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Extraction Quality of *Porang* Flour Due to Chip Flour Treatment and Ethanol Concentration

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Abstract. *Porang* tuber has a high potential for glucomannan levels. Improving the quality of *porang* tubers can be done by extracting dry chips from *porang* tubers. One alternative is to combine the process of using ethanol as a reagent to produce good quality *porang* flour. The purpose of the research activity is to modify dried chip *porang* flour using several ethanol concentrations for extraction and to characterize its products. The research methodology was carried out using two types of *porang* flour (brown and yellow) and ethanol concentrations (50, 70, and 90%). The data analyzed with SPSS 24 software. The research resulted the different treatments resulted in significantly different yield quality, moisture content, and ash content between treatments. The highest glucomannan content 66.94% and the highest whiteness index 82.08 was found in the extraction process using dried yellow chip with 90% ethanol concentration process technology. For further research, it is necessary to conduct a stepwise extraction to study the influence of varying ethanol concentrations in order to increase the glucomannan content.

1 Introduction

The prospect of developing local tubers in Indonesia is quite potential to be developed further. One of the prospective local tubers is *porang* and *iles-iles* which contain glucomannan and can be used as a food ingredient [1,2]. Shen and Li [3] tried to map konjac research activities based on bibliometric analysis, where implementation opportunities for food, pharmaceuticals, and other alternatives are growing and increasing. One way to increase the added value of *porang* products is by extracting glucomannan.

Extraction technology to separate glucomannan from other less necessary compounds. Apart from using ethanol, several methods have also been developed to obtain glucomannan with a higher yield [4]. The extraction method of glucomannan is conducted in an effort to extract it from both starch tissue and cell walls, thus greatly depending on the

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plant cell wall structure used as raw material [5]. This significantly affects the technology employed for the extraction process, whether through physical, chemical, or combination.

Extraction technology generally uses solvents including water, ethanol, acids, and Pb (Ac)2 [6]; using combination acid hydrolysis and ultrasonic [7]; using the enzyme alpha amylase [8]; centrifugation combined with heating [9]; a integration of solvent and packaging [10] as well as an optimization of solvent ethanol use and heating [11,12]. A simpler extraction technology that can be implemented using dry chips extracted with ethanol is still needed to increase glucomannan content.

Producing glucomannan extraction products from *porang* chips is still needed. Optimal research activities related to glucomannan extraction activities still require further optimization. The aim of this research is to modify the *porang* dry chip extraction technology using variations in ethanol concentrations and to characterize it.

2 Methodology

Materials used in this research activity include *porang* tubers, sodium chloride, sodium metabisulfite, ethanol, and distilled water. While the equipment used includes: a drying oven, blender, hot plate stirrer, filter cloth, filter paper, oven, furnace, water bath, centrifuge, digital scales, FTIR, and SEM (Scanning Electron Microscope).

The stages of research activities include the stage of making *porang* chips with two modifications, namely using a sun dryer and an oven. The results of dry chips obtained the quality of brown chips and yellow chips. The dry chips were then crushed using a disc mill and sieved with a minimum size of 60 mesh. *Porang* flour was then extracted using various treatments with ethanol concentrations of 50, 70, and 90%. The results obtained were then dried in a used oven at 60° C for 3 hours. This research activity is conducted in two replications.

Extracted flour was analyzed for yield, color (L, a, b, hue, and whiteness index), water content [13], ash content [13], glucomannan content [14], profile FTIR and its microstructural profile with SEM. The data was compiled and analyzed using ANOVA (Analysis of Variance) and further tested with Duncan. Data was processed using SPSS 24 software.

3 Results and Discussion

3.1 Analysis of Yield Content

The raw materials used for the extraction process of chocolate chip flour using sun drying and yellow chips which are processed using the oven drying method. To find out the yield from the extraction results, in Table 1.

Table 1. Results of yield content

No	Sample	Yield Content (%)
1	Brown - Ethanol 50%	61.79b
2	Brown - Ethanol 70%	68.77ab
3	Brown - Ethanol 90%	69.19ab
4	Yellow – Ethanol 50%	60.34b
5	Yellow – Ethanol 70%	67.19ab
6	Yellow – Ethanol 90%	74.09a

Note: Numbers followed by different letters indicate significantly different with a 95% confidence interval

The existence of different types of raw materials and the concentration of ethanol used for the extraction process produce significantly different yields. Based on the results, the highest yield was optimized with the extraction process method using yellow chip flour with an ethanol concentration of 90%.

3.2 *Porang* Flour Color Analysis

Color analysis (L, a, b) to identify the color characteristics of the control powder and the results of the extraction. While the Whiteness Index analysis is to identify the degree of whiteness from the influence of the process applied to *porang* chip flour. The color and degree of whiteness of the control flour compared to the extracted flour as shown in Table 2.

Table 2. Results of color analysis

No	Sample	L	a	b	Whiteness Index
1	Brown - Ethanol 50%	62.46d	4.93a	14.28a	59.54d
2	Brown - Ethanol 70%	66.66cd	4.50ab	12.43ab	64.12cd
3	Brown - Ethanol 90%	69.49bcd	4.64ab	12.96a	82.08a
4	Yellow – Ethanol 50%	78.30ab	0.93c	8.01d	76.82ab
5	Yellow – Ethanol 70%	73.46bc	2.72bc	10.56bc	71.24bc
6	Yellow – Ethanol 90%	84.92a	1.42c	9.09cd	82.08a
7	Brown *Porang* Flour	69.10bcd	4.64ab	13.48a	65.98cd
8	Yellow *Porang* Flour	84.66a	1.88c	12.10ab	79.79ab

Note: Numbers followed by different letters indicate significantly different with a 95% confidence interval
L : Lightness ; a : Red/Green Value ; b : Blue/Yellow Value

Based on the statistical results of the color parameters (L, a, b) of the control flour and variations in ethanol concentration of the extracted flour, there was a significant difference. The results of the WI analysis (whiteness index) for the highest extraction yields were found in the extraction treatment of yellow flour with an ethanol concentration of 90% and yellow flour with an ethanol concentration of 90%. The soaking technique ethanol combined with sodium metabisulfite on peeled yielded a WI value 82.85 [1]. These results can be seen by increasing the concentration of ethanol can increase the degree of whiteness of extracted *porang* flour. Ethanol can play a role at the same time to wash off the control flour used.

However, the Whiteness Index value of the yellow control flour which was treated using the drying method using an oven can also increase the WI value. The accuracy of the *porang* drying treatment process can improve the quality of control flour raw materials before further extraction processes. The extraction technique using the raw material for flour from dry *porang* chips can be used to anticipate the production process outside the peak harvest period of *porang* tubers. This can be used to anticipate the continuity of the factory production process outside the *porang* harvest season.

3.3 Analysis of Moisture, Ash and Glucomannan Content

Moisture content analysis is carried out to determine the quality characteristics so that the product is safe to store for a relatively long period. Ash content determines the potential presence of mineral materials contained in the resulting *porang* flour. The research resulted in moisture, ash, and glucomannan content of extracted *porang* flour compared to the control in Table 3.

Table 3. Results of analysis of moisture, ash and glucomannan content

No	Sample	Moisture Content (%)	Ash Content (%)	Glucomannan Content (%)
1	Brown - Ethanol 50%	4.86c	5.02f	47.24b
2	Brown - Ethanol 70%	4.39cd	5.72de	45.30b
3	Brown - Ethanol 90%	4.16cd	6.11cd	47.64b
4	Yellow – Ethanol 50%	4.75cd	5.39ef	62.18a
5	Yellow – Ethanol 70%	4.07cd	5.90bcd	67.28a
6	Yellow – Ethanol 90%	3.71d	6.54bc	66.94a
7	Brown *Porang* Flour	11.64a	6.95b	35.66c
8	Yellow *Porang* Flour	9.43b	7.73a	50.31b

Note: Numbers followed by different letters indicate significantly different with a 95% confidence interval

The analysis of *porang* flour showed that the moisture content was significantly different from the extraction results compared to the control. The highest moisture content was found in the control of cocoa which was processed using the sun drying method. The existence of a further extraction process lowers the moisture content.

The ash content in the resulting *porang* flour is still quite high. The ash content of the control *porang* flour was relatively higher than the extracted one. The lowest ash content was found in brown *porang* flour with the extraction method using 50% ethanol concentration. Based on the research findings of Herawati et al [1], *porang* subjected to peeling, ethanol soaking and sodium metabisulfite treatment resulted in a glucomannan content of 66.89%.

Glucomannan content is a parameter of the quality of the product. The control oven method had a higher glucomannan content than the control flour which was dried in the sun. The use of better raw materials will increase the value of the glucomannan content of extracted *porang* flour. This can be seen, with the extraction process of brown *porang* flour which has a lower glucomannan content compared to flour extracted from chip drying in the oven.

In terms of value, the highest glucomannan content was found in yellow *porang* flour which was extracted using 70% ethanol. However, statistically, yellow *porang* flour has the same glucomannan content for 50, 70, and 90% ethanol. This can be used as material for further extraction optimization to increase glucomannan levels. The multilevel washing or looping method and the addition of extraction time can also be used as an alternative for further optimization of the *porang* extraction process to obtain higher levels of glucomannan.

3.4 FTIR Analysis

FTIR to identify the components and clusters of the tested material being analyzed. Control *porang* flour and extraction results were further analyzed using the FTIR tool and the results were obtained as shown in Figure 1 below.

The transmission fractionation of the FTIR results of brown and yellow flour controls and the results of 90% ethanol extraction showed quite diverse results. Based on the FTIR results, it can be seen that the extraction process affects the absorbance results of the FTIR glow.

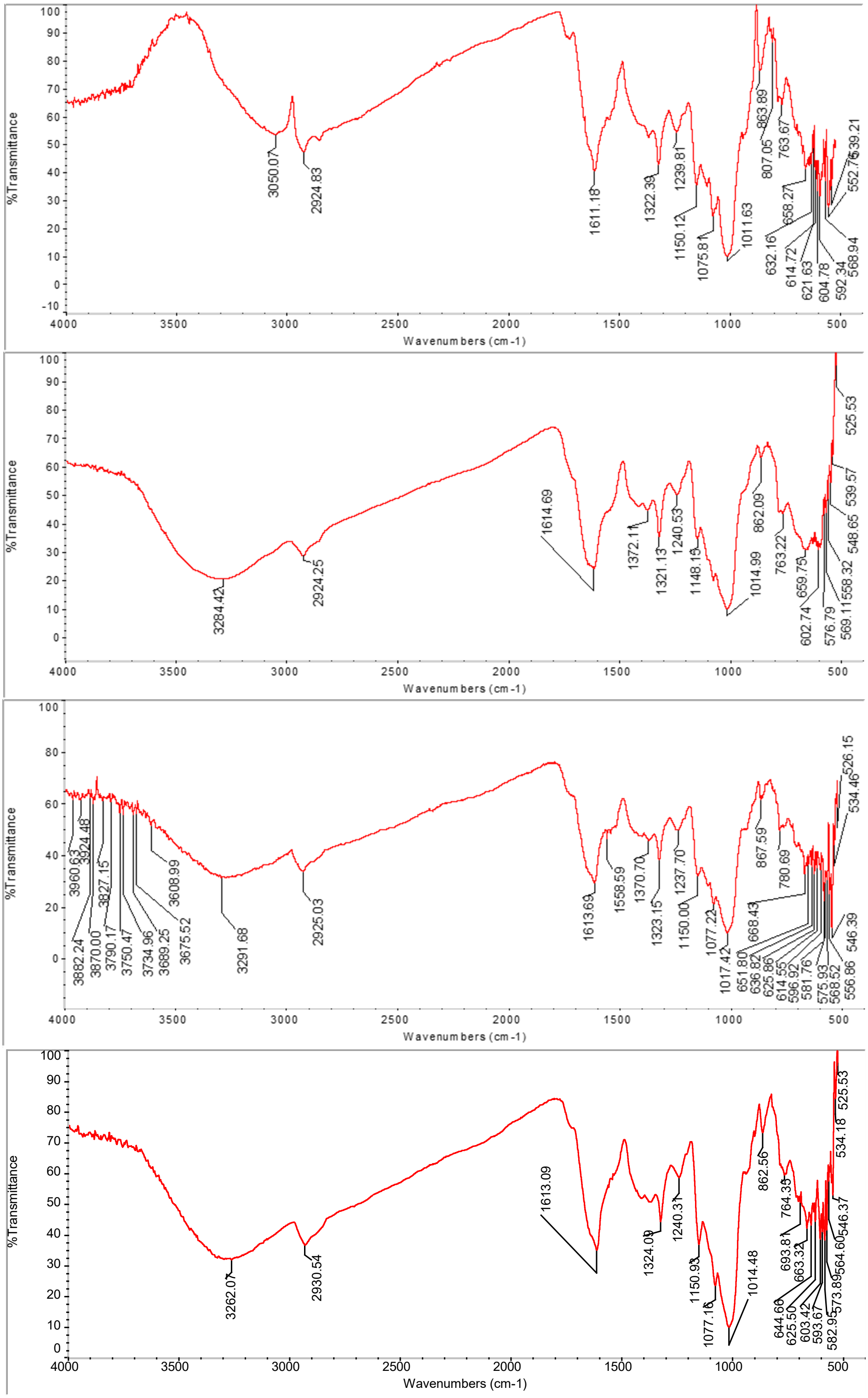

Fig.1. FTIR Analysis Results of Brown and Yellow *Porang* Flour and 90% Ethanol Extraction Results of Brown and Yellow Flour

The absorbance in the range of 2850-2925 cm-1 shows the vibrational asymmetry and symmetry of the alkane group. The asymmetrical and symmetrical flexural absorbances of CH, CH2, and CH3 are found in the absorbance ranges of 1444 cm-1 and 1383 cm-1. The mannose peaks are shown at peaks of 875 cm-1 and 805 cm-1 [15, 16, 17, 18].

3.5 SEM Analysis

Analysis of the microstructural profile of the control flour from brown and yellow chips compared to the results of extraction using 90% ethanol. Microstructural profile analysis was carried out using SEM tools. The SEM analysis results of the control flour were compared with the 90% ethanol extraction results in Figure 2.

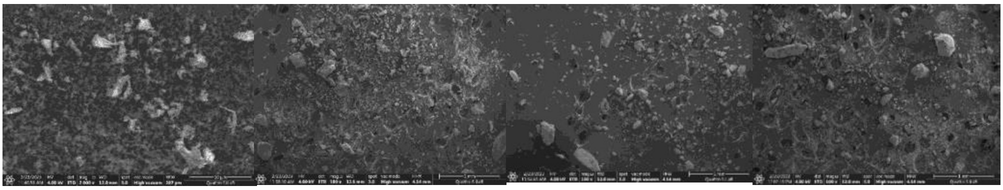

Fig. 2. SEM of Brown and Yellow *Porang* Flour and Results of 90% Ethanol Extraction of Brown and Yellow Flour

The microstructural profile using the SEM tool, it can be seen that the control powder still has sharp needles. In the extracted flour it can be seen that the presence of the extraction process can show that the flour looks more crumbly and the structure of the needles has started to cut and does not look sharp as was the case in the control *porang* flour before the extraction process.

The shape of the glucomannan granules of the konjac is ovoid which differs from other cells in the parenchyma. In glucomannan, there is a needle-shaped oxalate deposition in multicrystalline clusters [19]. Furthermore, Aryanti and Abidin [20] stated that white and yellow *porang* flour extracted using water has a smaller particle size and distribution compared to ethanol. Glucomannan flour, which has an irregular and non-uniform shape, is the surface structure of oxalic acid [21].

4 Conclusion

The existence of an extraction process using flour as raw material from dry chips can be used to guarantee the glucomannan extraction process at factories outside the *porang* harvest season. Handling the chips using the oven method increases the glucomannan content and improves the color of the resulting flour. The extraction process using ethanol can increase the levels of glucomannan. The extraction process also produces finer flour and reduces the sharpness of the oxalate needles based on the results of microstructural by the SEM tool. To increase the levels of glucomannan, further washing processes with a looping system, and increasing extraction time could be done.

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