

The **2<sup>nd</sup>** ICST 2017

Lombok - Indonesia. August, 23<sup>rd</sup> - 24<sup>th</sup> 2017



UNIVERSITI  
MALAYA

KUALALUMPUR

# Certificate

Awarded to

**Ngudiyono**

As **Presenter**

The 2<sup>nd</sup> International Conference on Science and Technology

*“Joint International Conference on Science and Technology in The Tropic”*

at University of Mataram  
West Nusa Tenggara, Indonesia

August, 23<sup>rd</sup> - 24<sup>th</sup> 2017



University of Mataram  
Rector,

Prof. Ir. H. Sunarpi, Ph.D.

The 2<sup>nd</sup> ICST 2017  
Chairman,

**2<sup>nd</sup> ICST 2017**  
THE EMERGENCE OF SCIENCE  
FOR HUMAN PROSPERITY AND HEALTH

Dr.rer.nat. Lalu Rudyat Telly Savalas



# 2<sup>nd</sup> 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

**AUGUST 23<sup>rd</sup>-24<sup>th</sup> 2017  
UNIVERSITY OF MATARAM**



**ISBN : 978-602-61265-1-1**





## **PROCEEDINGS**

**The 2<sup>nd</sup> International Conference on Science and Technology 2017**  
**“Joint International Conference on Science and Technology in The Tropic”**

**Mataram, August, 23<sup>th</sup>-24<sup>th</sup> 2017**

**PUBLISHED BY :**

**Universitas Mataram**

**Jl. Majapahit, No 62 Mataram West Nusa Tenggara, Indonesia 83125**

**Telp: +62-0370-633007**

**Fax: +62-0370-636041**

## PROCEEDINGS

### The 2<sup>nd</sup> International Conference on Science and Technology 2017 “Joint International Conference on Science and Technology in The Tropic”

Mataram, August, 23<sup>th</sup>-24<sup>th</sup> 2017

**Person In Charge** : Dr.ret.net. Lalu Rudyat Telly Savalas

**Council Committee** : Prof. Dr. Ir. H. Lalu Wiresapta Karyadi, M.Si

**Head of Steering Committee** : Prof. Ir Sunarpi, Ph.D

**Deputy of Steering Committee** : Prof. Dr. Dato' Azizan Abu Samah

**Peer Reviewer** :

Prof. James Gannon, Ph.D

Prof. Dr. Mohammad F.R. Hassanien

Prof. Dr. Lim Phaik Eem

Prof. Yong Hoi Sen

Prof. Helmut Erdman

Prof. Ir. Sunarpi., Ph.D

Prof. Ir. Sri Widuastuti, Ph.D

Prof. I Made Sudarma

Prof. I Komang Damar Jaya., Ph.D

Dr. Islamul Hadi

Dr. rer.nat. Teti Zubaidah, ST., MT

I Wayan Sudiarta, Ph.D

Dr. Imam Bachtiar

Dr. Syahrul

Aluh Nikmatullah., Ph.D

**Editor and layout:**

Dr.ret.net. Lalu Rudyat Telly Savalas

Cahyo Mustiko, ST.,M.Sc., Ph.D

Ir. Aluh Nikmatullah, Ph.D

Nanda Diniarti, S.Pi., M.Si

Dewi Nur'aeni Setyowati, S.Pi, M.Biotech

**ISBN : 978 - 602 - 61265 - 1 - 1**

Cetakan pertama : Agustus 2017

**Published by :**

Universitas Mataram

Jl. Majapahit, No 62 Mataram West Nusa Tenggara, Indonesia 83125

Telp: +62-0370-633007 / Fax: +62-0370-636041

**Copyright law protected**

Don't to quote, reproduce and translate some or all of these books  
without the permission of the publisher

## KEYNOTE SPEAKERS

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

## **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 “2<sup>nd</sup> 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 23<sup>rd</sup> to 24<sup>th</sup> 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 2<sup>nd</sup> ICST 2017

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

**OPENING SPEECH - RECTOR THE UNIVERSITY OF MATARAM**  
**The 2<sup>nd</sup> 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 2<sup>nd</sup> 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**

TABLE OF CONTENTS

Title	Page
<b>Preface</b>	i
<b>Opening Speech</b>	ii
<b>Table of Contents</b>	lii
<b>Agribusiness System in The Agro Tourism Area of Gumantar, North Lombok</b> Zainuri, Taslim Sjah, Ahmad Syauqi, Jayaputra	1-4
<b>Farming system in Dryland Area of North Lombok</b> Taslim Sjah <sup>1*</sup> , I Gusti Lanang Parta Tanaya <sup>1</sup> , Halil <sup>1</sup> , Budy Wiryono <sup>2</sup>	5-11
<b>Improving Maize Yield in Tropical Drylands Through Optimum Sunlight Interception by The Plant Canopy</b> I Komang Damar Jaya <sup>1*</sup> , Sudirman <sup>1</sup> , Jayaputra <sup>1</sup>	12-19
<b>Potential of Ant Plant (<i>Myrmecodiapendans</i>) Infuse as an Acute Diarrhea Medicine: An experiment on Rat as a model</b> Yoni Astuti <sup>1*</sup> , Idiani Darmawati <sup>2</sup> , Tantri Wahyu Utami <sup>3</sup>	20-24
<b>Three Dimensional Media and Computer Simulation for The Concept of Heat in Physical Learning</b> Hikmawati <sup>1*</sup> , Kosim <sup>1</sup> , Sutrio <sup>1</sup>	25-31
<b>The Effect of Fractionated Solvent Combination and Sample Concentration on Sun Protection Factor (SPF) Value of Corn Silk Methanol Extract</b> Rosalina Ariesta Laeliocattleya	32-36
<b>Uniformity Evaluation of Self Compacting Concrete Properties in Beam-Column Structural Elements Using Non-Destructive Testing</b> Ni Nyoman Kencanawati <sup>1*</sup> , Akmaluddin <sup>1</sup> , Hariyadi <sup>1</sup> , Suryawan Murtiadi <sup>1</sup> , Hafiz Hamdani <sup>1</sup>	37-43
<b>The Contribution of Soil Management Strategies to Plant and Soil Physical Health, and Soil Microbial Community</b> Lily Ishak <sup>1*</sup> , Philip Brown <sup>2</sup>	44-50
<b>Effectiveness of Goat Milk Yogurt Starter Against Various levels of HDL, LDL and Triglycerides in male white rats (<i>Rattus norvegicus Wistar strain</i>)</b> Sujono <sup>1</sup> , Wardoyo, I <sup>1</sup> , Putra, L.Y. <sup>1</sup>	51-54
<b>Adsorption of Free Fatty Acid from Crude Palm Oil on Natural Zeolite Activated with Sodium Hydroxide</b> Zhilal Shadiq <sup>1</sup> , Sang Kompang Wirawan <sup>1*</sup> , Arief Budiman <sup>1</sup>	55-61
<b>Hypoglycemic Effect of <i>Brucea javanica</i> (L) Merr Leaves and Seed Extract in Alloxan-induced Diabetic Rats</b> Handa Muliasari <sup>1*</sup> , Candra Dwipayana Hamdin <sup>1</sup> , Agus Dwi Ananto <sup>1</sup> , Muhsinul Ihsan <sup>2</sup>	62-67
<b>Capability Analysis to Regional Innovation Development Based on the Locality Characteristics in Jawa Timur Province</b> Ninie Fajar Puspita <sup>1*</sup> , Udisubakti Ciptomulyono <sup>2</sup> , Bambang Syairudin <sup>2</sup> , Arya Yudhi Wijaya <sup>3</sup>	68-75
<b>Aquaculture Waste as Ingredients For <i>Cyprinus carpio</i> Feed</b> Haerudin <sup>1*</sup> , Zaenal Abidin <sup>1*</sup> , Ayu Adhita Darmayanti <sup>1</sup>	76-80
<b>Yield and Growth Mungbean (<i>Phaseolus radiates</i> L.) with additional Organic Fertilizer under Intercropping System</b> Eka Widiastuti <sup>*</sup> , Fitria Zulhaedar dan Lia Hadiawati	81-91
<b>Desaining And Developing Rechargeable Aluminium-Ion Battery Based On Corncob As Activated Charcoal</b> Fitriah <sup>1*</sup> , Sri Wahyuni <sup>1</sup> , Aris Doyan <sup>2</sup>	92-99
<b>Urea Recovery from Industrial Wastewater by Adsorption using Porous Carbon and Its Utilization as Fertilizer</b>	100-106



Theresia Evila <sup>1*</sup> , Agus Prasetya <sup>1,2</sup> Teguh Ariyanto, Imam Prasetyo <sup>1,2</sup>	
<b>Imagined Regional Communities: Language Issue in a Decentralisation Policy in Indonesia</b> Ahmad Sirulhaq	107-111
<b>Magnetotelluric Data Processing Based on Hilbert – Huang Transform</b> Marendra Dwi Jatmiko <sup>1*</sup> , Warsa <sup>1</sup>	112-120
<b>Study on Performance and Environmental Impact of Sugarcane-Bagasse Gasification</b> Shafwan Amrullah <sup>1*</sup> , Indra Perdana <sup>1</sup> , Arief Budiman <sup>1,2</sup>	121-127
<b>The Effective Extension Methods for Prevention of Anthrax Diseases on Smallholders Farming in Suprotong West Nusa Tenggara Province as A World Halal Tourism Destination</b> Mashur	128-135
<b>Formula Optimisation of Milk Chocolate Bars Based on the Physical Quality and Organoleptic Characteristics</b> Dedy Rahmad <sup>1*</sup> , Muhammad Ikhsan Sulaiman <sup>2</sup> , Eti Indarti <sup>2</sup>	136-142
<b>Effect of Design Variation of Corncob Biomass Gasification on Boiling Time and Flaming Duration</b> Joniarta I Wayan <sup>1*</sup> , Wijana Made <sup>1</sup>	143-147
<b>Activity of Bamboo Rhizobacteria to Inhibit <i>Fusarium oxysporum</i> with In Vitro Screening</b> Baiq Yunika Hayatin <sup>1*</sup> , Faturrahman <sup>1</sup> , Ernin Hidayati <sup>1</sup>	148-152
<b>Isolation and Identification of Chitinolytic Bacteria from Intestinal Tissue of Tilapia (<i>Oreochromis niloticus</i>)</b> Alis Mukhlis <sup>1*</sup> , Sadikin Amir <sup>1</sup> , Nurliah <sup>1</sup> , Bagus Dwi Hari Setyono <sup>1</sup> , Endang Wulandari Suryaningtyas <sup>2</sup>	153-158
<b>Structural Behaviour of Spherical Hollow Reinforced Concrete Beam under Flexural Loading</b> Suryawan Murtiadi <sup>1*</sup> , Akmaluddin <sup>1</sup> , Maskimi <sup>1</sup>	159-162
<b>New Record <i>Phoniscusatrox</i> in The Developed Ecotourism Area of South Lombok Island, West Nusa Tenggara</b> Siti Rabiatal Fajri <sup>1</sup> , Sri Nopita Primawati <sup>1</sup> , Islamul Hadi <sup>2</sup> , Galuh Tresnani <sup>2</sup>	163-165
<b>The Application of Ground Pumice in Foamed Concrete for Accoustic Material</b> Maria Asunta Hana Pramudawati <sup>1*</sup> , Iman Satyarno <sup>1</sup> , M. Fauzi Siswanto <sup>1</sup>	166-173
<b>Chemical Compounds Analysis of Green Bean and Its Effect on <i>KopiLuwak</i> Cupping Quality</b> Murna Muzaifa <sup>1*</sup> , Dian Hasni <sup>1</sup> , Anshar Patria <sup>1</sup> , Febriani <sup>2</sup> , Amhar Abubakar <sup>3</sup>	174-182
<b>Quality of Gayo Arabica Coffee Affected by Farm Altitude and Coffee Varieties</b> Yusya Abubakar <sup>1</sup> , Dian Hasni <sup>1*</sup> , Heru Prono Widayat <sup>1</sup> , Murna Muzaifa <sup>1</sup> , Mahdi <sup>2</sup>	183-189
<b>Profesional Caring Factor Factors in Providing Services to Clients in Puskesmas</b> Ermina Istiqomah <sup>1*</sup> , Dwi Nur Rachmah <sup>1</sup> , Sudjtmiko Setyobudihono <sup>2</sup> , Fendy Suhariadi <sup>3</sup>	190-202
<b>A Case Report: A-27-years-old female with <i>ST-Elevation Electrocardiography: STEMI or Pericarditis?</i></b> Y. Pintaningrum <sup>1</sup> , S. Alifiya <sup>2</sup>	203-206
<b>Developing of Rechargeable Allumuim-Ion (Al-ion) Battery with Basic Material Activated Coconut Shell Charcoal</b> S. Wahyuni <sup>1*</sup> , Fitriah <sup>1</sup> , A. Doyan <sup>1</sup>	207-212
<b>Simulation of Monthly Rainfall Data of Dodokan Watersheed Using Nonparametric Statistical Downscaling Model</b> Mustika Hadijati <sup>1*</sup> , Desy Komalasari <sup>1</sup> , Nurul Fitriyani <sup>1</sup>	213-219
<b>Simulation of Monthly Rainfall Data of Dodokan Watersheed Using Nonparametric Statistical Downscaling Model</b>	220-229

Mustika Hadijati <sup>1*</sup> , Desy Komalasari <sup>1</sup> , Nurul Fitriyani <sup>1</sup>	
<b>Enhancement Flexural Strength of Brick Masonry Wall with Polypropylene Bands</b> Andreas Sugijopranoto <sup>1*</sup> , Andreas Triwiyono <sup>1</sup> , Henricus Priyosulistyo <sup>1</sup>	230-236
<b>Utilization of NanoChitosan as Biomordant of Natural Indigo Dye on Cotton Fabrics</b> Ira Purnawati <sup>1*</sup> , Yuni Kusumastuti <sup>2*</sup> , Hary Sulistyo <sup>1</sup>	237-242
<b>Flexural Properties of Tropical Natural Fibres Reinforced Epoxy Composites Prepared Using Vacuum Bagging Method</b> Jauhar Fajrin <sup>1*</sup> , Pathurahman <sup>1</sup> , Suparjo <sup>1</sup> , Teti Handayani <sup>1</sup>	243-249
<b>The Efficacy of Various Cropping Paterns to Utilize a Carry Over Fertilizer Aplication from Tobacco.</b> Nani Herawati <sup>1*</sup> , Putu Cakra Putra Adnyana <sup>1</sup> , Sudarto <sup>1</sup> , Baiq Nurul Hidayah <sup>1</sup>	250-256
<b>El-Nino Characteristics Based On Reservoir Volumetric</b> I Wayan Yasa <sup>1*</sup> , Moh. Bisri <sup>2</sup> , Moch. Solichin <sup>2</sup> , Ussy Andawayanti <sup>2</sup>	257-262
<b>Finite Element Modelling of Creep Glued-Laminated Bamboo</b> Ngudiyono <sup>1*,2</sup> , Bambang Suhendro <sup>3</sup> , Ali Awaludin <sup>3</sup> , Andreas Triwiyono <sup>3</sup>	263-268
<b>Physicochemical and Sensory Properties of Chicken Stock Powder Added with Carrots Extract (<i>Daucus carota</i>, L.)</b> Ismed <sup>*</sup> , Aisman, Suci Eka Amalia	269-275
<b>Growth, Yield and Seed Quality of Corn (<i>Zea mays</i> L.) due to Leaf Defoliation After Tassel ini Dry Land of Lombok Island Indonesia</b> Hiryana Windiyani <sup>1,2*</sup> , Eko Widaryanto <sup>2</sup> , Titiek Islami <sup>2</sup>	276-282
<b>Folate Content In Spinach (<i>Amaranthus</i> sp.), Katuk Leaves (<i>Sauropus androgynous</i>, (L.) Merr) and Singgalang Radish (<i>Brassica oleracea</i>) After Being Processed</b> Cesar Welya Refdi <sup>1*</sup> , Fauzan Azima <sup>1</sup> , Prima Yaumil Fajri <sup>2</sup>	283-286
<b>The Effect of Various Macroalgae Extract in Lombok to Mortality of <i>Artemia salina</i> Larvae</b> Novita Hidayatun Nufus <sup>1</sup> , Mursal Ghazali <sup>2</sup> , Rina Kurnianingsih <sup>2</sup> , Aluh Nikmatullah <sup>3</sup> , Sunarpi <sup>2*</sup>	287-290
<b>Tuned Mass Damper as Alternative Solution for Pedestrian Comforet in Existing Truss Bridge</b> Yumna Cici Olyvia <sup>1*</sup> , Bambang Suhendro <sup>1</sup> , Ashar Saputra <sup>1</sup>	291-298
<b>Children's Playground and Safety at the Kahayan Riverbank Settlement, Palangkaraya</b> Parmonangan Manurung	299-304
<b>The Potency of Kersen Leaves (<i>Muntingia calabura</i> Linn.) to Decrease High Blood Sugar Level</b> Ihlana Nairfana <sup>1*</sup> , I Ketut Suter <sup>2</sup>	305-308
<b>Subsurface Structure Interpretation of Southern Flank of Tangkuban Parahu Based on Gravity Method</b> Hasdi Abdullah <sup>1*</sup> , Djoko Santoso <sup>2</sup>	309-318
<b>The Importance of Early Maturing Hybrid Maize in The Limited Rainfall Areas to Anticipate Climate Changes</b> Baiq Tri Ratna Erawati <sup>1*</sup> , Awaludin Hipi <sup>1</sup> , Andi Takdir M. <sup>2</sup>	319-324
<b>A Neural Network Model for Indonesia's Foreign Reserves Model</b> Syamsul Bahri	325-331
<b>The Use of Near Infrared Technology for Rapid Measurement of Soil Nitrogen in Rice Paddy Field of Lombok Island</b> Bambang Hari Kusumo	332-336
<b>Sea Horse (<i>Hippocampus</i> sp.) Broodstock Culture in Controlled Tank</b> Dewi Nur'aeni Setyowati <sup>1*</sup> , Nanda Diniarti <sup>1</sup> , Nunik Cokrowati <sup>1</sup>	337-339

<b>Analysis on Heat Energy Utilization on White Copra Drying using Solar Energy Tray Drier</b> Murad <sup>1*</sup> , Rahmat Sabani <sup>1</sup> , Guyup Mahardhian Dwi Putra <sup>1</sup> , Diah Ajeng Setiawati <sup>1</sup>	340-347
<b>Application of Hydrological Water Supply Model to Calculate Discharge of Maronggek River in East Lombok</b> Sirajuddin Haji Abdullah <sup>1*</sup> , Hera Damayanti <sup>1</sup> , Guyup Mahardhian Dwi Putra <sup>1</sup> , Diah Ajeng Setiawati <sup>1</sup>	348-357
<b>Utilization of <i>Ulva lactuca</i> to Increase The Growth of <i>Eucheuma cottonii</i></b> Nunik Cokrowati	358-363
<b>Sociotechnical Adaptive Water Governance: A Case Study of Water Governance in Lombok Indonesia</b> Alex Laplaza <sup>1*</sup> , I Gusti L.P. Tanaya <sup>2</sup> , Suwardji <sup>3</sup>	364-376
<b>Characterization of Rice Husk and Wood Biochars and Their Effect on Soil Chemical and Agronomic Properties of Lettuce (<i>Lactuca sativa</i> L.)</b> Mulyati <sup>*</sup> , Tejowulan, S., Baharuddin, AB., Sukartono, Suwardji	377-384
<b>Seagrass Ecosystems Monitoring as Related to Coral Reef in Coastal Waters of Sekotong, West Lombok, Indonesia</b> Abdul Syukur <sup>1*</sup> , Didik Santoso <sup>1</sup>	385-392
<b>Fatty acid Composition of Ethanolic Extract of Seahorse (<i>Hippocampus barbouri</i>) from Ekas Bay, Lombok Island, West Nusa Tenggara</b> Seto Priyambodo <sup>1*</sup> , Dewi Nur'aeni Setyowati <sup>2</sup> , Nunik Cokrowati <sup>2</sup> , Nanda Diniarti <sup>2</sup>	393-397
<b>Effectiveness of <i>Ulva lactuca</i> Extract on <i>Kappaphycus alvarezii</i> Growth</b> Muhammad Fadlillah <sup>1*</sup> , Nunik Cokrowati <sup>1</sup> , M. Masyarul Rusdani	398-404
<b>Composition of Plankton on Floating Area in Batunampar Beach, East Lombok</b> Nanda Diniarti	405-410
<b>Water quality of Kertasari Bay West Sumbawa as Sustainability of Seaweed Cultivation Center</b> Edi Sulman <sup>1</sup> , Nunik Cokrowati <sup>2</sup> , Arziahningsih <sup>1</sup> , Rinto Basuki <sup>1</sup>	411-413
<b>Mapping Consumer Preferences and Physical Quality of Sie Reuboh (Cooked Meat) a Traditional Cuisine of Aceh</b> Dian Hasni, Novia Mehra Erfiza, Muhammad Faiz, Ulva Syahrina	414-421
<b>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</b> Lina Nurbaiti <sup>1*</sup> , Lalu Bramawangsa Banjar Getas <sup>1*</sup> , Sandra Yuliana Andini Putri <sup>1*</sup> , Felix Santoso <sup>1*</sup> , Ni Putu Ayu Dewanthi <sup>1*</sup> , Amalia Asfarina <sup>1*</sup>	422-426
<b>Correlation between BCL-2 and LMP-1 expression in patients with Nasopharyngeal Carcinoma WHO Type III</b> Hamsu Kadriyan <sup>1</sup> , Didit Yudhanto <sup>1</sup> , Fathul Djannah <sup>2</sup> , I Gusti Ayu Trisa Aryani <sup>3</sup> , Muhammad Alfian <sup>3</sup> , Markus Rambu <sup>3</sup> , Muhammad Rizqi Kholifaturohmy <sup>1</sup>	427-431

## **Finite Element Modelling Of Creep Glued-Laminated Bamboo**

**Ngudiyono<sup>1)\*,2)</sup>, Bambang Suhendro<sup>3)</sup>, Ali Awaludin<sup>3)</sup>, Andreas Triwiyono<sup>3)</sup>**

<sup>1)\*</sup> PhD Student Department of Civil and Environmental Engineering, Gadjah Mada University, Yogyakarta, Indonesia, Corresponding author at Department of Civil and Environmental Engineering, Gadjah Mada University, Grafika Street # 2, UGM Campus, Sleman, Yogyakarta, 55281, E-mail : ngudiyono@unram.ac.id

<sup>2)</sup> Department of Civil Engineering, Mataram University, Mataram, Indonesia

<sup>3)</sup> Department of Civil and Environmental Engineering, Gadjah Mada University, Yogyakarta, Indonesia

### **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**

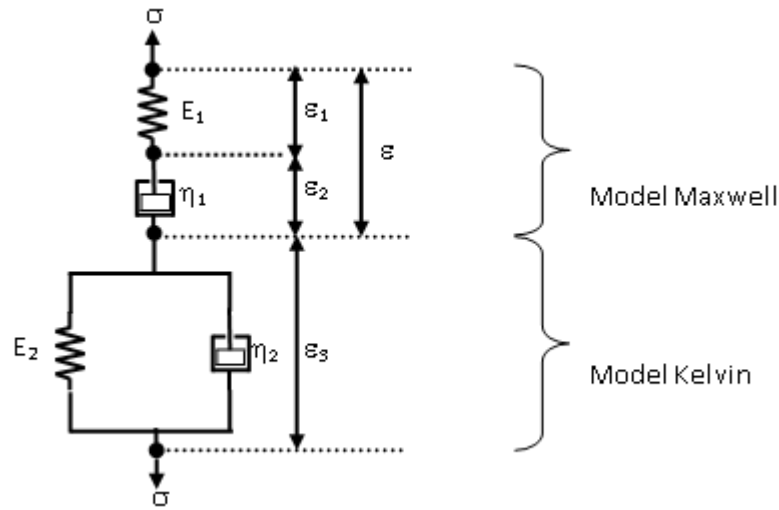
In recent years, bamboo has been widely used to replace timber as building material. The bamboo can typically be harvested in less than 3 - 4 years, renewable and sustainable material, mechanical properties similiar with timber (Sharma et al., 2015; Ni et al., 2016). The originally bamboo cross section 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 applicated to 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 1.** 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 model can be expressed as

$$\sigma + p_1 \dot{\sigma} + p_2 \ddot{\sigma} = q_1 \dot{\epsilon} + q_2 \ddot{\epsilon} \quad (1)$$

$p_1$ ,  $p_2$ ,  $q_1$ ,  $q_2$  expressed by elastic modulus then

$$p_1 = \frac{\eta_M E_M + \eta_M E_K + \eta_K E_M}{E_M E_K}, p_2 = \frac{\eta_M \eta_K}{E_M E_K}, q_1 = \eta_M, q_2 = \frac{\eta_M \eta_K}{E_K} \quad (2)$$

If  $E_M = 2G_M, E_K = 2G_K, \eta_M = 2\eta'_M, \eta_K = 2\eta'_K$ , so



$$p_1 = \frac{\eta'_M G_M + \eta'_M G_K + \eta'_K G_M}{G_M G_K}, p_2 = \frac{\eta'_M \eta'_K}{G_M G_K}, q_1 = 2\eta'_M, q_2 = 2\frac{\eta'_M \eta'_K}{G_K} \quad (3)$$

where,

$$G_M = \frac{E_M}{2(1 + \mu_M)}, G_K = \frac{E_K}{2(1 + \mu_K)}$$

$$\eta'_M = \frac{\eta_M}{2(1 + \mu'_M)}, \eta'_K = \frac{\eta_K}{2(1 + \mu'_K)} \quad (4)$$

If the deformation of viscoelastic bulk ignored, where  $\mu_K = \mu'_M = \mu'_K = 0,5$

Convert Burger model into Laplace transform

$$\bar{Y}(s) = \frac{q_1 s + q_2 s^2}{s(1 + p_1 s + p_2 s^2)} = \frac{1}{p_2} \left\{ \left[ \frac{q_1}{(s + \alpha)(\beta - \alpha)} + \frac{q_1}{(s + \beta)(\alpha - \beta)} \right] + \left[ \frac{q_1 \alpha}{(s + \alpha)(\alpha - \beta)} + \frac{q_1 \beta}{(s + \beta)(\beta - \alpha)} \right] \right\} \quad (5)$$

$$\alpha, \beta = \frac{p_1 \pm \sqrt{p_1^2 - 4p_2}}{2p_2}$$

Then Laplace inverse transform is applied to the last expression, so

$$Y(t) = \frac{G_M}{(\alpha - \beta)} \left[ \left( \alpha - \frac{q_1}{q_2} \right) e^{-\alpha t} + \left( \frac{q_1}{q_2} - \beta \right) e^{-\beta t} \right] \quad (6)$$

Relaxation shear modulus is requested in ABAQUS, substitution Eqs (2 - 3) into (5).

$$G(t) = \frac{G_M}{(\alpha - \beta)} \left[ \left( \frac{G_K}{\eta_K} - \beta \right) e^{-\beta t} + \left( \alpha - \frac{G_K}{\eta_K} \right) e^{-\alpha t} \right] \quad (7)$$

In prony series form,

$$G(t) = G_\infty + \left( \sum_{i=1}^n G_i G_0 e^{(-t/\tau_i)} \right) \quad (8)$$

Eqs (8) the series can be expanded into two items (n = 2),

$$G(t) = G_\infty + G_1 e^{(-t/\tau_1)} + G_2 e^{(-t/\tau_2)} \quad (9)$$

where

$$G_{\infty} = 0, G_1 = \frac{G_M}{(\alpha - \beta)} \left( \frac{G_K}{\eta'_K} - \beta \right), G_2 = \frac{G_M}{(\alpha - \beta)} \left( \alpha - \frac{G_K}{\eta'_K} \right), \tau_1 = \frac{1}{\beta}, \tau_2 = \frac{1}{\alpha}$$

If,

$$g(t) = \frac{G(t)}{G_0}$$

$$G(t) = G_{\infty} + G_0 (g_1 e^{(-t/\tau_1)} + g_2 e^{(-t/\tau_2)}) \quad (10)$$

where

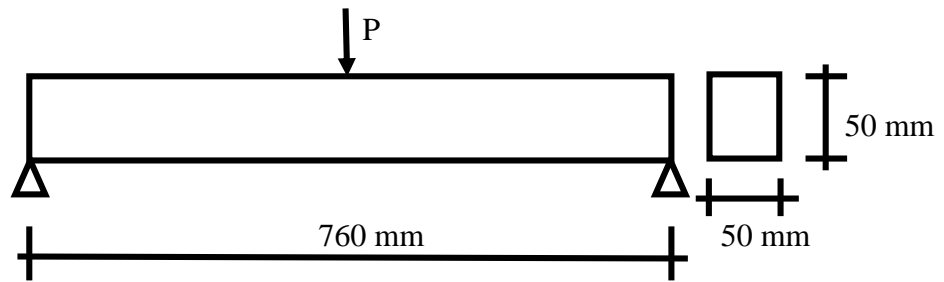
$$G_0 = G_M, g_1 = \frac{1}{(\alpha - \beta)} \left( \frac{G_K}{\eta'_K} - \beta \right), g_2 = \frac{1}{(\alpha - \beta)} \left( \alpha - \frac{G_K}{\eta'_K} \right)$$

$E_M, \mu_M, g_1, g_2, \tau_1, \tau_2$  are parameters of Burger model which can be used in ABAQUS software.

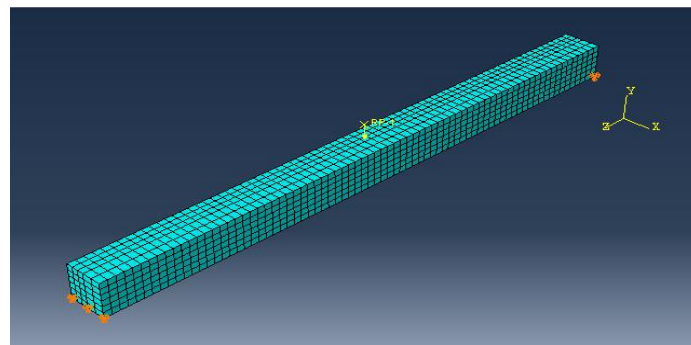
### 3. Finite Element Modelling Creep

The 3D model of the glued-laminated bamboo beam was created and analysed with finite element 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 Changsha during one year (365 days). According to the Burger model, data creep test then evaluated resulting some parameters viscoelastic material of glued-laminated bamboo such 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 beam according Eratodi (2014), showed in Fig 1, with different load level  $P = 10 \text{ kN}, 20 \text{ kN}, 30 \text{ kN}$  respectively

The procedures are modelling creep of glued-laminated bamboo as follow (i) create geometry 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 loading under various applied load level and boundary condition; (iv) use visco analyse type with time periode 365 days, increment 1 and error tolerance  $1 \times 10^{-6}$ . 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

**Table 1.** 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

**Table 2.** Creep properties compression and tension of glued-laminated bamboo in prony series

Parameter	Compression	Tension
$g_1$	0,88	0,18
$\tau_1$	6951,51	13945,73
$g_2$	0,11	0,81
$\tau_2$	16,74	13,96

#### 4. Result and Discussion

The results numerical simulation creep displacement behavior of glued-laminated bamboo beam under different load level  $P = 10 \text{ kN}$ ,  $20 \text{ kN}$  and  $30 \text{ kN}$  showed in Fig. 3 and the maximum displacement in mid span  $U_2$  showed in Fig. 4, 5, 6 respectively.

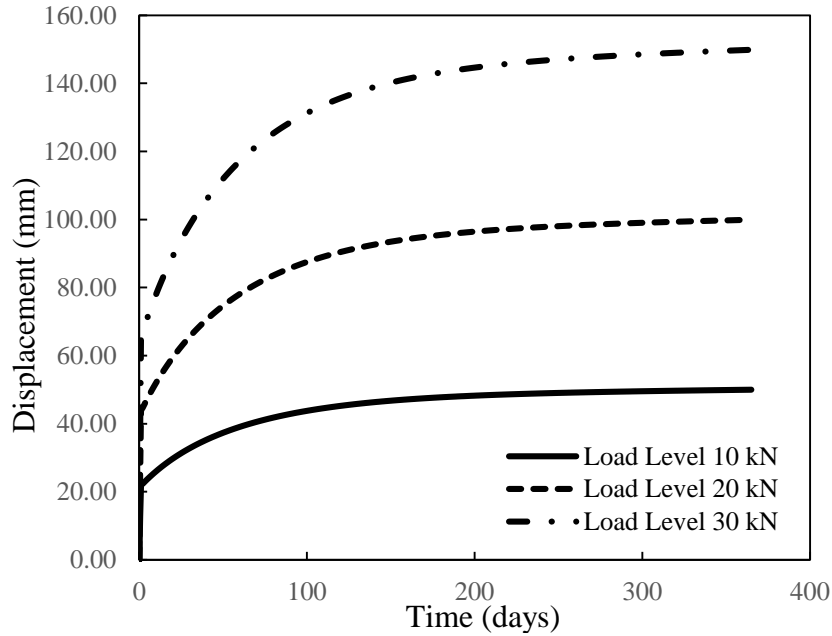


Figure 3. Creep displacement  $U_2$  under constant load

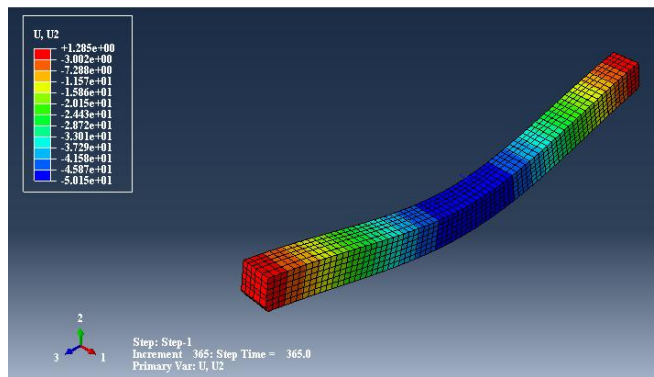


Figure 4. Creep displacement  $U_2$  apply constant load level 10 kN

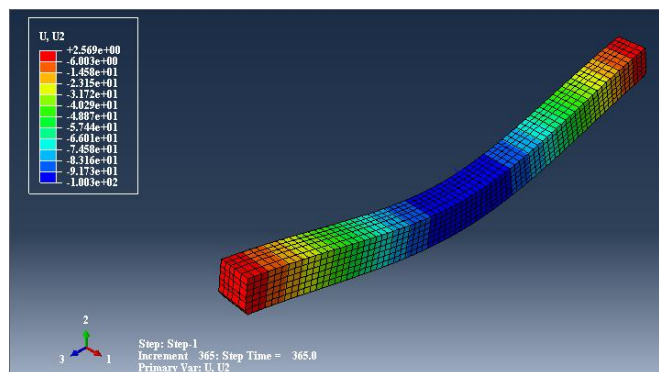
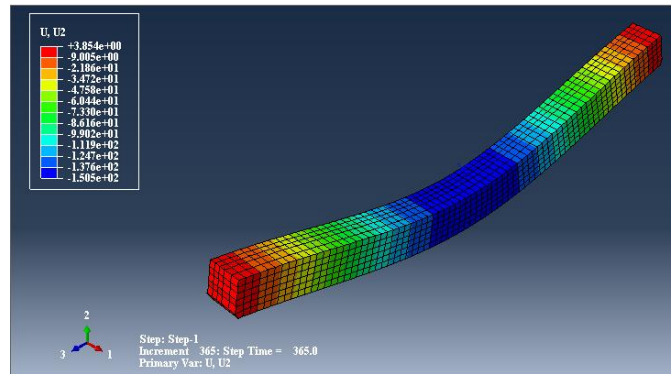


Figure 5. Creep displacement  $U_2$  apply constant load level 20 kN



**Figure 6.** Creep displacement  $U_2$  apply constant load level 30 kN

According to the Fig 3., the initial elastic and creep displacement of the beam increases in proportion to the load level. The initial elastic displacement 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 quickly initial elastic displacement based to the elastic 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 displacement theory are more greater than numerical analysis. The graphic also show primary and secondary creep behaviour of the beam.

The Fig. 4- 6 illustrate distribution of creep displacement at time 365 days in the span length. The maximum creep displacement 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 analysis is satisfy method for prediction creep displacement behaviour of viscoelastic material glued laminated bamboo under constant loading.

#### References

- Abaqus Version 6.4 (2003). Abaqus/CAE User's Manual. Pawtucket. Rhode Island. USA.
- Eratodi I. G. L. B. (2014). Beam-Column Connection Glued-Laminated Use Steel Plate Dikarter and, Desertasion, Postgraduate Program, Faculty of Engineering, Gadjah Mada University, Yogyakarta.



- Findley M. N., Lai J. S., & Onaran K. (1976). Creep and Relaxation of Nonlinear Viscoelastic Material with Introduction to Linear Viscoelastic, Dover Publication, Inc. New York.
- Gottron J., Harries K. A., & Xu Q. (2014). Creep Behavior of Bamboo. *Construction and Building Material* 66, pp. 79-88.
- Holzer S. M., Loferski J. R., & Dillard D. A. (1989). A Review of Creep in Wood : Concepts Relevant to Develop Long-Term Behavior Predictions for Wood Structures. *Wood and Fiber Science*, 21(4), pp. 376-392
- Kong J., & Yuan J. (2010). Application of Linear Viscoelastic Differential Constitutive Equation in ABAQUS. *International Conference On Computer Design And Applications (ICCCA)*.
- Li L. & Xiao Y. (2015). Creep Behavior of Glulam and CFRP-Enhanced Glulam Beams. *Journal of Composites for Construction*, June 10, pp 1-11.
- Ni L., Zhang X., Liu H., Sun Z., Song G., Yang L., Jiang Z. (2016). Manufacture and Mechanical Properties of Glued Bamboo Laminates, Glued Bamboo Lumber. *BioResources* 11(2), pp 4459 – 4471.
- Sharma B., Gattoo A., Bock M., Ramage M. (2015). Engineered Bamboo for Structural Applications. *Construction and Building Material* 81, pp. 66-73.