The Effect of Dry Extraction Process Technology on Characteristics of Porang Flour

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Abstract. Glucomannan is one of the functional components found in porang tuber. The modification of process technology is generally carried out in order to obtain optimal product characteristics according to glucomannan content from porang flour. One method that can be done to increase the glucomannan content of porang tuber is by carrying out a dry extraction process from the resulting porang chip flour. This research activity aims to modify the dry extract of porang chips and characterize the resulting product. For the dry extraction method, the extraction method was optimized from porang chips that had been dried and mashed. Several treatments were carried out, including the comparison of chip types from the ICAPRD Laboratory and Madiun farmers, flour mesh size (100 and 60 mesh), and the ratio of porang chip flour and solvent (1:2; 1:3 and 1:4). The results obtained were analyzed for yield, moisture content, glucomannan content, color, viscosity and proximate for the best product. Based on the analysis results obtained, the highest glucomannan content for flour from chips produced by the ICAPRD Laboratory with a size of 60 mesh and a solvent ratio of 1:3.

1 Introduction

Glucomannan is one of the functional components found in porang tubers. The modification of process technology is generally carried out in order to obtain optimal product characteristics according to the required yield parameters of porang flour. Porang flour can be used for several processed product applications [1]. One method that can be used to increase the glucomannan content of porang tubers is by carrying out a dry extraction process from the resulting porang chip flour.

Extraction or often said to be purification is a way to separate glucomannan from other compounds that are less needed, such as starch, fiber, and protein. Herawati *et al.* [2]

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analyzed the levels of glucomannan in porang and iles-iles flour. Purification of glucomannan from porang tubers generally uses ethanol because it is safe for use in the food sector. In addition to using ethanol, several methods have also been developed to obtain glucomannan with higher yields [3].

The extraction process method from porang chips can be optimized by optimizing quality chip manufacturing technology. Porang chips as raw materials can be compared with chips produced by porang farmers in porang-producing centers [4]. Glucomannan content can be increased by modifying the extraction of the resulting chip flour. In addition to the glucomannan content, several other parameters can also be carried out in order to meet the required quality of the minimum standard aspem as well as other required quality characteristics related to the implementation of the final product.

Glucomannan extraction technology can be done by several methods, either physically, chemically, or biologically. The method of extracting glucomannan from starch tissue or the cell wall of the raw material source, so that the extraction method is highly dependent on the structure of the cell wall [5]. In general, extraction methods using solvents include using water, ethanol, acid, and Pb(Ac)2 solvents after pre-treatment [6].

Other modification technologies can be carried out using acid hydrolysis and ultrasonic [7]; hydrolysis with alpha-amylase enzyme [8]; a combination of centrifugation and heating [9]; a combination of solvent concentration and heating [10], and a combination of the use of ethanol and heating solvents [11]. This research activity aims to modify the dry extraction of porang chips and characterize the resulting product.

2 Materials and Methods

The materials used in this study were porang, technical ethanol, and chemicals for analysis. While the types of equipment used are peeler, slicer, washing tub, extractor, drying machine, viscosimeter, and chromameter. Some of the chemicals used include NaCl, Sodium metabisulfite, ethanol, and water.

For the dry extraction method, the extraction process was carried out by comparing the raw materials from dry chips processed in the ICAPRD Laboratory with farmers' chips, size modification (60 and 100) of flour mesh, and the ratio of porang chip flour to solvent concentration (1:2; 1:3; 1:4). The solvent used was 50% technical ethanol with an extraction time of 15 minutes and 5 loops.

The extracted flour was then analyzed for moisture content [12]; glucomannan content analysis [13], color analysis (L, a, b, C, and Hue), and viscosity. The combination of physicochemical technology is carried out by considering efficiency and process optimization. The critical quality parameters and data related to the quantity of the product become a reference in optimizing the glucomannan processing process and the characteristics that may affect the quality of the final product. Based on the results obtained, then compiled and analyzed the data obtained further.

3 Results dan Discussions

Dry extraction of porang is carried out using flour from processing dry chips that have been produced. The modification process was carried out to produce flour containing higher levels of glucomannan. Some analysis of product characteristics extracted from porang flour includes analysis of yield, moisture content, glucomannan content, color (L, a, b and Hue), and product viscosity. The parameters of the analysis include important characteristics that affect the quality of the dry extract of porang flour.

3.1 Yield Analysis

Yield analysis is an important parameter for analysis. This parameter is needed when calculating mass balance optimization for product development on a larger scale. The yield analysis results on porang chip flour that had been extracted using 50% ethanol solution by looping 5 times for several treatments yielded results as shown in Table 1 below.

Table 1. Yield Analysis Results of Porang Flour Dry Extraction

Sample	Solvent Comparison	Yield (%)
Porang Flour 100 mesh (ICAPRD Laboratory)	1:2	17,2
	1:3	5,0
	1:4	10,2
Porang Flour 60 mesh (ICAPRD Laboratory)	1:2	40,0
	1:3	44,0
	1:4	22,0
Porang Flour 60 mesh (Madiun Farmer)	1:2	37,6
	1:3	36,4
	1:4	25,6

Based on the yield analysis results, there were fluctuations in the yield to differences in the ratio of the concentration of the solvent used. The highest yield was obtained in the treatment using porang chip flour from the ICAPRD laboratory with a size of 60 mesh. There is a decrease in the mesh size, resulting in a lower yield compared to the 60 mesh size. This can be due to the smaller size resulting in easily soluble components and less yield.

3.2 Moisture Content

Moisture content is one of the important parameters for identifying the results of the extraction process. Moisture content is also a parameter that determines the quality of flour so it is safe enough to be stored for a certain time. Based on the results of the analysis of the moisture content of the dried extract of porang flour, as shown in Table 2 below.

Table 2. Moisture Content Analysis Results of Porang Flour Dry Extraction

Sample	Solvent Comparison	Yield (%)
Porang Flour 100 mesh (ICAPRD Laboratory)	1:2	4,82
	1:3	6,17
	1:4	10,40
Porang Flour 60 mesh (ICAPRD Laboratory)	1:2	3,63
	1:3	5,51
	1:4	7,07
Porang Flour 60 mesh (Madiun Farmer)	1:2	8,15
	1:3	9,18
	1:4	10,44

The results of the observation were that all samples had a water content below 13% in accordance with SNI 01-1680-1989 regarding the characteristics of porang flour. The resulting water content indicates that porang flour is quality I porang flour according to SNI 01-1680-1989. The observation results are lower than the results of research by Dwiyono *et al.*, [14], which states that the water content of porang flour produced is 11.89%.

3.3 Glucomannan Content

Dry extraction of porang is carried out using flour from processing dry chips that have been produced. The modification process was carried out to produce flour containing higher levels of glucomannan. Modification technology is used to compare porang chip flour and ethanol solvent. Modification of concentration, time, and looping technique was carried out to produce better flour quality.

Table 3. Glucomannan Analysis Results of Porang Flour Dry Extraction

Sample	Solvent Comparison	Glucomannan Content (%)
Porang Flour 100 mesh (ICAPRD Laboratory)	1:2	35,41
	1:3	38,04
	1:4	38,17
Porang Flour 60 mesh (ICAPRD Laboratory)	1:2	84,56
	1:3	88,63
	1:4	79,18
Porang Flour 60 mesh (Madiun Farmer)	1:2	50,65
	1:3	54,37
	1:4	40,25

Herawati *et al.* [2] carried out the extraction process of porang and iles-iles flour, where the highest glucomannan content was 66.89%. Based on the results of dry extraction in this study, higher levels of glucomannan were produced than the results of Herawati *et al.* [2]. The treatment of giving ethanol during the extraction process causes a decrease in calcium oxalate because it is dissolved in ethanol along with other impurities [15].

3.4 Color Analysis

Analysis of color testing on samples with various solvent concentration treatments and extraction times was carried out using a chromameter so that the color in the sample could directly produce a "hue" value to identify the color in the sample. Based on the steps of the analysis method, the data obtained from the color testing analysis are as follows below.

Table 4. Color Analysis Results of Dry Extraction of Porang Flour

Sample	Solvent Comparison	L	a	b	C	Hue
Porang Flour 100 mesh (ICAPRD Laboratory)	1:2	80,37	3,62	19,17	19,51	79,30
	1:3	79,45	4,60	20,33	20,65	77,13
	1:4	81,93	4,38	16,66	17,23	75,43
Porang Flour 60 mesh (ICAPRD Laboratory)	1:2	80,48	2,30	14,71	14,89	81,11
	1:3	82,36	4,07	17,18	17,66	76,66
	1:4	77,98	2,89	17,33	17,57	80,54
Porang Flour 60 mesh (Madiun Farmer)	1:2	69,31	2,89	15,12	15,39	79,17
	1:3	70,27	3,79	16,67	17,10	77,18
	1:4	71,49	4,06	17,80	18,22	77,15

The lightness color correlation value ranges from 0% for the darkest color (black) and 100 for the lightest color (white) [16]. While the a* value is an indication of the chromatic color of the red-green mixture, if the a value shows a positive number 0 to 80 then the sample tends to approach red and if it shows a negative number from 0 to -80 then it indicates that the sample tends to be green [17].

The b value is a mixed chromatic color between blue and yellow with a positive value between 0 to 70, indicating that the color is close to yellow, while if it is negative 0 to -70 then the sample tends to approach blue (Sinaga, 2019). Meanwhile, the value of C or chroma is a color level based on sharpness which serves to define the color of a product that tends to be shiny or dull with a number around 0 to 100, which means that the higher the color, the duller the color, while the lower the color the glossy.

The level of washing with ethanol causes differences in color intensity, namely, the higher the washing rate, the lighter the color of the flour. This is stated by Kurniawati *et al*. [18] that ethanol provides an advantage where the compound that causes the color of flour mixed with glucomannan is separated from glucomannan, while the red color that appears in the extraction results is the original color of porang which tends to be reddish yellow.

3.5 Viscosity Analysis

A sample of 1 gram was added to 100 ml of distilled water, and then the sample was heated in a basin filled with water at a temperature of 80°C then cooled. After that, the viscosity analysis test was carried out using a viscoster tool. The results of the viscosity analysis of the extracted flour are obtained, as shown in Table 5.

Table 5. Viscosity Analysis Results of Porang Flour Dry Extraction

Sample	Solvent Comparison	Viscosity (cP)
Porang Flour 100 mesh (ICAPRD Laboratory)	1:2	41,63 (L2)
	1:3	40,97 (L2)
	1:4	39,10 (L2)
Porang Flour 60 mesh (ICAPRD Laboratory)	1:2	3759 (L3)
	1:3	5692 (L3)
	1:4	1463 (L3)
Porang Flour 60 mesh (Madiun Farmer)	1:2	49,63 (L2)
	1:3	41,70 (L2)
	1:4	134,77 (L2)

Based on the viscosity data that has been produced; generally, the sample data from the simplo test with duplo has a significant change. This is probably due to the difference in viscoster spindle speed and temperature changes from 80°C to 100°C. Therefore, there is a significant difference in viscosity data. In the application of viscosity analysis, two methods of using a spindle are carried out. For flour with a size of 100 mesh and porang flour from Madiun farmers, use an L2 spindle, while for 60 mesh porang flour from ICAPRD laboratory chips, use an L3 spindle. This is because, when using the same spindle, the tool cannot read it, so there are differences in the use of the spindle.

3.6 Proximate Analysis

Proximate analysis of porang flour from dry extraction was carried out on the best results from all treatments, namely for the production process technology using chips from ICAPRD with a size of 60 mesh and a solvent concentration ratio of 1:3. Based on the results of the proximate analysis as shown in Table 6 below.

Table 6. Results of Optimal Porang Flour Proximate Analysis

Analysis Parameter	Content (%)
Moisture	10,24
Ash	2,60
Fat	1,10
Protein	1,85
Carbohydrate	84,21

Based on the results of the analysis of the quality of the dry extraction product of porang flour, the main component results in the form of carbohydrates. It can be seen that fiber, starch, and glucomannan are carbohydrate components. With the composition of glucomannan content, which is quite high above the possibility of soluble fiber components, namely glucomannan is the main component of the existing carbohydrate content. In contrast, starch and other components are in small quantities due to the extraction process that has been carried out.

4 Conclusion

The type of chip raw material source, mesh size, and the ratio of raw material to solvent concentration affect the yield, moisture content, glucomannan content, color, and viscosity of the resulting porang flour. Based on the results of the yield analysis, the highest glucomannan content was found in the treatment of chips from the ICAPRD laboratory with a size of 60 mesh extracted using a 1:3 ratio between raw materials and solvents. The best porang flour is obtained from dry extraction with characteristics: 10.24% moisture content, 2.60% ash content, 1.10% fat content, 1.85% protein content, and 84.21% carbohydrate content. For further activities, further research should be carried out on the effect of ethanol concentration, the number of extraction loops, and extraction time to increase the yield and glucomannan content of the resulting porang flour.

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