca* as the control, 1 hour (P1), 2 hours (P2), 3 hours (P3), 4 hours (P4) and 5 hours (P5). Extract concentration of 15%, is done in the following manner: A total of 900 ml *Ulva lactuca* mixed with 6 liters of seawater, after mixed then put seaweed that has been tied to a rope ris.

2.2 Research procedure

Sampling was done six times, each at 7, 14, 21, 28, 35, and 42 days after planting. Samples were taken at three sampling points at each rope in the raft at each sampling. So, the number of samples at each take is 72 samples of seaweed. Each sample that has been collected is directly weighed wet weight.

2.3 Parameter of Research

The parameters used to test the results of this research that Absolute Growth, According to Effendi (2003), $G = W_t - W_0$; G = Absolute Average Growth (gr); W_t = weight Seed At End Research (g); W_0 = Serious Seeds in Early Research (gr). Specific Growth Rate (Effendi, 2003).

$$LPS = \frac{Ln\,Wt - Ln\,Wo}{t} X\ 100\ \%;$$

LPS = Average Specific Growth Rate (%); W_t = The average weight of the seeds on a t *i* (g) (i = first week, the second week ... t); W_0 = The average weight of the seeds on a t *i* -1 (g); T = Observation Period (day). Percentage of Dry Weight% Dry weight = $\frac{Dry\,weight(g)}{Gross\,weight(g)} x\ 100\%$.

2.4 Water Quality Measurements

Measurement of water quality parameters in this study include: temperature, current water, depth, salinity, brightness, dissolved oxygen (DO), and acidity degree (pH).

2.5 Carageenan Content

Kappaphycus alvarezii seaweed that has been cut into small pieces soaked with ± 100 ml of distilled water for 24 hours. After that, washed thoroughly on running water. *Kappaphycus alvarezii* then put in a *glass beaker* containing 100 ml of distilled water and

then added 1% NaOH solution to a pH of 8.5 to 9. The sample was then heated at 70-90ºC for 3 hours. Next, the solution is filtered with a gauze. Distillate then added ± 25 ml *absolute* ethanol and allowed ± 30 minutes. After precipitation, filtering is done to remove the ethanol solution. Distillate was added *petridish* which has known weight is then heated in an oven at a temperature of 60-70ºC for 24 hours and after that, the results were weighed cold Yag (Aaron *et al.*, 2013).

2.5 Data analysis

The variable data rate of growth of seaweed which has been obtained will be tabulated using *Microsoft Excel* and analyzed using *Analysis of Variance* (ANOVA) and further Tukey test (HSD) if there is significant (significantly different) effect of the test treatment.

3. Results and Discussion

3.1 Specific Growth Rate, Absolute Growth and Percentage of Dry Weight

The growth rate of *Kappaphycus alvarezii* soaked with extracts of *Ulva lactuca* by ANOVA analysis results are presented in Table 1. Results *Analysis Of Variance* (ANOVA) showed that the extract *of Ulva lactuca* against specific growth rate and the growth of the absolute and percentage dry weight of *Kappaphycus alvarezii* effect Which was not significant between soaking treatments 1 hour to 4 hours, but significant with treatment without immersion and immersion 5 hours. After maintenance for 42 days or 6 weeks.

Table 1. Results of the effect of soaking time of *Ulva lactuca* extract on the growth *Kappaphycus alvarezii*

Treatment	Growth parameters		
	LPS (% / day)	PM (g)	% Dry
Control	3.146 ± 0.073 ^{b}	192.50 ± 7.99 ^{b}	62.515 ± 1.689 ^{bc}
P1	3.749 ± 0.184 ^{A}	268.75 ± 26.30 ^{a}	70.347 ± 2.281 ^{A}
P2	3.599 ± 0.078 ^{A}	247.50 ± 10.41 ^{a}	68.479 ± 1.019 ^{ab}
P3	3.428 ± 0.071 ^{ab}	225.42 ± 8.75 ^{ab}	65.539 ± 2.158 ^{abc}
P4	3.614 ± 0.179 ^{A}	250.00 ± 24.46 ^{a}	68.618 ± 2.305 ^{ab}
P5	3.134 ± 0.322 ^{b}	192.92 ± 35.76 ^{b}	61.442 ± 5.140 ^{c}

Description: *Superscript* = notation real-treatment difference *(a* = 5%)
P1-P5 = 1 hour long immersion treatment code
LPS (% / day) = Specific Growth Rate (% / day)
PM (g) = Absolute Growth (g)
% Dry = Percentage of Dry Harvest (%)

On the results of the data the highest grade average specific growth rate, the growth in absolute and percentage dry weight *Kappaphycus alvarezii* found on the treatment P1 is the 1-hour immersion. Soaking in *Ulva lactuca* give a positive result to the growing rate *Kappaphycus alvarezii.*

3.2 Specific Growth Rate Chart

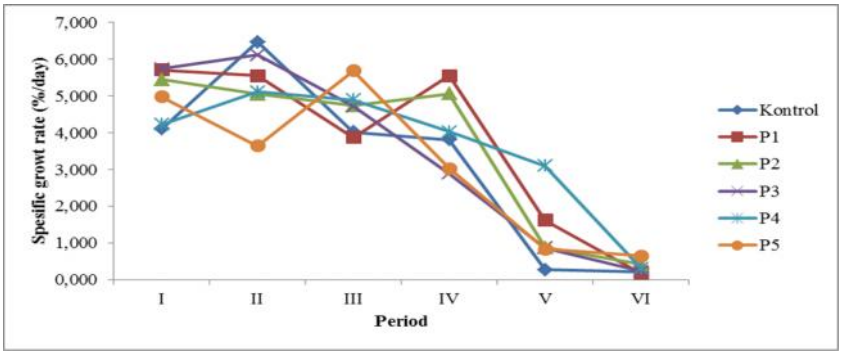

Figure 1. Specific growth rate chart

The graph above shows that the specific growth rate of each observation period has increased and decreased between treatments. In different observation periods, each treatment experienced a peak of growth rate. In the observation period I, the 1 hour and 3 hour immersion treatment experienced the highest growth rate. In contrast to the second observation period, where treatment without immersion (control) experienced the highest growth rate of other treatments. While in the observation period III, the highest growth rate occurred at 5 hours immersion treatment. The 1-hour immersion treatment experienced the highest growth rate again in the IV observation period, then 4 hours of immersion treatment experienced the highest growth rate in the observation period V. While in VI observation period or at the last observation almost all treatments experienced the same growth rate, except the immersion treatment 5 hours of the highest.

Ulva lactuca extract a high impact on the growth of seaweed *Kappaphycus alvarezii*, compared with growth of *Kappaphycus alvarezii* without giving extract of *Ulva lactuca.* Growth *Kappaphycus alvarezii* seaweed *Ulva lactuca* extract given good growth. This is due, because thalus which is able to absorb the nutrients better growth promoters such as cytokinin and auxin contained by the extract of *Ulva lactuca.* So the growth rate *Kappaphycus alvarezii*, have a very good growth rate. However, growth *Kappaphycus alvarezii* fed extracts of *Ulva lactuca*, did not have a significant effect *(p* <5%) among the treatments on specific growth rate, the growth in absolute and percentage dry weight of the harvest. This can be seen in the presence of the notation in each column presented from table 1.

Nevertheless, the highest growth occurred in 1 hour immersion (P1) treatment of either the specific growth rate, absolute growth or percentage of dry weight of the harvest. The high growth value at 1 hour immersion due to the adequate intake of nutrients absorbed by thalus at the time of immersion is done. This is reinforced by Akbar (2016), that 15% extract with 30 minutes immersion and 5% extract with 90 minutes of immersion has a good specific growth value compared to other treatments during 4 weeks maintenance. The use of low extract concentrations by the treatment of long immersion times and the use of high concentrations of extract by shortening the length of immersion time has a higher yield.

Long immersion does not go well for growth, due to soaking more than 4 hours like 5 hours immersion, nutrient intake absorbed by thalus has an optimal time limit. Immersion beyond the optimal time limit, is expected to lead the growth impact is not good or *alvarezii Kappaphycus* growth will decline. In addition to soaking time, allegedly factor that inhibits the growth also caused by environmental conditions of cultivation, because the plant-eating animals, disease and lower currents or higher, thereby disrupting the growth rate *Kappaphycus alvarezii.*

3.3 Water quality

The rate of growth in seaweed *Kappaphycus alvarezii* not be separated from the high and low water quality. Aside from a given extract, water quality also influences the growth of of *Kappaphycus alvarezii.* Santoso and Nugraha (2008) says that the nutrients required by the

seaweed obtained from the nutrients contained in water bodies and will grow well in the area having a temperature between 27 ^{0} C-30 ^{0} C and seaweed can grow to a maximum at the pH of the water Ranges from 6-9, with an optimum pH of about 7.5-8.0. Dissolved oxygen in waters ranging from 11 mg / l at a temperature of 0 ^{0} C and 7 mg / l at 25 ^{0} C, in natural waters dissolved oxygen is usually less than 10 mg / l (mudeng *et al.,* 2015).

Table 2. Water quality

Parameter	Unit	Range
Temperature	^{0} C	32.4
DO	mg / l	5.84
Salinity	ppt	32
PH	-	7.3
Current Speed	cm / sec	14
Brightness	M	2.5

Anggadiredja *et al.,* (2008), the optimal water temperature around the plant seaweed ranging between 26-30 $^{\circ}$C. As temperatures are important for the metabolism of seaweed, because the metabolic rate increases with increasing water temperature. Temperature values obtained in the study was 32.4 ^{0} C. The temperature values obtained in this study is a value that is not too ideal for *Kappaphycus alvarezii* growth rate, but the value is still tolerable for growth.

Disolved Oxigen (DO) value obtained in the study amounted to 5.84 mg / l, DO values obtained are still within the limits of optimal DO *Kappaphycus alvarezii* to support growth. Dissolved oxygen is a basic necessity for living creatures in the water. The content of dissolved oxygen to support seaweed cultivation is 3-8 mg / l (Ditjenkanbud, 2008).

The current water is 14 cm/sec obtained in this study is the current velocity is not very optimal. So that little seaweed get the nutrients brought by the flow of water. According to Suparman (2014), seaweed is an organism that feeds through the flow of water through it or through the synthesis of foodstuffs around it with the help of sunlight. Good flow can deliver nutrients and clean the dirt and plant *thallus* of engaging members (Rahman *et al.,* 2015).

Salinity value is 32 ppt and is still in normal condition, because growth of seaweed in salinity is still in normal growth. This is supported by, Santoso (2008), about 28-34 ppt salinity water with salinity optimum value of about 33 PTT enough for fattening *thallus.*

The value of acidity or pH 7.3 is the optimal pH value on seaweed growth. The pH value obtained in this study can best support the growth of *Kappaphycus alvarezii.* According to Susilowati (2012), alkaline waters (7-9) are productive waters and play a role in encouraging the process of changing organic matter in water into minerals that can be assimilated by phytoplankton of marine waters and coastal pH is relatively more stable which is in a narrow range, Usually ranging from 7.7 to 8.8. The pH is affected by the buffer capacity ie the presence of carbonate and bicarbonate salts thereof.

The brightness level in the study was 2.5 m. The value of the brightness level is in the normal value for the growth *Kappaphycus alvarezii,* so that seaweed can take advantage of sunlight through water for energy and photosynthesis. Seaweed brightness requires light as a source of energy for the formation of organic materials necessary for normal growth and development, the location of seaweed cultivation preferably in clear waters or high brightness of about 2-5 m (Suparman, 2014).

Carrageen content

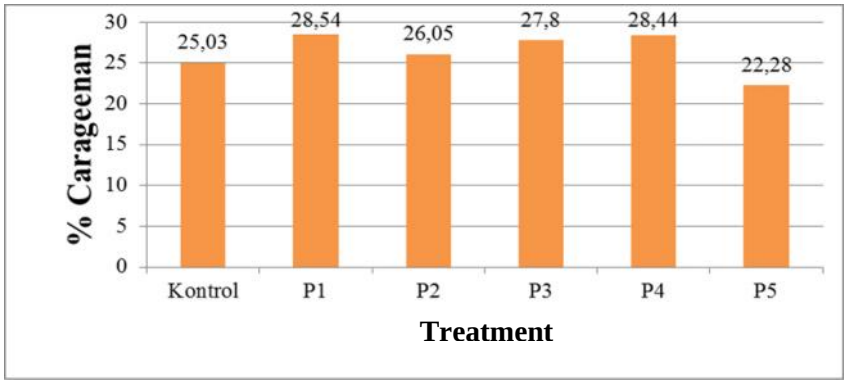

Figure 4.4. Carrageenan content

Based on the data obtained on the chart above, the value of yield carrageenan seaweed produced by *Kappaphycus alvarezii* with different soaking treatment ranged from 22.28% to 28.54%. Ministry of Trade (1989) *in* Masthora (2016), states that the value of the average yield of carrageenan set by the Ministry of Trade by 25%. So the results of the carrageen content that has been eligible. The content of carrageenan obtained more than the requirements of the Department of Trade, allegedly due to prolonged submersion with *Ulva lactuca* extract in addition to a positive impact on growth, also contains provisions carrageenan is more than the Department of Commerce.

Carragean content is the carrageen weight contained in dried seaweed and expressed in percent. The higher the carrageenan content, the greater the output. In this research, the highest content of carrageenin content was found in 1 hour soaking treatment (P1) with carrageen yield value of 28.54%. While the lowest value found in the treatment of soaking 5 hours (P5) is 22.28%. The intensity of carrageenan content in *Kappaphycus alvarezii* allegedly due to differences in the length of time of immersion. In addition, the high value of carrageenase rendement also occurs when the extraction of carragenin content test. Burhanuddin (2012), states that the content of carragenan high enough caused by the absorption of nutrients process is good enough, where the nutrient is needed for the formation of polysaccharides which is the main component of Carageenan (karginofit) formation deposited on the cell wall. Furthermore, it is added that the number of seaweed extract (carrageenan) is usually also influenced by season, habitat, plant age and cultivation method. Carrageenability content obtained at 1 h immersion treatment (P1) has fulfilled the requirement of carragenen content determined by Trade Department.

4. Conclusion

The conclusion of this study is the soaking time for effective *Ulva Lactuca* extract on growth and carrageenan content of *Kappaphycus alvarezii* is 1 hour.

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Composition of Plankton on Floating Net Area in Batunampar Beach, East Lombok

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Abstract

Batunampar beach is part of the waters of Ekas bay. From early 1990's until now in Batunampar beach has cultivated of groupers and lobsters using floating net. For two decades Batunampar waters get input from organic materials either from feed trash and excret from the fish cultivation. This input has an effect on the physical, chemical and biological parameters of the waters. The aim of study are to determine the composition and diversity of plankton species in Batunampar Waters. Sampling was conducted in July- September 2017 by taking a composite of 3 stations. The results obtained that the most plankton found is Bacillariophyceae class and zooplankton was found nauply from crustacea

Keywords: plankton, Floating net, aquaculture, marine

1. Introduction

Almost for two decades Batunampar coastal waters was a place of fish cultivation with floating net cage system. Where during the period of cultivation on floating net cages (KJA) many inputs of organic material into the waters in the form of feed trash and the excretion of fish (Bartozek et al., 2014). The feed that is wasted on the KJA system is about 30% -50% (M.R.A Putri and Sri EP, 2013). Where the cultivation of this system can have an impact on the biological community and the quality of water due to nutrients that enter the system, such as phosphorus and nitrogen that cause eutrophication (Bartozek et al., 2016). Eutrophication is the result of excessive nutrient enrichment and along with increasing pollution problems in estuary areas around the world (Huei-Meei Su et al., 2004).

According to Junaidi et al., 2014 that Batunampar waters were classified as "medium-polluted" waters based on the Storet index. There was also research from Setyowati, et al., (2013) and Junaidi et al. (2014) that the waters of Batunampar have exceeded the quality standards required by the Minister of Environment No.51 of 2004. Excess nutrients will make explode plankton grow. Organic matter derived from the excretion of biota cultivation and the death of plankton. Input of organic material into the waters will be decomposed by the detritus in the form of a complex of microorganisms into its composition. The process of reshuffling large-size organic materials into suspended organic matter can add turbidity value in the waters. In addition, the results of decomposition into nutrients can support the growth of excessive plankton or termed blooming algae.

Excess water conditions with high nutrients is not automatic that will grow only required plankton organisms in the waters. But usually eutrophic conditions will cause plankton that can not be used even poison the biota that inhabit these waters. Therefore, to manage the waters further it takes the composition and plankton diversity that exist around the floating net cages.

2. Materials and Methods

This research was conduct in August until October 2017 on South Batunampar Village where data collected in Floating cage area. Survey method was used in this research. The data was collect will analyze with statistic and descritif.

Water quality parameter was collect were temperature, Dissolved Oxygen, Salinity, Acidity, Phosphor and Total Amonia Nitrat (TAN). All water quality parameter was analyzed in situ. Time to collect data from 10 – 12 am

The sample of water was filtered with a Plankton net size 25 and preserved with Lugol. Sampling was done horizontally were plankton net pull by boat at low speed. Types of Plankton were identified using books identified of Omura et al., (2013) and Yamaji (1976). Calculation Plankton abundance using APHA (1989). Diversity index was used Shanon-Wiener (Sachlan, 1973)

$$H' = -\sum ni/N \times ni/N \quad (1)$$

were:

H' = Diversity Index
ni = the number of individuals of each type
N = total number of individuals of all types.

Table 1. Value of Environmental Quality by Plankton Structure Community

Diversity Index (H')	Community Structure	Catagory
➢ 2,41	Very stable	Very good
1,81 – 2,4	More Stable	Good
1,21 – 1,8	Stable	Medium
0,61 – 1,2	Enough stable	Bad
< 0,6	Unstable	Very Bad

Dominance Simpson index

$$Di = ni/N \times 100\% \quad (2)$$

were :

D = dominance simpson index
ni = number of individual type-1
N = total number of individuals of all types

Dominance : if Di> 5%
Sub dominance : if Di in between 2-5%
Not dominance : if Di<2%

3. Results and Discussions

3.1 Type of Plankton

From the observation results, 17 plankton species were found consisting of 6 classes as shown in Figure 1. The most collected classes are Bacillariophyceae with abundance of 325 cells / L. Bacillariophyceae is a natural food biota that live in the sea and its population is high in brackish and marine waters and is known as diatoms. Diatom cells are coated with cell walls derived from silica. Diatoms are able to carry out photosynthesis because they contain chlorophyll. In general, diatoms are divided into three orders namely Coscinodiscacea, a rounded diatom and has a radial symmetry body shape, Fragilariaceae, a rustless pen diatom that bebrkentuk bilateral symmetry and Bacillariceae, diatom pen with rafe. Genera from Bacillariophyceae class in Batunampar Waters consists of 12 and many diatoms are pennales / needles. The plankton of the Chlorophyceae class is the second largest number of classes.

From the observation has results 10 types of plankton which consists 4 classes were Bacillariophyceae, Chlorophyceae, Foraminifera and Dinophyceae. The dominant class was Bacillariophyceae with an abundance of 325 cells / l. Bacillariophyceae is a natural feed for biota living in the ocean and its population is high in the brackish and sea

waters. But the presence of dinophyceae class must beware and followed up so as not to become blooming. According to Cokrowati et al. (2015), Batunampar waters have the potential for the appearence of Harmful Algae Blooms (HABs). Blooming certain algae is a sign that the environmental balance in a waters has been damaged so that the condition is only beneficial for certain types of algae.
When viewed from the water quality (phosphorus), batunampar coastal waters have entered in the rich of nutrient waters (PO4 = 0.25 mg / l) and the quality of water has over base on Kep-MenLH No.51 of 2004 which maximum of 0.015 mg / L. Added by Junaidi et al. (2014) Ekas Bay has been in the status moderate fouled waters. Nitrogen is a limiting nutrient for the growth of phytoplankton in sea waters because the presence was not always in the waters. The abundant of presence phosphorus indicates that the waters have received excessive input of organic material from cultivation activities.

The presence of Dinophyceae class is a bad sign for water resources and should be followed up to avoid being blooming. This is corroborated by Cokrowati et al. (2015), that the waters of South Batunampar have the potential for the emergence of Harmful Algae Bloom's (HABs). Certain algae is a sign that the environmental balance in the waters has been damaged so that conditions only benefit some algae species.

In addition to plankton of collected phytoplankton species also animal plankton / zooplankton. There are two classes incorporated in the zooplankton group namely crustacean larvae and Hexanauplia. The suspected crustacean larvae are the larvae of sand lobster that are widely present in Batunampar waters. The crustacean larvae and Hexanauplia are the beneficiaries of phytoplankton or as a first-rate consumer (herbivore).

3.2 Water quality

The sampling at Batunampar coincided with the second transitional season. ie in August -September. In the transition season the waves are very strong and make the entire water column perfectly blended. This can be seen with the high value of phosphate parameters and above the required quality standards.

When viewed from the parameters of water quality of phosphorus, Batunampar coastal waters are included in the rich of nutrient waters (PO4 = 0.25 mg / l) and the water quality exceeds the quality standard of Kep-MenLH No.51 year 2004 which maximum 0,015 mg / L.

Other water quality parameters are still below the quality standard (Table 2). In contrast to the situation in 2012. Based on the research of Junaidi et al. (2014) Teluk Ekas has been in water status with moderate contamination with 3 parameters above the quality standard ie ammoniac, nitrate and phosphate parameters.

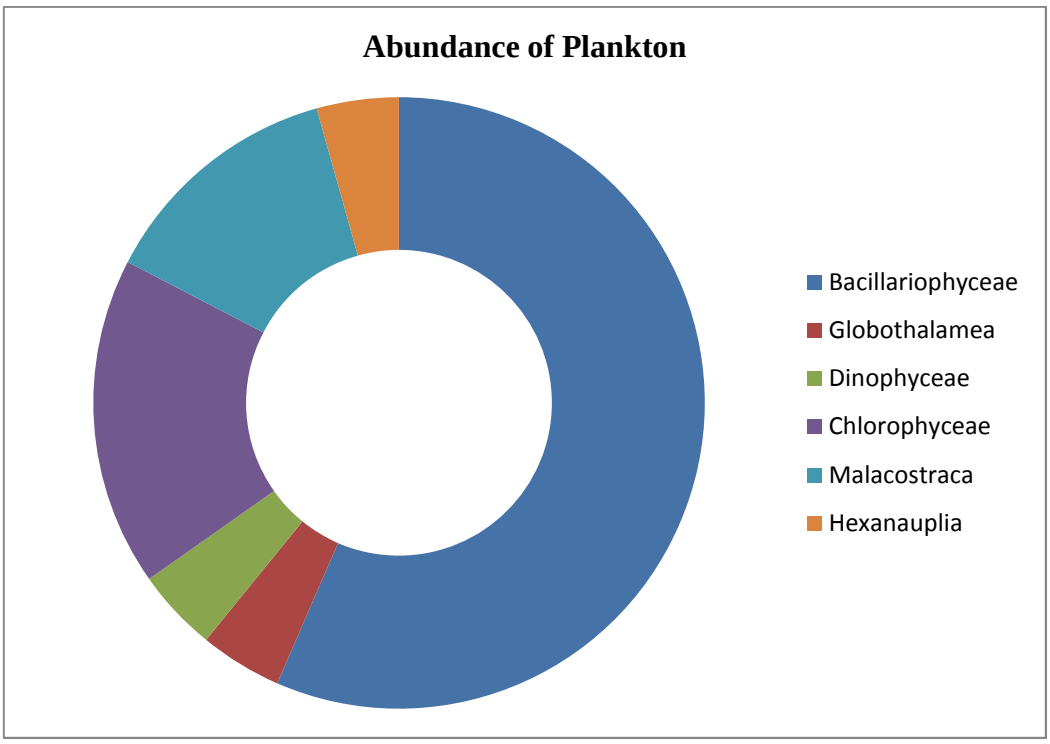

Figure 1. Abundance every clases plankton in floating net cage area

3.3 Environmental Index

The diversity index (H) plankton in Batunampar is 2.64 and the dominance index (D = 0.08). Species with the highest diversity index are: Synedra sp., Fragilaria sp., And Clamydocapsa sp. (Table 3).

Table 2. Water quality in floatinnet cage area

No	Parameter	Batunampar value	KepMenLH No.51
1	Temperatur (^{O}C)	25,8	As naturaly
2	Water Transparance (meter)	4	>5
3	pH	8,12	7-8,5
4	Dissolved Oxygen /DO (mg/L)	5,5	>5
5	Total Amonia Nitrat (mg/L)	0,26	0,3
6	Fosfat (mg/L)	0,03	0,015
7	Nitrat (mg/L)	0,001	0,008
8	Salinity (ppt)	33,5	As naturally

Looking at the diversity index below 3 by Abel (1979) indicates that the plankton diversity in Batunampar waters particularly the KJA region is low. The low level of diversity is possible because of the unfavorable environmental conditions for the life of various types of plankton. Based on Radiara and Erlania (2015) that in the Gulf ekas kekeruhnan bsa reached 25.4.NTU. The high turbidity value is one of the limiting factors for the diversity of phytoplnacton species that grow there. High cultivation will prevent the entry of sunlight into the waters, when light is limited then photosynthesis will be limited as well.

The high condition of this kekeruahn also makes no dominant plankton. Light is a limiting factor in addition to nutrients in plankton diversity. Because light is energy that will be stored through the process of photosynthesis by phytoplankton which will eventually be exploited by zooplankton or other herbivore.

Batunampar waters, especially the KJA region, including critical areas based on environmental indices reinforced by the value of ait quality taken. Special handling needs for turbidity levels can be reduced by adding a filter feeder organism such as the seams.

Table 3. Enviromental index of plankton

Class	Family	Species	Average	H	C
Bacillariophyceae	diatomaceae	*Synedra ulna*	2	0.27	0.02
Bacillariophyceae	fragilariaceae	*Fragilaria*	2	0.27	0.02
Bacillariophyceae	hemiaulaceae	*Hemiaulus sinensis*	0.5	0.11	0.00
Bacillariophyceae	skeletonemaceae	*Skeletonema costatum*	0.5	0.11	0.00
Bacillariophyceae	triceratiaceae	*Triceratium taves*	0.5	0.11	0.00
Bacillariophyceae	coscinodiscaceae	*Coscinodiscus granii*	1	0.18	0.00
Bacillariophyceae	bacillariaceae	*Pseudo nitzschia*	0.5	0.11	0.00
Bacillariophyceae	lithodesmiaceae	*Dytilum sol*	0.5	0.11	0.00
Bacillariophyceae	triceratiaceae	*Cerataulina smithii*	0.5	0.11	0.00
Chlorophyceae	gloeocystaceae	*Clamydocapsa* sp	2	0.27	0.02
Bacillariophyceae	naviculaceae	*Navicula elegans*	1	0.18	0.00
Bacillariophyceae	aulacodiscaceae	*Aulacodiscus gracilis*	0.5	0.11	0.00
Bacillariophyceae	stephanodiscaceae	*Cydotella* sp	0.5	0.11	0.00
Globothalamea	globorotaliidae	*Globorotolia pumilio*	0.5	0.11	0.00
Dinophyceae	ceratiaceae	*Ceratium* sp	0.5	0.11	0.00
Malacostraca	palinuridae	*Crustacean larvae*	1.5	0.23	0.01
Hexanauplia	pontellidae	*Pontellina plumata*	0.5	0.11	0.00
Total			15	2.64	0.08

4. Conclusions and Recomendation

Floating net area on Batunampar was found 17 types of plankton which consists 6 classes were for example Bacillariophyceae, Chlorophyceae, Foraminifera and Dinophyceae. The dominant class was Bacillariophyceae with an abundance of 325 cells / l. The abundance of phosphorus in batunampar waters signifies the waters have received the input of excessive organic material from the aquaculture of floating net cages.

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Water quality of Kertasari Bay West Sumbawa as Sustainability of Seaweed Cultivation Center

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Abstract

The purpose of this study is to determine the current of water quality in Kertasari bay and feasibility for seaweed cultivation. Kertasari bay is a watershed used as a seaweed cultivation area since 2008. Seaweed cultivation is the main livelihood of the community of Labuhan Kertasari Village. Seaweed cultivation system used is "Patok dasar" system. The type of seaweed cultivated is *Eucheuma striatum*. Cultivators do cultivation throughout the year with a production cycle for 3 months. This research was conducted in Kertasari bay Labuhan Kertasari Village, Taliwang District, West Sumbawa, West Nusa Tenggara Province. The research method used is descriptive method by performing direct measurement of water quality parameters and analyzing the data. Water quality parameters measured were temperature, pH, salinity, Dissolved Oxygen, and brightness. The results stated that the water quality parameter of Kertasari waters is in the range of values required for seaweed cultivation activities.

Keywords: Eucheuma striatum, water quality, Kertasari, cultivation, Bottom off

1. Introduction

Labuhan Kertasari village is located in Taliwang District, West Sumbawa Regency, West Nusa Tenggara. Development of Agriculture, Fisheries and Forestry is directed to advanced, efficient and aimed at increasing the income of farmers and fishermen, expanding employment, business opportunities, provision of industrial raw materials and public consumption and tourism support. Labuhan Kertasari village has the potential of seaweed cultivation and it has a bay region in the form of a productive bay. Given the world market demand to Indonesia which each year reaches an average of 21.8% of the world's needs. Based on data from the Department of Fisheries and Husbandry of West Sumbawa Regency (2015), seaweed production in Kertasari Village in 2015 was 271,827 tons. Monthly production data during 2015 show different production patterns every month. In January to July the production value ranges from 6 tons to 9 tons. In August to December showed excellent production values ranging from 37 tons to 45 tons. The pattern of development of different seaweed production each month is mostly due to uncertain climatic conditions ie high temperatures and water temperatures and suspected water quality decline. The decrease of seaweed growth is also suspected due to the occurrence of coastal abrasion resulting in silting in the waters of the cultivation location. The siltation that occurs causes the seaweed can not grow well and can even die. Sometimes cultivators are forced to harvest early. Harvest age should be 45 days, but due to bad conditions and damage, the harvest is forced to be done at the age of 20 days and with little seaweed production. Increasing the production of seaweed is currently faced with the problem of decreasing the carrying capacity of the aquatic environment and the uncertain climate conditions. Environmental carrying capacity is related to water quality of Kertasari bay. Kertasari bay is productive and have appropriate water quality for seaweed cultivation activities. But the water quality is not continuous in good condition, the tendency of decline. Likewise with the water quality condition Kertasari, tends to decline due to continuous seaweed cultivation activities, household waste and shrimp ponds around Kertasari. So it is necessary to do this research to determine the suitability of water quality at this time for seaweed cultivation activity.

2. Materials and Methods

This research used descriptive method, that is by explaining and analyzing water quality data that has been measured. The parameters of water quality measured are temperature, pH, salinity, dissolved oxygen, and water transparency.

3. Results and Discussion

Table 1. The water quality parameter values of Kertasari Bay.

Parameter	**Range**	Feasibility for seaweed cultivation *(Source : Kepmen No. 51/MENKLH/2004*)
Temperature (°C)	29,0 - 29,8	27-30
Disolved Oxigen (mg/L)	8 – 8,1	>4
Salinity (ppm)	31 -32	28-34 or >37
pH	7,1 – 7,2	6,5-8,5
Water transparency (m)	6-7	>5
Current (cm/detik)	6 - 13	20-30 or >40

Based on the result of temperature measurement in Kertasari bay shows that the waters have temperature range 29,0-29,8°C. MENKLH (2004) states that a reasonable range for seaweed growth is in the range 27°C-30°C, according to Thirumaran and Anantharaman (2009) studies thatwhen temperatures less than 20°C *Kappaphycus alvarezii* will die, whereas at 21-30° C average, the average growth will be optimal and according to research results Amiluddin (2007) *Kappaphycus alvarezii* seaweed experiencing death at temperatures around 35°C. So it can be said that in this study, the temperature can be categorized according to the growth of seaweed.Salinity of 31-32 ppm is still within the range that supports grass growth, water salinity of about 28-34 permil with an optimum salinity value of about 33 permil is sufficient for thallus filling (Santoso, 2008., Kepmen, 2004). This is supported by Arisandi (2011) stated that salinity value 30-35 ppm can increase cell number, growth and yield of carrageen seaweed. The value of pH range of Kertasari is 7,1 - 7,2, according to Kepmen. 51 / MENKLH / 2004 pH range for the feasibility of seaweed cultivation ranged from 6.5-8.5. The pH value of Kertasari is in that range. Daulat (2014) high-low pH waters can be affected by many at least the underland organic materials through the river.Water transparency is a light capability to penetrate the water layer at a certain depth. The measurement results show that the brightness of Kertasari bay is in the range of 5 m-7 m, the value is within the required range. The range of 5m - 7m is said to be feasible for seaweed cultivation, this is supported by Prihaningrum et al., (2001) that clear water conditions with trasparency levels of not less than 2-5 m are good enough for seaweed growth. Kertasari current water current is 6 - 13 cm / sec, can be regarded as very calm waters and outside the range required by Ministerial Decree no. 51 / MENKLH / 2004, ie 20-30 or> 40. Calm waters conditions can be used as a reference selection method of cultivation is used Bottom off. So the low current velocity does not become an obstacle for the growth of seaweed. The results of Kadi and Atmadja (1988) suggest that relatively strong water mobility is able to keep seaweed clean from sediment and epiphytes so that all parts of the thallus can work well for photosynthesis.

4. Conclussin

Based on the range of water quality parameter values, Kertasari Waters can be said to be feasible for seaweed cultivation activities. So Kertasari sustainability as a center of seaweed cultivation can be done.

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Mapping Consumer Preferences and Physical Quality of *Sie Reuboh* (Cooked Meat)- a Traditional Cuisine of Aceh

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Abstract

Sie reuboh is traditional cuisine from Aceh which literally defined as cooked meat. The dish is cooked with addition of tallow and traditional vinegar in specific way. This combination produces traditional food which has long shelf life even in room temperature. However since the modern life style approached, the consumers preferences also changed. This study objectives are to map recent consumer preferences towards *sie reuboh* and to analyse the physical characteristics of *sie reuboh.* Forty four Aceh citizens who understood the know-how of *sie reuboh* are interviewed to gain consumer insights, the updated formulation used and the cooking process. The survey found out that consumers nowadays tend to add only up to 500g of tallow and vinegar in the range 25-30 ml for each kilogram of meat, which then are used as base of independent variables, named as tallow addition (0%; 25%; 50%) and vinegar addition (2.5%; 5%). ANOVA stated that addition of tallow significantly influenced ($P \leq 0.01$) colour, aroma and flavour which assessed hedonically, compared to the use of vinegar which significantly affected ($P \leq 0.01$) all examined parameters. It also found out that tallow and vinegar elevate consumer acceptances towards all *sie reuboh* sensory attributes

Keywords: cow-meat, vinegar, tallow, cooking loss, traditional food

1. Introduction

Aceh is one of Indonesian Province which has high diversity of traditional food, either as finger or savoury dish. *Kuah belangong* or *sie reuboh*, as an example of savoury traditional dish with cow-meat as raw material. This heavy cuisine commonly produced during fest days such as Idul Fitri, Idul Adha and other Islamic fests (Nur et al., 2015). Based on BPS (2015), cow meat consumption in Aceh continuously increased where in 2012 reached up to 6.564 tonnes and sharply rose up to 10.063 ton in 2015. This numbers showed the high amounts of Acehnese's necessity on cow meat as raw material of their daily diets.

Sie reuboh is one of Aceh traditional cuisine which originally cooked by Great Aceh district. This dish made by cow meat which mixed with tallow, vinegar and spices as its recipes. Suhairi (2007) reported that tallow is added up to 30% from total of cow-meat, whereas Fitri (2002) stated that tallow could be added up to 20% from total of cow-meat. Then except of addition of tallow, addition of vinegar also required as the complementary material in *sie reuboh* processing. The addition of vinegar reported can increase quality of *sie reuboh*. Based on Suhairi (2007), 7.5% of vinegar is added from total of cow-meat used. Based on Masyitah et al., (2016), *sie reuboh* with addition 12% of vinegarhas highest value for hedonic test for colour, aroma, taste, texture and appearance attributes rather than using 0%, 0.1% and 0.14% of vinegar. But up to this time, there is any information available related to sensory quality of *sie reuboh* based on addition of tallowand vinegar.

Sensory quality could be measured by consumer preferences and attributes intensitie.Consumer preferences is definitely have strong linkage with life style and trends (Setyaningsih et al., 2010). Nowadays health and convenience life style are main consideration of consumers, which might have contribution towards the changes in addition level of tallow in *sie reuboh*due its rancidity and rapid oxidation (Suhairi, 2007). On the other hand, addition of vinegar definitely influence the sourness of sie reuboh, but also might involve on the prolonging of *sie reuboh* shelf life.Therefore in order to map consumer preferences and gather up to date formulation of *sie reuboh*, survey is required to be done. To conclude with, the survey is required to map recent formulation of *sie reuboh, whilst* the study

related to sensory quality of *sie reuboh* based on the addition of two materials above is required to map consumer preferences.

2. Materials and Methods

2.1 Materials

Materials used on this study is cow meat, which freshly bought in Lambaro traditional market – Aceh Besar. The cow meat is part of Aceh local cow which is 3 years old. The complement ingredients are allow, pasteurised vinegar (pH 3,6) that has been fermented for three months, red chillies 5%, rawit chillies 1%, garlic 1%, galangal 5%, ginger 1%, salt 1%, turmeric powder 0,3%, lemon extract 2% and 100% of water. All percentages based on total of used fresh meat. For organoleptic test, except sie reuboh, mineral water, coffee powder and unsalted crackers are used (Meilgaard et al., 2008).

2.2 Methods

The research is divided onto two main stages. The first one is survey with face to face interview and laboratory experiment. Survey was conducted in 22 sub-district in Aceh Besar, where two respondents are collected for each district. Sampling is chosen purposively, meaning that only people who naturally understood the know-how of *sie reuboh* processing techniques are interviewed. The interview is guided with questionnaire which is previously validated. Questionnaire consists of 24 ended questions, which divided onto demographic questions and *sie reuboh* information (raw materials, processing and storage condition).

The laboratory experiment done by determining the addition of tallow (0%, 25% and 50%) and vinegar (2.5% and 5%) as independent variables. The defined parameters are colour, aroma, flavour and texture hedonically. The treatments are repeated three times, which made total samples are 18 samples. Data then statistically measured by Analysis of Variance (ANNOVA) and Duncan Multiple Range Test (DMRT) by SPSS 17.0.

2.3 Procedures

Fresh meat is cleaned from fat and cut on to block with average weight 90-100 g, then washed and drained for 5-10 minutes. Before cooking, meat, salt and lime extract and tallow based on treatment placed on *beulanga* and well-mixed. Galangal and other spices are coarse blended for 1-2 minutes, mixed with meat and added water. Then all ingredients cooked for ± 60 minutes until boiled, then vinegar is added and continue boil for another ± 30 minutes. Cooling down the *sie* reuboh, placed on vacuum plastic bags and store for one night at ± 5^{o}C. Prior to analysis, *sie reuboh* is re-cooked for 15 minutes and drained, then cut on 1cm thickness and homogenized all samples. The samples are served to 40 panellists for hedonic test (Meilgaard et al., 2008; AMSA, 2011).

3. Results and Discussion

3.1 Survey

The survey was followed by 44 respondent, who is citizen in 22 districts out of total 23 districts in Great Aceh region. Pulo Aceh, which is the only district where the citizen was not interviewed, is considered as not-representative sample since Pulo Aceh is Small Island and has different traditional cuisine. From the survey, it could be seen that the preferences of consumers towards *sie reubohi*s slightly changed. Table 1 showed the list and amounts of ingredients used during this savoury dish. Compared to other reports (Fitri, 2002; Suhairi, 2007; Masyitah, 2016), the survey gained that amounts of vinegar is decreased from other studies. But this survey also obtained that lime extract is also used as sources of acid whereas it is absence in the other studies.

Table 1. Results of survey and comparison with other studies

Ingredients	Amounts of Ingredients			
	Survey	Fitri (2002)	Suhairi (2007)	Masyitah (2016)
Cow meat (g)	1000	1000	1000	1000
Tallow (g)	0, 250, 500	200	300	0
Traditional vinegar (ml)	25, 50	50, 60, 70, 80, 90	75	0, 100, 120, 140
Fresh red chilies (g)	50	50	50	25
Red chilies powder (g)	0	0	0	10
Rawit chilies (g)	10	0	10	10
Garlic (g)	10	15	10	15
Galangal (g)	50	10	20	20
Ginger (g)	10	20	20	20
Tumeric (g)	3	20	25	20
Salt (g)	10	30	25	15
Lime Extract (ml)	20	0	0	0
Water (ml)	1000	0	125	300
Fresh lime leaves (g)	0	0	0	0, 10, 20, 30

This survey also found out the different amount of tallow, less used of garlic, ginger and turmeric. This changes imply the shifting trend of food diet in Aceh. *Sie reuboh* is known as traditional dish which has high intensity of acid taste and long-shelf life. But nowadays, consumers have benefits of refrigerator which can be used to storing food in low temperatures. Therefore the amounts of vinegar added might be decreased. On the other hand, this survey also found out several range of tallow added, which might be influenced by the health issues. *Sie reuboh* is kind of dish which repeatedly heated prior to consumption. The re-heat process is reported to increase the Iod number, level of rancidity and FFA number (Suhairi, 2007) which lead to high cholesterol amounts and carcinogenic risk. Based on this findings, the option to eliminate tallow or decrease the added amounts is considered by some consumers

3.2 Colour by Hedonic Test

Panellist is scored the color of *sie reuboh* hedonically in range between 2.90-4.27 (neutral-like it) with mean score is 3,53 (like it). ANOVA pointed out that addition of vinegar has significant influence ($P<0.01$) toward its color hedonically, which could be seen in Figure 1. From the figure it clearly explained that each treatment level is significantly difference with others. As many vinegars are added, it tends to increase panellist acceptance up to 4.08 (like it). In normal process, cooking produces Maillard reactions and oxidized the meat, then the protein denatures which changed the meat color into grey or brown (Jamhari et al., 2007).But in *sie reuboh* processing, since the vinegar added, the acidity is low (pH 3.6) the reactions above are prevented. This might be occurred due to vinegar which has low pH, where Purnamasari et al., (2016) reported when acetic acid in vinegar is diffused in protein myofibril of carcass, the negative electrostatic repulse between filaments of carcass is decreased and caused the pale colour of meat, but the carcass seems brighter as it reflects the light.

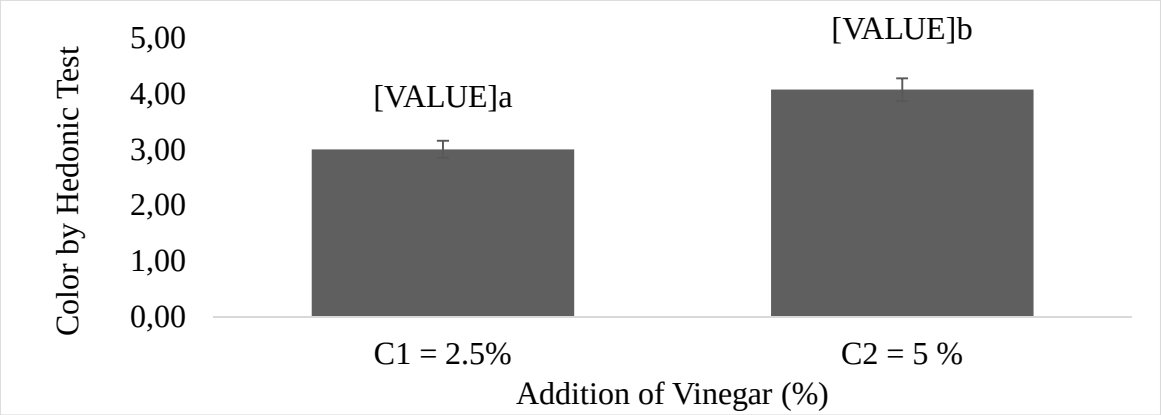

Figure 1. The effect of vinegar addition towards colour of *sie reuboh* assessed hedonically at $DMRT_{0.05}$ = 0.20 (1st level), 021 (2nd level), KK=0.90%, value which is followed with similar alphabet showed the insignificant difference between levels (hedonic scale 1= very much dislike; 2=dislike; 3=neutral; 4=like it; 5= like it very much).

3. 3. Aroma by Hedonic Test

The hedonic scores given by panellist towards aroma of *sie reuboh*are in range between 2.87- 3.67 (neutral-like it) with average is 3,26 (neutral). ANOVA pointed out that two independent variables have significant influence (P<0.01)onaroma *ofsie reuboh*, as presentedin Figure 2 and Figure 3. Figure 2 shows the effect of tallow addition towards aroma of *sie reuboh* perceived by panellist. Panellists tend to prefer *sie reuboh* with high amount of tallow added, even though panellist acceptances towards *sie reuboh* with 25% of tallow is not differentiated with other two levels. Aroma is formatted by fat oxidisation during cooking and releasing the aroma volatiles such as carbonyl and aldehyde. Therefore the amount of tallow added influenced the aroma perceived by panellists, since as many as tallow added, it tends to produce more carbonyl and aldehyde as well as volatilecompounds (Purba et al., 2014; Soeparno, 2011).

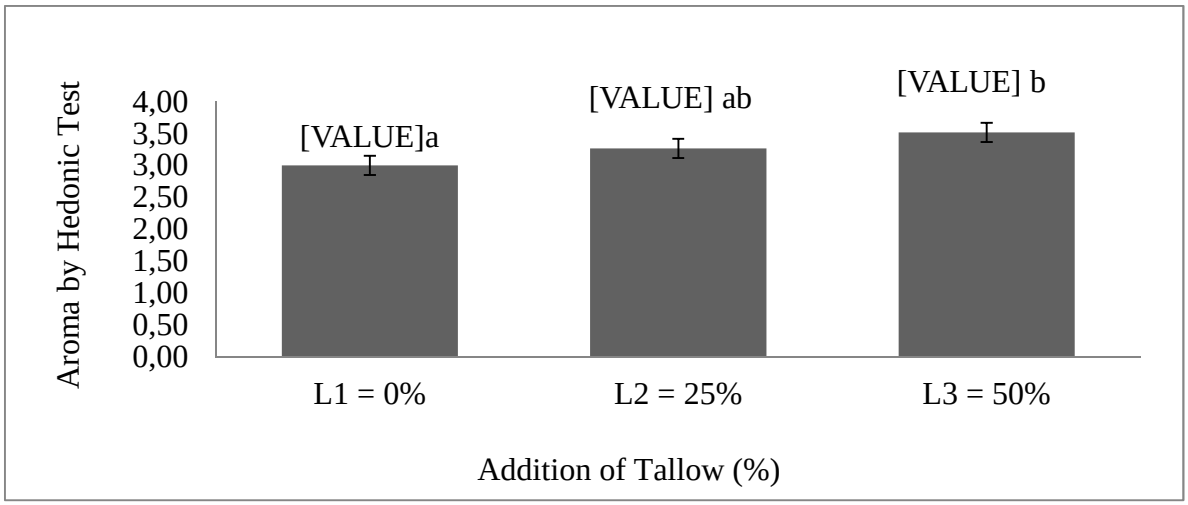

Figure 2. The effect of tallow addition towards aroma of *sie reuboh* assessed hedonically at $DMRT_{0.05}$ = 0.290 (1st level), 0.304 (2nd level), 0.314 (3rd level) KK=1.18%, value which is followed with similar alphabet showed the insignificant difference between levels (hedonic scale 1= very much dislike; 2=dislike; 3=neutral; 4=like it; 5= like it very much).

On the other hand Figure 3 shows the effect of two levels on vinegar addition towards aromaof *sie reuboh* which are significantly different. Panelist tend to perceived *sie reuboh* with more vinegar added with higher acceptance score (3.39-neutral) than the lower one. This is might be occurred due to vinegar intensifythe sour taste, by diffusing through the cell which considered as specific aroma of *sie reuboh*. On the other hand, addition of vinegar is pressing out the bloody aroma, as described as aroma of fresh by lowering the water activity and releasing the volatile compound (Illy *et al*.,2016).

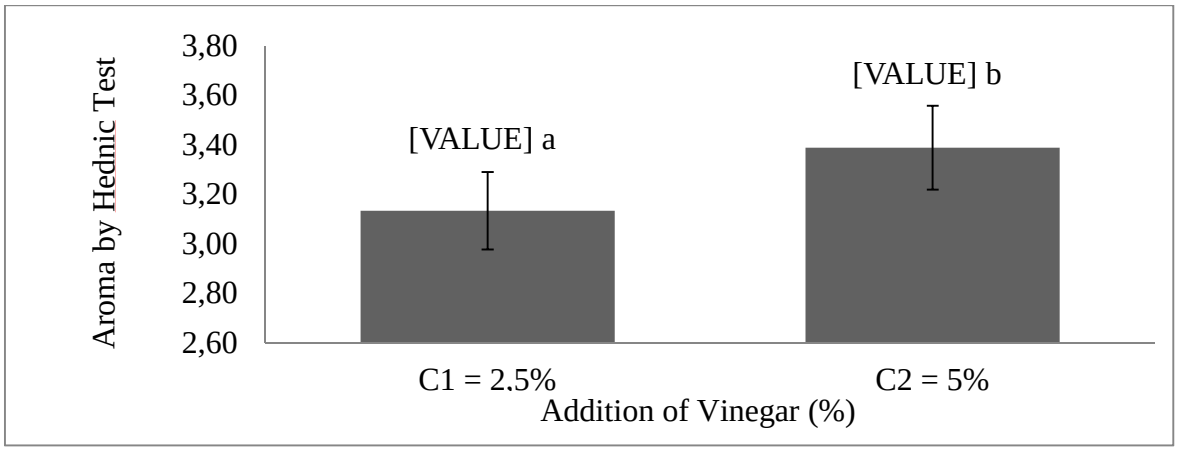

Figure 3. The effect of vinegar addition towards aroma of *sie reuboh* assessed hedonically at $DMRT_{0.05}$ = 0.240 (1st level), 0.250 (2nd level), KK=1.18%, value which is followed with similar alphabet showed the insignificant difference between levels (hedonic scale 1= very much dislike; 2=dislike; 3=neutral; 4=like it; 5= like it very much).

3.3 Flavour by Hedonic Test

Panellist accepted flavour of *sie reuboh* with hedonic score in range of 3.10-3.87 (neutral-like it) with average is 3.53 (like it very much). ANOVA pointed out that two independent variables have significant influence (P<0.01) towards flavor *ofsie reuboh*, as presented in Figure 4 and Figure 5. Figure 4 shows the effect of tallow addition towards consumer acceptance of flavour attributes. Based on consumer preferences, up to 50% of added tallow tend to elevate the flavor of *sie reuboh*, since the first (0% of tallow) and second level (25% of tallow) are not significantly differentiated. As reported by previous studies (Masyitah, 2016: Suhairi, 2007) flavour is manifestestation of chemical reaction during process, specifically named as Stecker degradation and Maillard reaction. These phenomenon's mainly involved by protein and carbohydrates. However, the addition of tallow proven to enhance the flavoursince the lipid is oxidized during the cooking process.

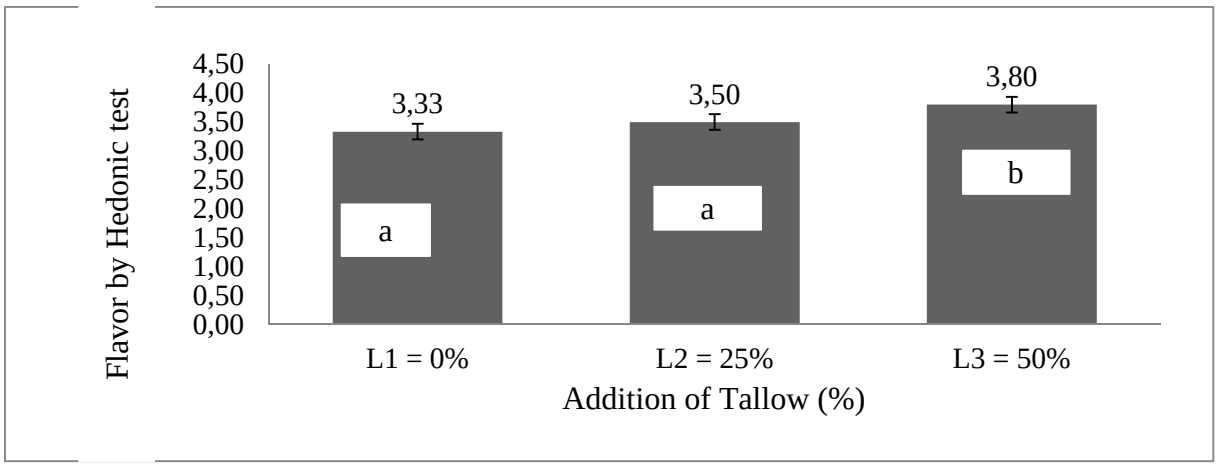

Figure 4. The effect of tallow addition towards flavor of *sie reuboh* assessed hedonically at $DMRT_{0.05}$ = 0.265 (1st level), 0.277 (2nd level), 0.289 (3rd level) KK=0.99%, value which is followed with similar alphabet showed the insignificant difference between levels (hedonic scale 1= very much dislike; 2=dislike; 3=neutral; 4=like it; 5= like it very much).

Moreover, Figure 5 picturize the effect of two level of vinegar addition towards the flavor of *sie reuboh*assessed hedonically by panelist. The given flavor score is significantly differentiated between these two levels, where the consumer acceptance is inline with the amounts of vinegar added. This is because sour or acid flavor is defined as specific characteristics of this dish. Therefore, panelist tend to oversee this flavor. The sour flavor is a an impact of well-diffusion of organic acids through the membrane cells together with water (Illy et al., 2016; Soeparno, 1992).

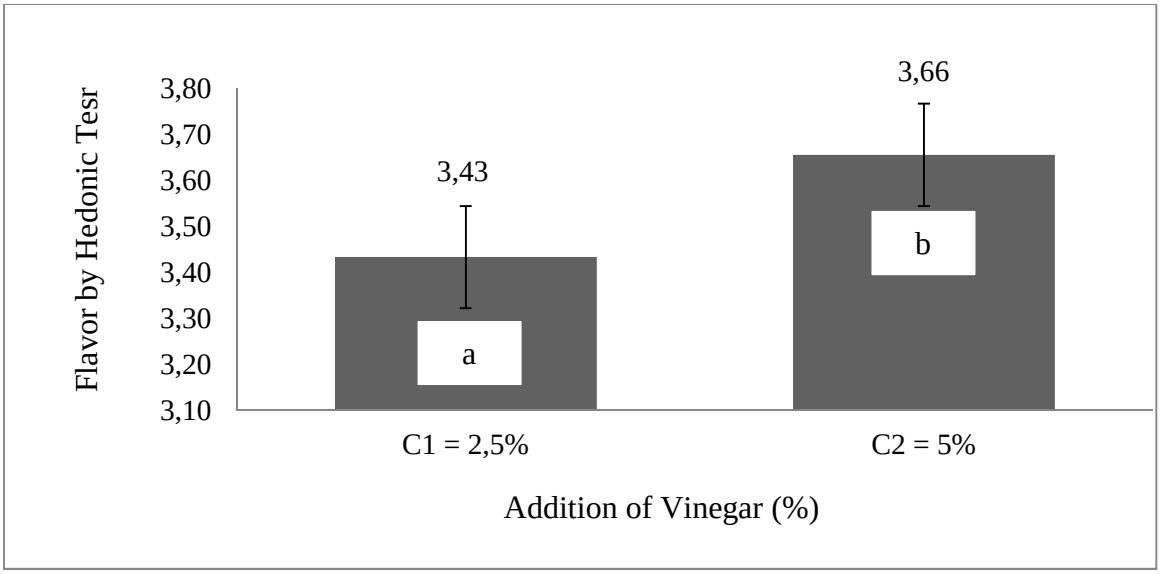

Figure 5. The effect of vinegar addition towards flavour of *sie reuboh* assessed hedonically at $DMRT_{0.05}$ = 0.220 (1st level), 0.230 (2nd level), KK=0.99%, value which is followed with similar alphabet showed the insignificant difference between levels (hedonic scale 1= very much dislike; 2=dislike; 3=neutral; 4=like it; 5= like it very much).

3.4 Texture by Hedonic Test

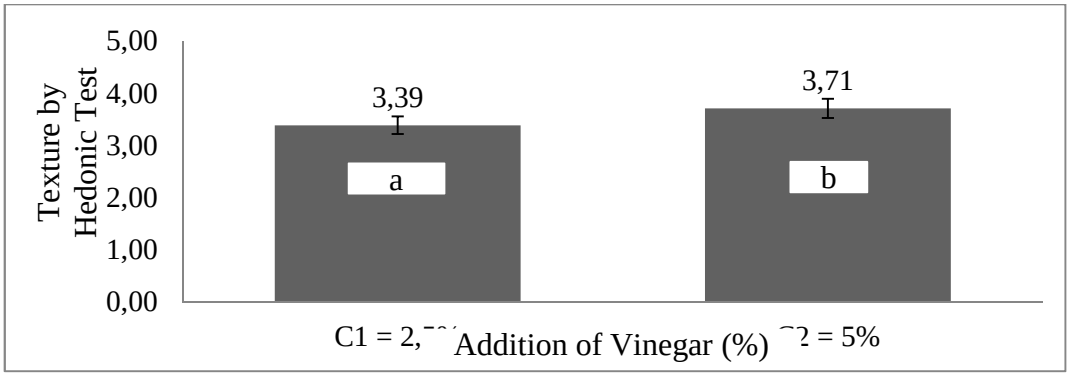

Figure 6. The effect of vinegar addition towards texture of *sie reuboh* assessed hedonically at $DMRT_{0.05}$ = 0.260 (1st level), 0.270 (2nd level), KK=1.19%, value which is followed with similar alphabet showed the insignificant difference between levels (hedonic scale 1= very much dislike; 2=dislike; 3=neutral; 4=like it; 5= like it very much).

The texture of *sie reubohi*s valued hedonically by panellist with score in range of 3.13-3.87 (neutral to liket it) with average is 3.57 (like it very much). ANOVA pointed out that the addition of vinegar has significant influence (P<0.05) towards texture*ofsie reuboh,* as presented in Figure 6. Figure 6 shows the effect of vinegar addition towards texture of *sie reuboh* based on consumer acceptance. From the graph, it could be seen thateach level of added tallow is significantly differentiated. Additionup to 50% of vinegar forces the decrease of pH of *sie reuboh,* which impact toward protein denaturation (Jengel et al., 2016; Winarno, 2008). Then as protein denaturises, protease hydrolizes the actyn, myosin and other muscle tendons such as collagen and elastin. This hydrolysis contributes toward meat tenderness, which at the end has impact towards texture and consumer acceptance (Soeparno, 2005; Setyaningsih etal., 2010).

4. Conclusion

Taking everything into consideration, we can conclude that recently there is slightly shifting of amount and type of ingredients used in *sie reuboh* formulation due to consumer concerns towards health and life style.The amount of vinegar and tallow added in formulation of *sie* reuboh significantly influences sensory attributes and consumer acceptance. Consumers tend to like *sie reuboh* which cooked with 50% up tallow and 5% of vinegar.

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Analysis of The Role of Midwives and Nutritionists in Early Detection of Malnutrition and Growth Disorder in Two Year Old Babies at Narmada Public Health Care Working Area

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Abstract

Acute malnutrition in the form of wasting and chronic malnutrition of stunting are common nutritional issues worldwide especially in developing countries. Midwives and nutritionists are given full responsibility and authority to carry out initial services in community, especially nutritional problems in two year old babies. This study was conducted to find out the role of midwives and nutritionists in early detection and initial management of malnutrition in two year old babies at Narmada Public Health Care working area. This study used mixed method (phenomenology and cross sectional approach). Qualitative data was collected by indepth interview and observation while quantitative data was collected by using a guided questionnaire that had been tested before. From a total of 27 respondents, 25 respondents (92,6%) have good knowledge and 2 respondents (7,4%) have moderate knowledge. The determination of babies nutritional status performed by nutritionist was determined by using three indicators that are weight/age, height/age, and weight/height, while the midwives only using weight/age. Midwives ability to analyse early detection of malnutrition and its initial management is poor, while nutritionists' analysis ability is good.

Keywords: Knowledge, skill, midwife, nutritionist, malnutrition

1. Introduction

Acute nutritional deficiencies the form of chronic malnutrition or stunting children have become nutritional problems in the world, especially in developing countries, including in Indonesia. The World Health Organization (WHO) estimated that 175 million children in developing countries are malnourished based on age-based weight data, and about 230 millions are stunted by height according to age (Kuntari et al, 2011). The prevalence of stunting in Indonesia nationally in 2013 was 37.2%. The result of monitoring of nutritional status conducted by West Nusa Tenggara Provincial Health Office in 2012 indicated that 22.72% of baduta (two year old babies) experienced stunting (short) and 16.82% of them are severely stunted (very short) (Riskesdas, 2013). The First 1000 Days of Life Period is a period of thebeginning in the womb until the age of the first 2 years after birth. During this period there is a rapid and continuous growth especially the development of brain cells so that if there is interruption of nutrient intake, will have an impact on child growth (Setyaningsih, 2009).

Puskesmas (Public Healthcare Center) and Posyandu (Integrated Healthcare Center) as community spearheads have an important role in early detection, screening and first service in the prevention of malnutrition cases (Nency & Arifin, 2005). Midwives as health workers play a role in health providers at the primary level, including responsibility for fostering and monitoring posyandu activities and family assistance. Nutritionists are those responsible for the authority and the right to fully perform services in the field of community nutrition. Based on the background, the researcher intends to conduct research on the role of midwives and nutritionists in early detection of malnutrition and initial management of children under 2 years in the working area of Puskesmas Narmada.

2. Materials and Methods

This research uses combination method with qualitative and quantitative method; qualitative research method using approach of phenomenology and quantitative research

method using cross-sectional approach. Research subjects are all village midwives and nutritionists at Posyandu in the working area of Puskesmas Narmada and midwives and nutritionists working at Puskesmas Narmada in May-June 2017.

In the qualitative method, the research samples used were all village midwives and nutritionists residing in the Posyandu working area of Narmada Puskesmas and midwives and nutritionists working in Narmada Community Clinic that meet the inclusion criteria. Eigth midwives a the Puskesmas, , eleven village midwives and eight nutritionist were taken as the total sample used in this research, with a total number of 27. In qualitative research methods, the selection of research subjects, sample size, and sample selection is conducted by snowball technique.

Qualitative data was collected by indepth interview and observation while quantitative data was collected by filling out the guided questionnaire. Qualitative data analysis is done by revealing the phenomenon of individual experience and quantitative data analysis using Chi-Square test.

3. Results and Discussion

3.1 Characteristics of Respondents

Table 1. Respondent Characteristics

Variables		Amount	percentage (%)
Gender	Male	1	3.7
	Woman	26	96.3
Age	20-30	15	55.5
	31-40	9	33,3
	41-50	3	11,1
Education	D3	25	92,6
	D4	1	3,7
	S1	1	3,7

The table above shows that of 27 respondents, most of the respondents are women (96.3%) and only 1 male respondent (3.7%). Most respondents were in the age range of 20-30 years (55,5%), the rest 9 people (33,3%) were 31-40 years old, and 3 people (11,1%) were 41-50 years old. This age is still classified as adult productive young age and based on research stating that productive age is a period in which a person can maximally achieve satisfactory achievement in his career (Cuwin, 2009) because at this age, a person will be more creative in his work and life (Sari, 2003). The more people get older then the higher the curiosity about health is (Sari, 2003). Increasing the age of a person can affect the increase in knowledge gained, but at certain ages before the elderly, the ability to accept or remember knowledge will decrease (Abu, 2003).

Most of the respondents (92.6%) received D3 (three year undergraduate) education including the nutritionist.; One person (3.7%) is a graduate of D4 midwifery program and 1 person (3.7%) is a graduate of S1 (full undergraduate) midwifery program. The level of education affects a person's ability to understand and perform actions or skills that are taught or trained. The higher education level of a person, the understanding, ability, skill and thoroughness will also be better. A higher level of education is required in performing the tasks at the posyandu so it will be easier for them to absorb and digest the tasks(MOH, 2002). Based on the results of a study performed by Sarma (2016), Mariana (2004), and Wariyah (2001,, the factors that influence the quality of health personnel action are education and

training. This shows the importance of education for health workers to clinical practice in health services.

3.2 Midwives and Nutrition Knowledge About KMS

Tabel 2.Knowledge Level

Category	Amount	Percentage (%)
Bad	-	-
Medium	2	7,4%
Good	25	92,6
Total	27	100,0

The table above shows that from a total of 27 respondents, 25 people (92.6%) have good knowledge on their assigned tasks while 2 respondents (7.4%) have medium knowledge and no respondents are categorized as having bad knowledge. Good knowledge tends to improve the quality of their work. If the quality of their work is good, then the performance of Posyandu will be better as well.

The ability of health workers in counseling is not far from the knowledge they have. Knowledge is the result of knowing and occurs after a person performs sensing, eg sight, hearing, smell, feeling and touch towards a particular object through the level of know, understand, application, analysis, and synthesis. Knowledge can be obtained in a non-scientific way, eg trial and error, power, personal experience, thought, or scientific (Notoatmodjo, 2003)[7]

The results of qualitative research indicate that the way to determine the nutritional status of children performed by nutritionists is correct, i.e by using three indicators, namely BB / U, TB / U, and BB / TB. This has not been applied by midwives who only use KMS or BB / U indicators alone in measuring the nutritional status of the child. In interpreting the nutritional status of the child in the case given, all the nutritionists responded appropriately. For the midwives, only 6 out of 14 responded correctly. A total of 8 midwives made the wrong interpretation. The respondents of the midwives who answered incorrectly consisted of 3 midwives and five village midwives.

Assessment of risk of failure to grow in children was answered correctly by 6 out of 7 nutritionists while almost all midwives were wrong in determining the risk of developing baduta in the given cases. Respondents said reevaluation would be done within 1 month of cases requiring 1-2 weeks evaluation. This is in line with previous results indicating that good knowledge does not guarantee that a person will apply them in action and make them skilled in performing tasks, so training is required more than practice with the lecture method of the puskesmas (Sutiani, 2014).

3.3 Midwife Skills and Nutrition

In the period of research during May to June 2017, no midwives or nutritionistsdid the measurement of body weight and height were found. Weight measurements were performed by cadres during posyandu and height measurements were not performed. Based on the results of interviews with village midwives and nutrition workers it is known that the height measurement using the length board is done once every three months in the assigned weighing month.

The results of research by Suryansyah et al 2016 on the Relationship Between Knowledge and Skills of kader with Stunting Event in Working Area of Puskesmas Narmada

indicates that knowledge and skill and ability in early detecting of stunting is bad. In the study, it is also mentioned that the skills of kader in anthropometry measurements are bad. This condition can make the wrong interpretation of nutritional status.

The results of interviews and observation show that height measurement is not done every month. Fidteen respondents said that the height measurement using the length board is done once every three months in the weighing month. This indicates that the procedure performed was not appropriate where the child's body length or height should be measured monthly (Setyaningsih, 2009).

Length or height measurement are important indicators for assessing the nutritional status of children. The purpose of early detection is to know the existence of deviations or disorders and development of baduta children. Early detection should be done completely and correctly to determine the actual condition of the child because early detection is one of the act of data assessment to see the condition of the child so that the next action can be determined. It is hoped that with the right early detection, it will be easier to determine the action to be done (Setyaningsih, 2009)

4. Conclusions and Recommendations

4.1 Conclusion

Based on the results of qualitative and quantitative data analysis and discussion, the conclusions of this study are as follows:

1. Knowledge of midwives and nutrition workers in the working area of Narmada Puskesmas on KMS is mostly good.
2. Midwife and nutrition skills in the working area of Narmada Puskesmas regarding the measurement and interpretation of nutritional status can not be evaluated because all are done by the cadres.
3. Implementation of nutritional status measurement activities in posyandu is not according to standard in terms of time and tools, height measurement is only done every 3 months and weight done every month, by using == tape meter as the tool.
4. Ability of midwife analysis in early detection of malnutrition and early management is poor.

4.2 Recomendations

There should be more guidance to the cadre in charge of measuring to improve the knowledge and skills about antropometric standard inspection and interpretation. Coaching can be done with a more intensive method. One example is through continuos "Train of Trainer" (TOT) followed by all cadres.

1. The role of midwife and nutrition actively in early detection of malnutrition and baduta growth
2. Working with the educational institutions Faculty of Medicine, University of Mataram in doing TOT as a form of community service of teaching staff of the Faculty of Medicine, University of Mataram.
3. The teamwork from across professions./sector should be encouraged.
4. Training on nutritional analysis and interpretation on baduta for Doctor, Nutritionist, and Midwife is needed.

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Correlation betweenBCL-2 and LMP-1 expression in patients with Nasopharyngeal Carcinoma WHO Type III

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Abstract

Epstein-Barr virus (EBV) is associated with Nasopharyngeal carcinoma (NPC). Previous studies have found an increased expression of latent membrane protein (LMP) 1in NPC. However the correlation between NPC prognosis and EBV remains unclear. The aim of this study was to investigate the correlation between LMP-1 and BCL-2, one of the prognostic factors in NPC.Forty-four patients with NPC,age range between 20-79 years old, were treated in West Nusa Tenggara General Hospital, Indonesia.The presence ofBCL-2 and LMP-1 was detected by immunohistochemistry (IHC) staining. Approximately 34% biopsies showed a positiveLMP-1 expression in tumor cells and 66% were positive for BCL-2 expression. LMP-1 expression was strongly correlated with BCL-2 expression (r = 0.733, p=0,002).In conclusion, the prognosis of NPC may involve BCL-2 expression. However it is also possible that upregulated BCL-2 expression could be due to LMP-1 independent mechanisms.

Keywords: NPC, EBV, BCL-2, LMP-1, Immunohistochemistry.

1. Introduction

Nasopharyngeal carcinoma (NPC) is a malignancy in epithelialof nasopharyngs, which is anatomycally covert by small cavity of nasopharyngs. This leads to difficulty in early diagnosis. Finally, most cases of NPC are found in advance stage.

NPC is one of the most prevalent malignancy in Southern China and Southeast Asia region. Approximately 50.000 new cases were reported every year in theseregions (Lo et al, 2006). In Indonesia the prevalence of NPC reach 6,2 per 100.000 people annually. Itis predominant in male with a ratio 2-3:1. According to studies in several countries, undifferentiated carcinoma (WHO type 3) was the most common histopathologic type of this malignancy (Lo et al., 2006, Adham et al, 2012, Fendri et al, 2011).

NPC is one of the classic malignancies associated with EBV infection. Several studies showed their correlation with several methods. Osman et al., (2012) found a correlation of NPC and EBV with imunohistochemistry and hibridization. According to their study, 90% of patient with NPC were infected by EBV. Another author use a PCR to identify several latent proteins of this virus, including LMP-1. According to this research, EBV infection is about 65-90%.

B-cell lymphoma-2 or BCL-2 is a human proto-oncoprotein, located in nucleus membrane, reticulum endoplasma and the outer layer of mitochondrial membrane (Tulalamba W and Javsistri T, 2013). The oncogenic effect of BCL-2 is exerted through inhibition of cell apoptosis. Therefore the presence of BCL-2 has been considered as one of prognostic factors of NPC. Overexpression of BCL-2 has been reported to correlate with aggressive traits in NPC such as lymph node infiltration, metastasis, recurrence and poor survival rate (Tulalamba W and Javsistri T, 2013).

The aim of this study was to investigate the correlation of BCL-2 and LMP-1in patients with NPC in Lombok. Lombok is one of the islands in Indonesia located in the eastern part of Indonesia.We were interested to conduct the study in Lombok due to low

environmental condition and personal hygiene status susceptible to EBV infection(Adham et al, 2012).

2. Material and Methods

2.1 Subjects

Biopsies and medical records of 44 patients,age range between 20-79 years old, treated in West Nusa Tenggara General Hospital, Indonesia, consecutively collected between 2012 to 2016 were studied. Histological classification was made using the World Health Organisation standard criteria. NPC with histological classification WHO type III was observed. This study has been approved by the ethics committee of Mataram University, Indonesia.

2.2 Detection of LMP-1 and BCL-2

Imunohystochemistry techniquewas used to detect LMP-1 and BCL-2 expression (antibody primer COX-2(code M3617,clones CX-294, monoclonal; DAKO Japan, dilution 1:1000)).The expression of LMP-1 was classified as positif or negative depending on the staining cell colour. Blue colour referred to negative and light brown referred to positive. For BCL-2 it was classified as negative if the cell staining (brown colour) less than 1 %, positive 1 if cell staining 1-9%, positive 2 if 10-50% and positive 3 if more than 50%.

3. Result and Discussions

During the study period, 44 patientsenrolled to this study. NPC occurred mainly in the age range of 40-49 years old (29,5%) (Table 1). The proportion of patients above 40 years old with NPC was twice as much as those below 40 years old. There were more male patients diagnosed with NPC than the females (Table 1).

Table 1 Distribution of subject agesand gender

Age category (year)	Frequency (%)	Male (%)	Female (%)
20-29	7 (15,9)	4 (9,1)	3 (6,8)
30-39	10 (22,7)	6 (13,6)	3 (6,8)
40-49	13 (29,5)	8 (18,2)	6 (13,6)
50-59	9 (20,4)	8 (18,2)	1 (2,3)
60-69	3 (6,8)	2 (4,5)	1 (2,3)
70-79	2 (4,5)	1(2,3)	1 (2,3)
Total	**44 (100)**	**29 (65,9)**	**15 (34,1)**

According to IHC staining of44 parafin blockfrom NPC patients, 15 (34,1%) was BCL-2 negative, 13 (29.5%) positive 1, 1 (2.2%) positive 2 and 15 (34.1%) positive 3 (Table 2 and Figure 1). In contrast, 29 (65.9%) was LMP-1 negative and 15 (34.1%) was LMP-1 positive (Table 3 and Figure 2).

Table 2. BCL-2 expression in NPC WHO type III

BCL-2	Amount	Percentage (%)
0	15	34,1
+1	13	29.5
+2	1	2,2
+3	15	34,1
Total	**44**	**100.0**

In this study, correlation analysis between BCL-2 and LMP-1 were performed by using Lambda test. The result showed that LMP-1 was strongly correlated with BCL-2 expression (r=0.733, p=0,002).

Table 3. LMP-1 expression in NPC WHO type III

LMP-1	Amount	Percentage (%)
Negative	29	65,9
Positive	15	34,1
Total	**44**	**100.0**

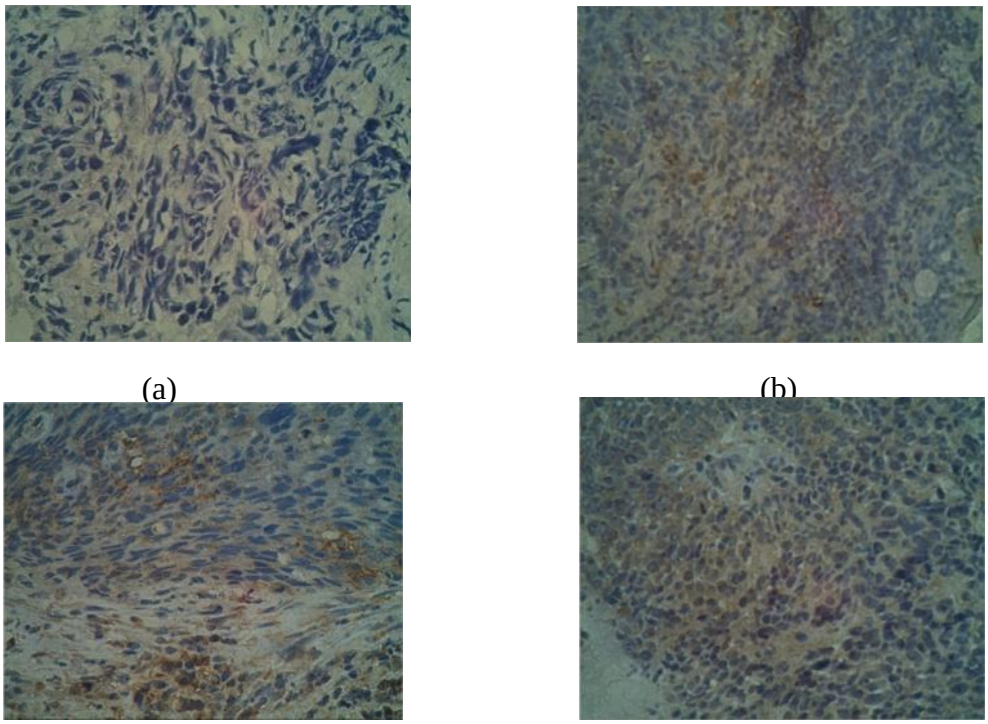
This study explored the association between EBV infection and NPC WHO type III. The characteristics of subject with NPC in our study are in line with the previous studies (i.e. more male with NPC than female with NPC, more NPC cases in subjects above 40 years). The gender susceptibility may be caused by alcohol consumption and smoking (Adham et al, 2012; Osman et al, 2014; Barnes et al, 2015; Chua et al, 2016).

Our result showed that the majority of patient with NPC were more than 40 years old. This result is similar with Bortakhur et al (2016), Fendri et al (2011) and Adham et al (2012). Consumption of salted fish and exposure to carcinogenic agent have been suggested as the main contributor for the occurance of NPC (Zheng et al, 2010). In Lombok, due to its geographic location, salted fish is commonly consumed by the locals.

In this study, LMP-1 was positive in 34% cases, whereas BCL-2 positive were in 66% cases.Expression of LMP-1 in NPC varied between researchers depending on the method used. Li et al (2007) detected 43% LMP-1 positive (24 of 56 patients) using IHC method. Using similar primer as the present study, Barcella et al (2004) reported only 6 of 40 (15%) patiens with LMP-1 positif. Others found more frequent expression of EBV in NPC patients.

According to Yip et al (2006), BCL-2 was more commonly observed in Asian/Chinese people (33 of 49 or 67%). Fendry et al (2011) found higher BCL-2 L12 expression were correlated with shorter disease free survival (0,017) and higher risk of relapse (hazard risk 6,82). BCL-2 L12 is a family of BCL-2 apoptosis. On the other hands, Kontos et al (2013), on his study about BCL-2 associated X genes (BAX) which is a family of pro-apoptosis of BCL-2, found that BAX expression is associated with longer disease free survival (p=0,016). Those resultstend to support the hypothesis that BCL-2 is important in prognosis of NPC.

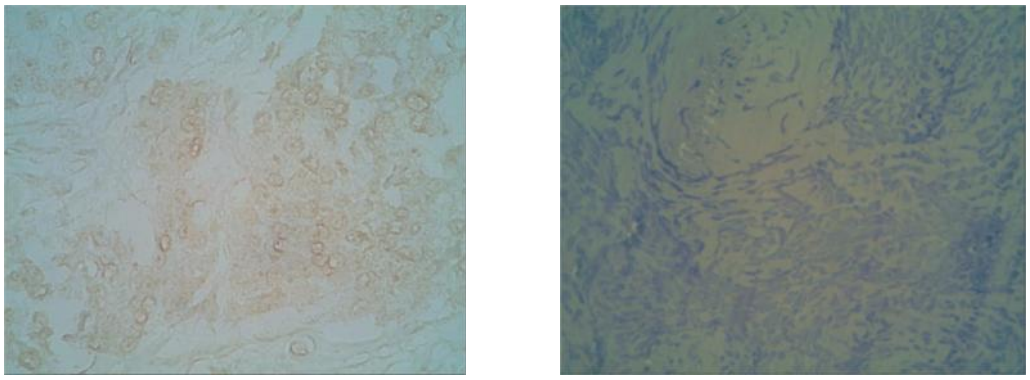
We also found a strong correlation between LMP-1 and BCL-2 expression. This finding is in line with the previous studies in adult NPC. Although the association between BCL-2 and EBV is still debated, this result is very important for the future strategic of NPC treatment, especially in specific region such as Lombok which has a low human development index (32 of 33 provinces in Indonesia) (BPS, 2016). The treatment should included BCL-2 as an important prognostic factors of NPC.



(a) (b)

(c) (d)

Figure 1.ExpressionBCL-2 (IHC staining) :(a) negatif (-) brown colour less than 1%, (b) positif 1 (+) brown colour 1-9%, ExpressionBCL-2 (IHC staining) (continued) : (c) positif 2 (++) brown colour 10-50%, (d) positif 3 (+++) brown colour more than 50%



Positive (ligth brown colour) **Negative (blue colour)**

Figure 2. Expression of LMP-1 (IHC Staining)

4. Conclusions and Recommendations

In conclusion, the prognosis of NPC may involve BCL-2 expression. However it is also possible that upregulated BCL-2 expression could be due to LMP-1 independent mechanisms.

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