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Preface: Proceedings of the 4th International Conference on Bioscience and Biotechnology (4th ICBB 2021), 21st-23rd September 2021.

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Preface: Proceedings of the 4th International Conference on Bioscience and Biotechnology (4th ICBB 2021), 21st-23rd September 2021.

Eka Sunarwidhi Prasedya, S.Si., M.Sc., Ph.D.
Chairman of 4th ICBB 2021

This issue of IOP conference proceedings contains papers presented at the 4th International Conference on Bioscience and Biotechnology (ICBB) 2021. The ICBB is an annual international conference since 2018 that was initiated by Prof Ir H Sunarpi PhD. This year we are lucky to collaborate with Postgraduate-studies (Pascasarjana) University of Mataram thanks to the director Prof. Ir. H Muhamad Sarjan, M.Agr.,C.P. Ph.D and vice director Prof. Ir. Bambang Hari Kusumo, M.Agr.St., Ph.D. This meeting is hosted by Lab of Bioscience and Biotechnology Research, University of Mataram, Indonesia. It is held for three days, from 21 to 23 September 2021 by virtual conference with zoom platform due to COVID-19 pandemic.

Interactive online presentations were arranged through Zoom Video Communications for the participants to present their ideas. The conference was divided into two main sessions: Main session for Keynote speakers and Panel Sessions for participants. A time of 30 minutes was given for Keynote speakers to present their fabulous work. For panel session, 10 minutes were given for participants to share their research and findings. A total of 204 participants (180 presenters and 24 non-presenters) from Universities, Research Institutes and also Government Departments joined the conference. All the selected papers were peer reviewed by expert reviewers in a double blind review system as per the review policy given by IOP Conference Series.

On the first day of the conference (21st September) invited talks were presented by Prof. Julian Heyes, Ph.D. from Massey University New Zealand on "*Deriving value from elite indigenous fruit and vegetable species*", Prof. Bambang Hari Kusumo, M.Agr.St., Ph.D. from University of Mataram on "*Rapid measurement of soil carbon using near infrared technology*"and Prof. Dr. Endang Semiarti, M.S., M.Sc. from Universitas Gadjah Mada Indonesia on "*Biotechnology approach to improve the quality and quantity of orchids as potential agricultural commodities in Indonesia*". The second day of the conference presented talks by Prof. Lim Phaik Eem, Ph.D. from University of Malaya on "*Importance of marine habitat conservation for utilization and discovery of new bioresources of seaweeds*", Prof. Mat Vanderklift, Ph.D. from Indian Ocean Marine Research Centre CSIRO Australia on "*Opportunities for sustainable use of coastal ecosystems*", Assoc.Prof. Dr. Rapeeporn Ruangchuay from Prince of Songkla University Thailand on " *Seaweed resources in Thailand: cultivation and utilization*" and Dr.rer.nat. Andri Frediansyah, M.Sc. from LIPI Indonesia on "*Microbial natural products: a discovery strategy*". The final day of the conference included talks by Prof. Akihiro Hazama, Ph.D. from Fukushima Medical University on "*Investigation of cigarette smoke-induced cell hyperplasia mechanism using Induced Pluripotent Stem Cell (IPSCs)*", Prof. Kato Yasuhiro, Ph.D. from Keio University Japan on "*Water circulation of the earth and life*" and Eka Sunarwidhi Prasedya, Ph.D. from University of Mataram Indonesia on **"***Microbiome implications for bioprospecting of seaweeds".*
Our special gratitude also goes to the Rector of Mataram University for the support given to this conference. Also, we are thankful for the enormous support of IOP conference proceedings for supporting us in every step.

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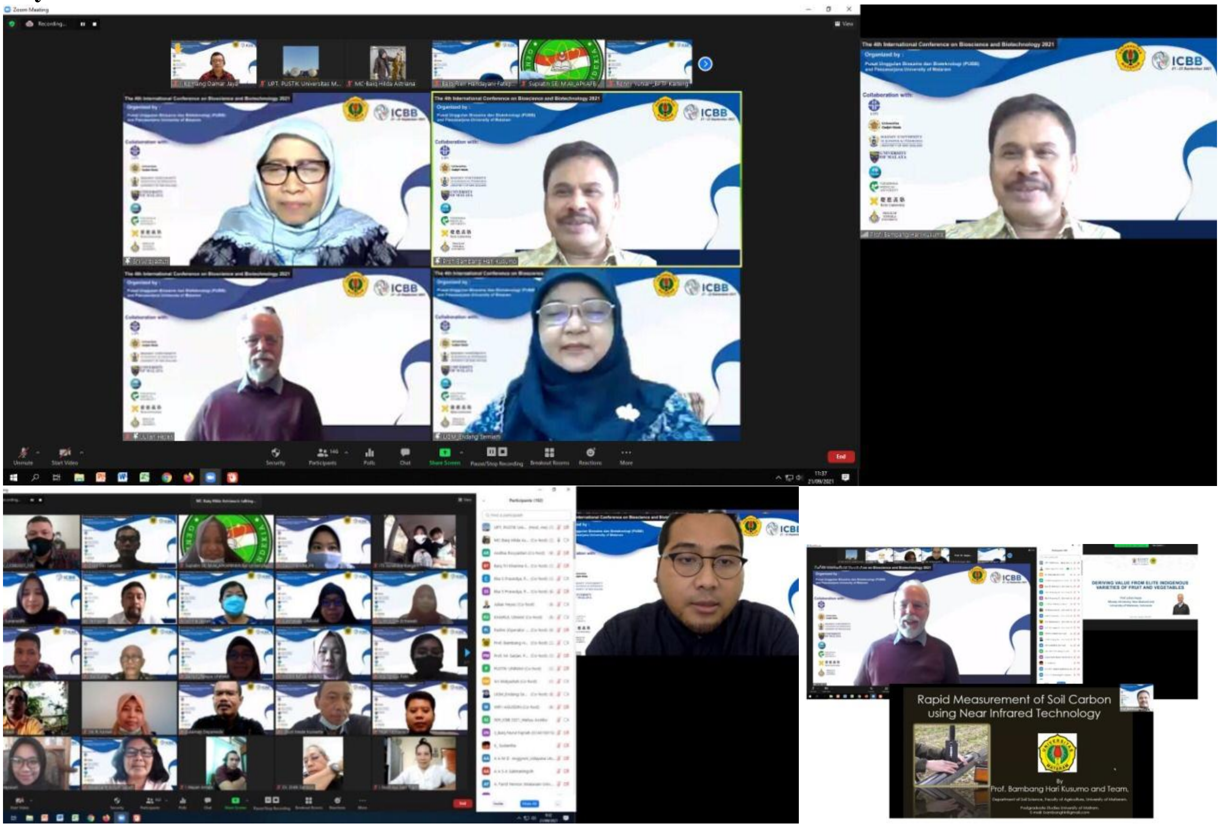

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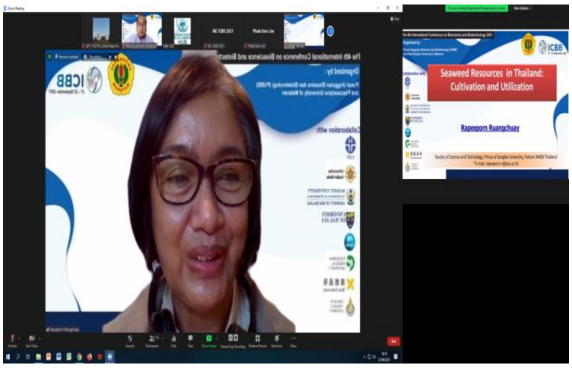
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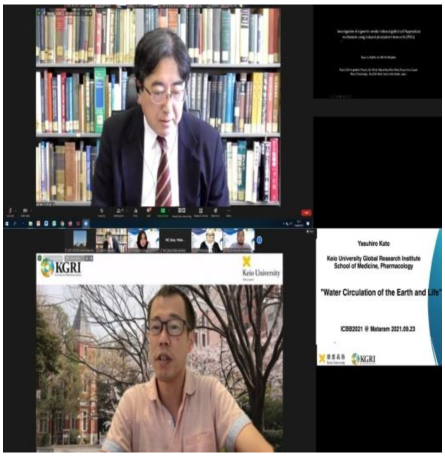
Yasuhiro Kato
Keio University Global Research Institute
School of Medicine, Pharmacology
"Water Circulation of the Earth and Life"
ICBB2021 @ Mataram 2021.09.23

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Optimization Process to Increase the Quality of Lombok Porang Flour

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Abstract. As a primary source of glucomannan, porang (*Amorphophallus oncophyllus* Prain) has a decisive role in the food and non-food industry development. However, the naturally high calcium oxalate content in the corm is one obstacle why it is not safe as a food material. This paper describes and discusses the optimizing process to reduce the level of calcium oxalate content and improve the quality of the flour of porang locally grown in Lombok. Porang samples were obtained from the center of growing area in North Lombok. Series of trials were carried out, including treatment using a salt solution, blanching, and fermentation technology. The parameters observed in this study were the calcium oxalate content, moisture content, and the color of porang flour. The results from these trials indicated that soaking in salt solution and blanching technology significantly reduced the calcium oxalate concentration in the flour. However, the oxalate levels in the flour were slightly higher than the quality standard requirement. In contrast, fermentation treatment was not effective in reducing the oxalate level. In general, all treatments significantly reduced the flour-moisture content. Further research is required in order to produce quality local porang flour that meets quality standards.

1. Introduction

Porang (*Amorphophallus oncophyllus* Prain) has become an essential plant for Indonesia's farmers in the last five years, including in West Nusa Tenggara. This type of plant usually grows naturally in the forest under the perennial trees, where many of them grow on the mountain slopes or along the river [1]. Farmers do not provide any input or special care like other food crops. However, since the demand for porang products with promising economic value, either in the form of chips and flour from the global market, has increased recently [2], farmers have started to grow porang by applying good farming practices and providing agricultural inputs. Considering this potential market, many farmers have started to grow porang commercially in West Nusa Tenggara province. Developing porang business is essential for farmers, especially in a marginal area, where the business itself acts as an alternative source of income and improves land productivity, further increasing the region's community income.

Among tuber plants, porang is an essential tuber crop as it contains a high amount of carbohydrate portions consisting of glucomannan, starch, crude fiber, free sugars, and other chemical components [3]. The glucomannan component is essential in porang flour [4], reaching about 87% [5]. Glucomannan is a hydrocolloid polysaccharide consisting of D-glucose and D-mannose and has a 1-4-glycoside bond and an acetyl group at the C-6 position [6]. Because of the high content of carbohydrates, porang flour is an alternative materials food product development and has the potential to support food security. Glucomannan compounds from porang flour have long been used as food materials in Japan and China. In Japan, for example, porang flour, also known as konjac flour, is the primary material for konnyaku and shirataki [7]. Glucomannan content may also play an important role as food additives such as thickener, texture-forming, and thickener in food processing. Some study carried out recently also demonstrated that porang flour is adequate for food additives such as thickener, gelling agent, and stabilizer [8, 9], [10].

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However, there is another chemical component in porang tubers that needs attention before porang flour can be used safely as a food material that is calcium oxalate [7]. In plants, oxalate components exist in two forms: water-soluble oxalates, which bind to Na + and K +, and oxalates that are insoluble in water, which bind to divalent ions such as Ca2 + and Mg2 + [11]. All forms of oxalate are soluble in acidic solutions [12]. Oxalate in porang corm is present as a calcium oxalate which is insoluble in water but dissolves well in acidic solution [13]. It is crucial to control calcium oxalate content in porang processing since this compound can cause health problems that show some symptoms, including itching in the mouth, burning sensation, irritation of the skin, mouth, and digestive tract when consumed in large quantities. In addition, oxalate is an anti-nutritional compound that can inhibit the absorption of minerals such as iron and calcium in the body [14]. The level of calcium oxalate in porang corm is considerably high and affected by plant parts, the maturity of the corm, and the time of harvest [15]. In addition, calcium oxalate levels may also differ among the varieties [16].

Previous research demonstrated that the concentration of oxalate in several crops might be reduced. Previous research by Lukitaningsih *et al.* [17] reported that repeated washing three times using 5% salt solution for 15 minutes could reduce calcium oxalate by 43.07%. In comparison, Chotimah and Fajarani [18] reported that blanching with a 6% salt solution at 80°C for 30 minutes reduced calcium oxalate by 60%. Kasaye *et al.* [19] stated that heating and fermentation were effective methods to reduce oxalate content in cassava and sweet potato flour. Another research has also reported that the fermentation process for 72 hours can reduce oxalate levels in breadfruit tubers [20]. Research on kimchi also reported that the anaerobic fermentation process of kimchi for five days reduced the average calcium oxalate content by 38.50% [11]. In general, the fermentation process in tubers results in changes in several physicals, chemical, and functional properties of flour. These include changes in the texture of fermented flour or modified flour that is smoother than the flour without fermentation [21]. Anggraeni and Yuwono [22] stated that natural (spontaneous) fermentation might affect the physical properties of sweet potatoes, such as an increase in the brightness of the color and elimination of the unpleasant aroma in flour. Flour quality may be affected by fermentation times. Wulandari et al. [23] reported that the best quality of gadung flour was obtained after fermentation for 96 hours. On the other hand, Widyasaputra and Yuwono [24] revealed that sweet potato fermented for 36 hours produced the best physical characteristics of sweet potato flour.

Research on the local porang of Lombok and its processing technology that fulfills porang flour quality requirements is still limited. Because of the region's high potential porang agribusiness development, studying an effective technology for porang processing is crucial to support safe material alternatives for food product industries. This paper describes and discusses the optimizing process to reduce the level of calcium oxalate content and improve the flour quality of porang locally grown in Lombok.

2. Materials and Methods

The experiment was conducted using Completely Randomized Design experimental methods [25]. Series of trials were conducted to investigate the effective porang flour processing technology that produces good quality local porang flour. The first trial evaluated the effect of soaking porang corm slices in 5% salt solution for 4 hours, blanching treatment at 90ºC for 15 minutes, combining 5% salt solution and blanching treatments on the quality characteristic of porang flour. The second experiment was focused on investigating the fermentation time on calcium oxalate of porang flour. The third experiment studied the effect of air velocity and mass of the material used on the oxalate level. For all trials, there were three replications for each treatment.

The parameters analyzed in this trial were the total oxalate levels using the volumetric permanganometric titration method [26], the moisture content assessed using the thermographic method [27], and the color (L value) using a MiniScan EZ chromameter [28]. The data were analyzed using the Analysis of Variance at a 5% significant level using the Co-stat software [25]. When there is a significant difference, it was further tested with the Honestly Significant Difference Test at the same significant level. Findings from these data and their studies are discussed in the following section.

3. Results and Discussion

3.1. The effect of salt and blanching on the local porang flour characteristics

Oxalates are widely distributed throughout all plants in readily water-soluble forms, such as potassium, sodium, ammonium oxalate, and insoluble needles like calcium oxalate crystals [29]. It is well published that the concentration of oxalate content in porang is very high, which may limit the utilization of porang corm for food product materials. Previous research reported that the level of calcium oxalate in plant materials could be reduced by several treatments, including soaking in an acid solution, alkaline, and salt (to reduce oxalate levels of insoluble crystalline solid) and soaking in warm water (to reduce levels of soluble oxalate compounds in the form of oxalic acid). Soaking porang tubers in the salt solutions is intended to eliminate the itching due to the high oxalate content in the porang tubers [11]. By reducing oxalate content in porang tubers to the safe level as required, porang tubers can be used as an alternative for food products.

This research revealed that 5% salt solution and blanching for 15 minutes significantly reduced the calcium oxalate level of local porang flour compared to the control. The combination treatment of soaking porang tuber slices in 5% salt solution followed by blanching treatment resulted in the lowest calcium oxalate content (0.13%). This treatment reduced the calcium oxalate content from 0.27% to 0.13% or reduced about 51.85% (Table 1).

Table 1. The average calcium oxalate, moisture content, and color value of untreated and treated local porang flour.

Treatments	Calcium Oxalate (%)	Moisture content (%)	Color	
			(L)	(°Hue)
Control	0.27[a]	12.5	71.62[a]	70.51
5% Salt solution	0.23[b]	12.9	67.12[b]	72.65
Blanching for 15 minutes	0.22[b]	12.4	51.71[c]	72.71
Salt solution and *Blanching*	0.13[c]	11.3	62.15[d]	67.37

*Value is the mean of three replications. Means followed by the same letter within the same column are not significantly different ($p<0.05$).

Unfortunately, the oxalate concentration achieved in this treatment remained far higher than the threshold calcium oxalate safe level for food materials, which is maximal of 71 mg/100 g or 0,071% [30]. The decrease in the calcium oxalate level may be associated with its solubility that increases in water and high temperature. On the other hand, salt or NaCl can be ionized in water into Na^+ and Cl^-. Based on the fact that when more ions Na^+ and Cl^- are contained in the solution, more bonds with ion Ca^{2+} and $C_2O_4^{2-}$ may occur, producing sodium oxalate ($Na_2C_2O_4$), which is soluble in water. So that the oxalate level in the treated porang flour decreased as the compound was soluble in soaking water and discarded. Goodenough and Stenger [31] stated that the solubility of calcium oxalate in water increases as the temperature increases. The decomposition reaction of calcium oxalate crystals into calcium oxide also occurs rapidly at high temperatures [32]. Widari and Rasmito [33] also reported that the longer the heating process for porang tubers, the higher the decrease in the oxalate level in porang flour.

Furthermore, data in Table 1 showed that 5% salt solution and blanching treatments when applied alone or in combination between 5% salt solution and blanching did not affect the moisture content and the color of porang flour. The moisture content level of porang flour in all samples fulfilled the minimum quality requirement for flour moisture content based on the porang flour standard by the Indonesian National Standard (SNI 7939:2013) [34] which required the moisture content to be below 13%. In addition, the color of porang flour samples was also relatively the same among the samples based on the lightness and the Hue values (Table 1).

3.2. The effect of fermentation on the oxalate and glucomannan content of local porang flour

Fermentation technology has been reported to have a significant effect in decreasing oxalate components in several crops. Fermentation combined with heat treatment reduced oxalate content in tuber crops [19]. Fermentation treatment also reduces oxalate content in breadfruit [20] and kimci [11].

The results obtained by Mayasari [35], a part of our research activity series and used as an undergraduate thesis, show that fermentation time significantly affected the oxalate content in porang flour. The longer spontaneous fermentation was carried out, the lower the oxalate content in porang flour. The average oxalate levels decreased from 5.26% in porang flour from the unfermented corm to 1.9% in porang flour of fermented corn for 60 hours. The average oxalic acid content of the corn fermented for at least 36 hours was significantly lower than the control or unfermented corm [35].

3.3. The effect of air velocity and mass of the material used on oxalate level

Porang tubers have a high content of glucomannan, an essential component for food product materials, and contain a high amount of oxalate [7]. Glucomannan is a polysaccharide that has a specific gravity greater than calcium oxalate in porang flour. With this characteristic, the blowing method may be used in separating the components in porang flour as the mechanism, which is a moving air stream to separate the particles based on differences in mass, density, and particle size. Thus, the calcium oxalate with a lower density will be exhaled and separated from glucomannan [36].

This study separates calcium oxalate from glucomannan by blowing a method using a fluidized bed. The results from this trial revealed that the treatments significantly reduced the oxalate content in porang flour (Figure 1). Reduced oxalate occurred in both samples with a mass of 500 grams and 1000 grams.

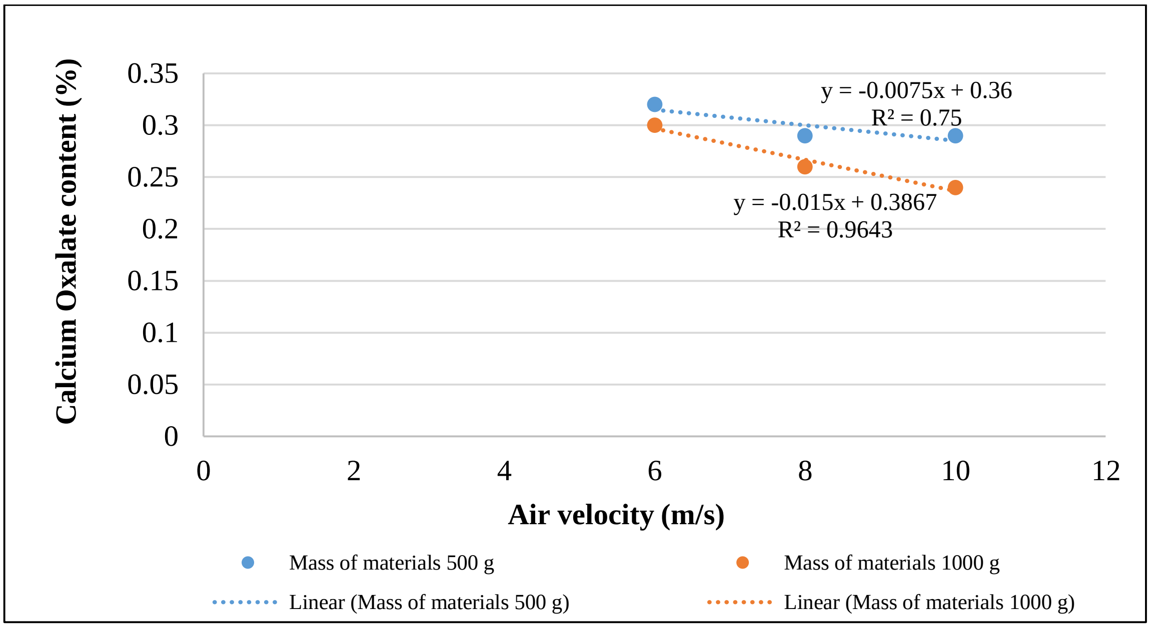

Figure 1. The regression on the effect of air velocity on the oxalic acid content of porang flour.

Data in Figure 1 indicated that the percentage of calcium oxalate in porang flour decreased as the airflow velocity (m/s) increased in both sample sizes (mass of 500 g and 1000 g). The oxalate levels in porang flour with a mass of 500 g using airflow velocities of either 6 m/s, 8 m/s, or 10 m/s were 0.32%, 0.29%, and 0.29%, respectively. Whereas, the calcium oxalate levels of porang flour with the experimental mass of 1000 g at the same speeds were 0.30 %, 0.26 %, and 0.24 %, respectively. Based on these values, it can be seen that the results of the separation with a mass treatment of 1000 g are better than those with a mass treatment of 500 g. This is indicated by the oxalate content remaining in the flour after the separation process was carried out. The lowest oxalate content (0.24%) was obtained in the 1000 gr mass treatment with an airflow velocity of 10 m/s.

The level of calcium oxalate achieved in this trial has not fulfilled the minimum safe oxalate level for food materials which has to be less than 0,071% [30] as mentioned before. Other additional treatments may be needed to get rid of more oxalate from the flour. Sari [37] used variations of grinding and blowing air to reduce calcium oxalate levels in porang flour. Another previous research also reported that the best treatment to reduce calcium oxalate levels was grinding and blowing air at a speed of 11.2 m/s. The stamp mill and blowing fractionation process can reduce the calcium oxalate content in iles-iles flour [38].

4. Conclusion

Based on the results of this research, it can be concluded that the treatment of immersing porang tubers in 5% salt solution combined with blanching for 15 minutes at 90°C significantly reduced oxalate levels but still exceeded the minimum allowable requirements. Likewise, the fermentation treatment in this study has not been effective in reducing oxalate levels to a safe level so that flour can be used as food materials. Further research needs to be done by combining the treatment of component separation and chemical purification to obtain safe and quality porang flour.

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