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Analysis of The Characteristics of Porang Flour as A Coating Material After Treatment of NaCl Solution

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Abstract

The application of coatings from natural materials is currently needed to improve the appearance and maintain quality, so that it can support the green economy, namely increasing the welfare and social equality of the farming community. One of the basic ingredients in the manufacture of coatings from the polysaccharide group is porang flour. The main problems faced in the development of porang flour as a coating are that the color is still brown and itchy caused to the high content of calcium oxalate. Treatment with NaCl salt is one of the efforts to improve the quality of porang flour as a coating material. Immersing porang in NaCl salt solution repeatedly can reduce calcium oxalate. The reason of the observation became to decide the impact of the concentration and time of soaking of porang slices into the salt solution of NaCl on the characteristics of the resulting porang flour. This study used a two-factor randomized design, namely the concentration of NaCl salt solution (5, 10, and 15%) and the second factor was the soaking time (15, 30, and 45 minutes). Each treatment combination was repeated three times. The concentration and time of soaking into the salt solution of NaCl affected on color L*, browning index, water content, solubility, and acidity of porang flour. The best treatment was soaking time of 30 minutes with NaCl concentration of 15%.

Keywords: porang flour, coating, characteristic, viscosity, natrium chloride

1. Introduction

The coating is a thin layer that has the ability to withstand chemical, physical, and biological changes [1][2]. The components that make up the coating are hydrocolloids, lipids, and composites [3][4][5]. One of the advantages of using a coating is that its constituent polymer can act as an active ingredient matrix so that it can maintain its nutritional and sensory attributes [6][7]. The coating requirements are water resistance, barrier property, permeable, easy-to-form emulsions, non-sticky, easy to dry, does not affect quality, low viscosity, transparent, tasteless, odorless, and pressure-tolerant [8].

The application of coatings from natural materials is currently needed to improve the appearance and maintain quality [9][10], so that it can support the green economy, namely increasing the welfare and social equality of the fruit-farming community. Fruits, while significantly reducing the risk of environmental damage. According to [11], coatings help preserve the quality and increase the shelf life of fruits. In line with the opinions [9][12] and [13] coatings can maintain the physicochemical, physiological, and microbiological properties of food so that it can maintain quality, be safe, and extend shelf life.

The use of coatings from natural materials to replace synthetic preservatives is urgently needed. One of the basic ingredients in the manufacture of coatings from the polysaccharide group is porang flour [14]. Porang (*Amorphophallus muelleri* Blume) is a potential source of glucomannan. Porang tubers contain glucomannan or a fairly high source of water-soluble fibre, which is 79.91%

[15]. Glucomannan sourced from porang flour exhibits biodegradability, antioxidant properties, low toxicity, affordability, and ease of application [16][17]. Its role as an emulsifying agent is frequently employed in the food industry due to its capacity to create a high-viscosity gel when in a liquid state [16][18]. Numerous investigations have endeavored to employ it for preserving and extending the shelf life of lotus [19] and apples [20].

The main problems faced in the development of porang flour as a coating are that the color of porang flour is still brown and itchy caused to the high content of calcium oxalate [19]. This brownish color is undesirable in the manufacture of coatings because the requirement for a good coating is a clear transparent color, so additional treatment is needed to improve its appearance [21][8]. Treatment with NaCl salt is one of the efforts to improve the quality of porang flour as a coating material. Immersing porang in NaCl salt solution repeatedly can reduce calcium oxalate [22][23]. There is little information about the concentration and soaking time in NaCl solution on the quality of porang flour produced. Based on this, it is necessary to research the treatment of NaCl salt solution on the characteristics of porang flour as a coating material. The primary objective of this study was to assess how variations in the concentration and soaking duration of porang slices in a NaCl salt solution influence the properties of the resulting porang flour.

2. Materials and Method

2.1 Research Design

This study used a two-factor randomized design, namely the concentration of NaCl salt solution (5, 10, and 15%), and the second factor was the soaking time (15, 30, and 45 minutes). Three repetitions were carried out for each treatment. The data were tested to see the difference with ANOVA, if there was a difference, it was continued with Duncan's test. Research tools used include spectral colorimeter CS-280, refractometer, viscosimeter fluorimeter ND J8S, pH meter, UV Vis Libra S60 Spectrometer, oven, and homogenizer. Research materials include porang tubers (*Amorphophallus muelleri* Blume) aged 6 months obtained from Asah Duren Village, Pekutatan District, State Regency, Bali Province. Additives NaCl, Ca (OH)2, and glycerol was obtained in Denpasar. The place of research is the Laboratory of Food Analysis and Food Processing, Faculty of Agriculture, University of Warmadewa.

2.2 Research Implementation

Preparation of porang flour as the basic ingredient of porang coating begins with the porang sorting process, and then peeling is carried out to remove the skin. Slicing is done after the washing process, with a thickness of 5 mm. Soaking with NaCl salt solution according to the treatment, namely 5, 10, and 15% for 15, 30, and 45 minutes, after which rinsing was carried out to remove the remaining salt solution. The next process is soaking in a 1.5% Ca $(OH)_2$ solution for 20 minutes. drying process at 50°C using an oven for ±48 hours was carried out after the porang was drained. The dried porang slices were ground and then sieved using a 50-mesh sieve. Porang coating is made by dissolving porang flour into the water in a ratio of 1: 10. Then the addition of a 1.5% glycerol emulsifier, after the homogenization process is carried out for 10 minutes using a sonicate model Q125. Particle measurement using a UV-vis spectrometer. Heating using a temperature of 70 ± 1°C for 5 minutes, then cooled and the porang coating is ready to be applied.

2.3 Parameter Methods

2.3.1 Color

Color was measured using a Colorimeter (Cs-280) as delta-E (ΔE=[(ΔL*)2 + (Δa*)2 + (2b*)2]½. Color readings are taken three times and averaged to give a value for each product.

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2.3.2 Water Content

The water content test was carried out by weighing 5 g of the sample and then placing it in an aluminium cup which had been dried for one hour at a temperature of 105°C and the weight was known. The sample was heated at 105°C for three hours, then cooled in a desiccator until cold and then weighed. Heating and cooling were repeated until a constant sample weight was obtained. Water content = Initial sample weight – Final sample weight x 100 Initial sample weight

2.3.3 Solubility

The solubility value is expressed as a percentage of the weight of the residue that cannot pass through the filter paper to the weight of the sample of material used and can be calculated using the formula:

$$Solubility\ (\%) = \frac{(c-b)}{100-\%KA/1000} x100$$

2.3.4 Acidity

The acidity measurement method is based on measuring hydrogen ion activity potentiometrically/electrometrically using a pH meter. Before testing, calibrate the pH meter with pH 4 and pH 7 buffer solutions according to the equipment operating instructions.

3. Results and Discussion

3.1 Porang flour without salt treatment

Potential porang flour as raw material in the manufacture of coatings that will be applied to fruits. Analysis of porang flour without salt treatment as a control resulted in pH data, color coordinates L*, a*, b*, browning index, water content, and solubility as shown in Table 1.

Table 1
Porang flour without NaCl treatment

No	Parameter	Average
1	Color	
	L*	20.86
	a*	0.16
	b*	1.90
2	Browning index	20.94
3	Water content	15.76
4	Solubility	48.37
5	Acidity	6.34

3.2 Color L*

Color is an important indicator of the quality of porang flour. The results showed that the remedy of salt concentration and soaking time and their interactions appreciably affected the color brightness level (L*) of porang flour as an edible coating material. The brightness value of porang flour ranged from 20.26-23.29, the highest value was obtained in the 15% salt concentration treatment with a soaking time of 30 minutes as shown in Figure 1. This means that the maximum salt concentration with a time of 30 minutes has resulted in the optimal level of brightness of porang flour. According [24], besides reducing calcium oxalate, NaCl salt is also a compound that can prevent discoloration in porang tubers.

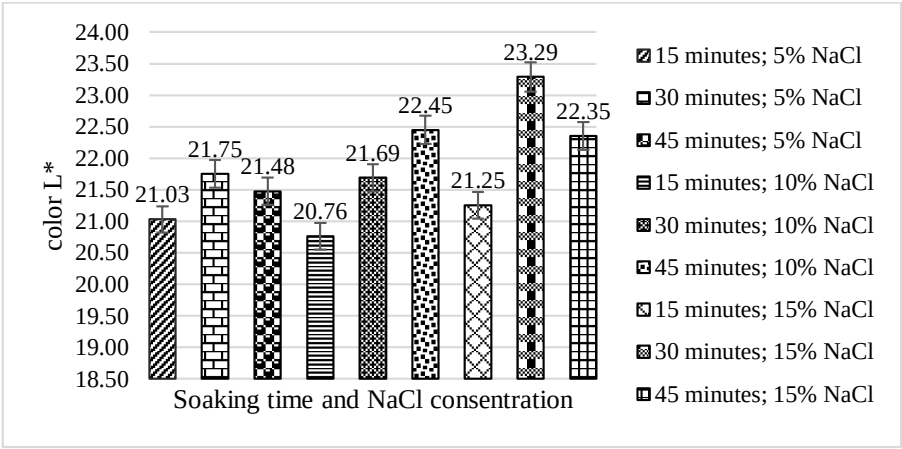

Figure 1
Color L* of porang flour

3.3 Browning Index

Browning is a change in the color of a food substance from a light color to a dark color (brown). The treatment of salt concentration and soaking time and their interactions significantly affected the browning index of porang flour as a coating material. The browning index value of porang flour ranged from 1.69-2.69, the highest value was obtained in the 10% salt concentration treatment with an soaking time of 45 minutes as shown in Figure 2. An increase in the browning index value indicates a darker color. The addition of salt at the right concentration and soaking time can prevent the browning process so that the bright and transparent color of the resulting coating will be achieved. In line with the opinion [25]. The characteristics obtained from porang flour are High purity (90.98%), viscosity (27.940 cps), and transparency (57.74%).

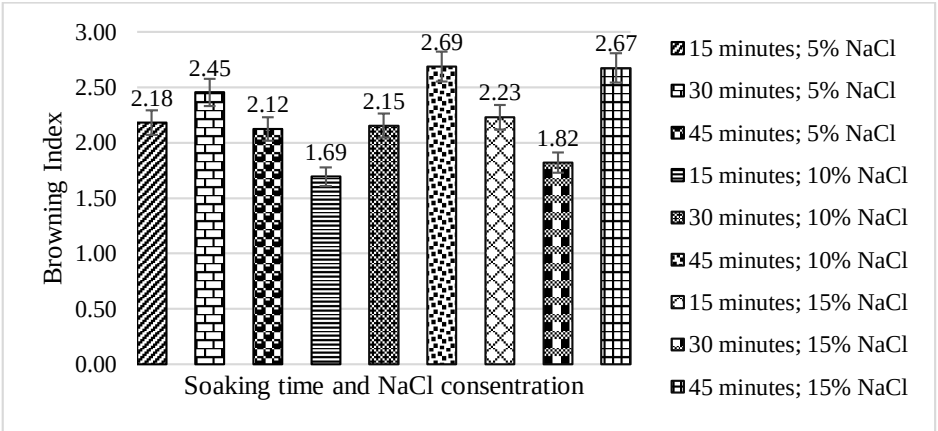

Figure 2
Browning index of porang flour

3.4 Water content

The results showed that the treatment of salt concentration and soaking time had a very significant effect, while the interaction had no significant effect on the water content of porang flour. The water content of porang flour as an edible coating material with an soaking time treatment of 12.12-22.22%, while the salt concentration treatment showed results between 14.24-21.31%. The lowest water content was obtained at the treatment time of soaking for 30 minutes. According to [26], the moisture content of porang flour greatly affects its quality. The advantage of glucomannan contained in porang flour when used as an edible coating is that it can retain water on the coated material [27]. The water content of porang flour is shown in Table 2.

Table 2.

The water content of porang flour	Concentration			Average	
	5%	10%	15%		
15 minutes	24.85	13.33	25.76	21.31	a
30 minutes	19.39	10.00	13.33	14.24	a
45 minutes	22.42	13.03	23.33	19.60	a
Average	22.22 a	12.12 b	20.81 a		

Note: The average value followed by the same letter in the same column and row means that it is not significantly different in the 5% BNT test

3.5 Solubility

Solubility is a very important factor in the application of glucomannan, both in the food and non-food industries. The results showed that the treatment of salt concentration and soaking time and their interactions had a significant effect on the solubility level of porang flour. The solubility value of porang flour ranged from 48.57-58.79% as shown in Figure 3. Glucomannan is a water-soluble dietary fiber found in porang flour which is strong hydrocolloid and low in calories and is widely used in the food industry both as a functional food and as an edible coating material [22]. The purification technique of porang flour is intended to produce porang flour which has solubility properties, namely: easily soluble in water and safe for human consumption. The solubility of glucomannan in porang flour is expected to be easily applied in various industries. The longer the soaking time in NaCl salt, the higher the solubility. Low solubility can be caused by the high molecular weight of natural glucomannans and strong hydrogen bonds [28].

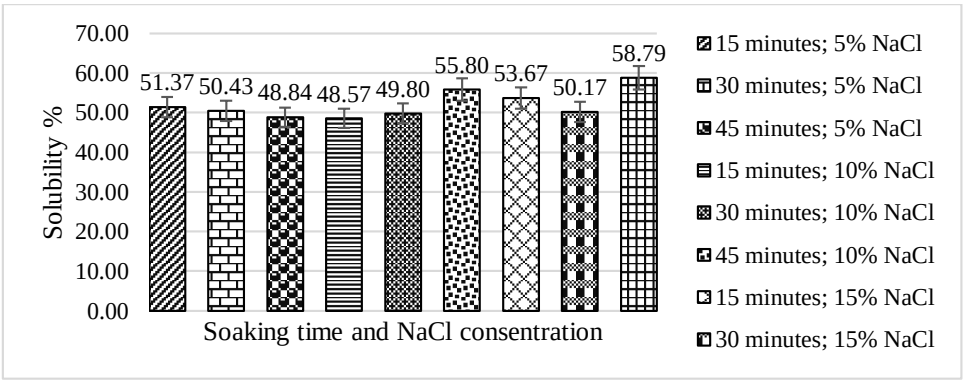

Figure 3
Solubility of porang flour

3.6 Acidity

Acidity is an important thing to note because it will affect the quality of porang flour as an edible coating material. The results showed that the treatment of salt concentration and soaking time and their interactions had a very significant effect on the acidity of porang flour. The highest acidity obtained was 9.55 from the 15% salt concentration treatment with a soaking time of 30 minutes as shown in Figure 4 and this indicates that porang is alkaline. In this acidity range, the possibility of fungal growth is very small, so the quality of flour can be maintained [11]. Thus, the potential of porang flour as an edible coating is getting higher. Following the opinion [8], a good edible coating is that it can act as an antimicrobial.

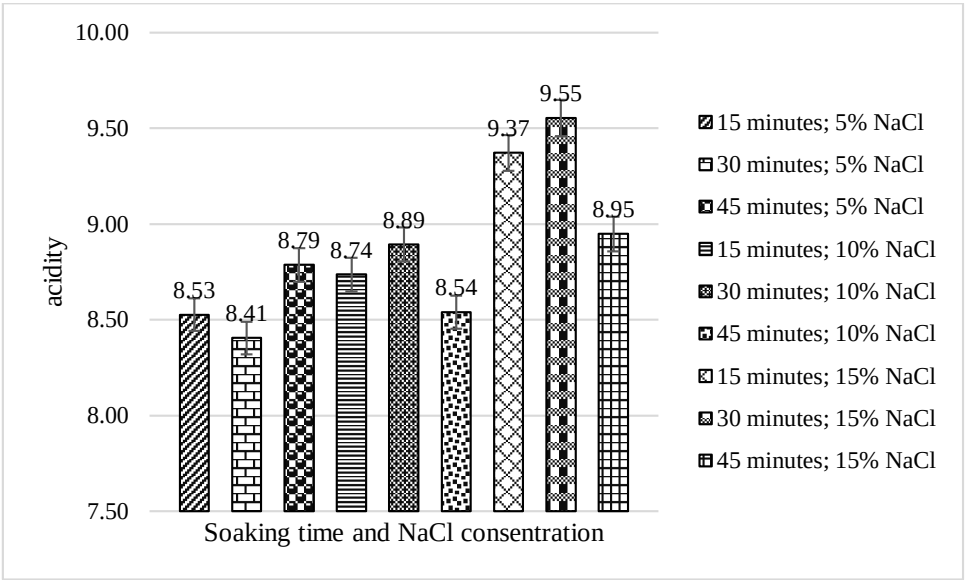

Figure 4
Acidity of porang flour

4. Conclusion

The concentration and time of soaking into the salt solution of NaCl affected color L*, browning index, water content, solubility, and acidity of porang flour. The best treatment was a soaking time of 30 minutes with NaCl concentration of 15%. The resulting porang powder is the smoothest, most soluble, and the lowest water content. The acidity is 9 so it is less likely to get moldy, when viewed from the brightest color compared to other treatments.

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