

The Effect of Using Glucomannan Flour and Carageenan on The Manufacture of Jelly Candy

Sri Rachmania Juliastuti^{1,*}, Hartinah Meliyati², Glenn Mochamad Rayhan Machmud³

Received September 26, 2023; Revised July 11, 2024; Accepted August 14, 2024

DOI: [10.12962%2Fj2964710X.v5i1.18896](https://doi.org/10.12962%2Fj2964710X.v5i1.18896)

Abstract—Indonesia is one of the countries that produces porang tubers in the world. The biggest benefit of cultivating porang plants is to obtain the tubers. The harvested porang tubers can be sliced or chipped and then dried. Porang slices or chips can then be processed into konjac flour or konyaku. From konjac flour, glucomannan can be obtained. The aim of this research is to make jelly candy from porang flour which will be purified first by an extraction process using ethanol. The research method used was to extract 70 gr of porang flour using 96% foodgrade ethanol with a concentration of 50% as much as 560 ml by stirring on a hotplate at 30 °C and assisted by a magnetic stirrer using research variables in the form of a stirring speed of 600 rpm and a long time of stirring (30 minutes, 60 minutes, 90 minutes) which will then be filtered to obtain porang flour precipitate then in the oven for 12 hours with a temperature of 90 °C. From the research results, it was found that the best glucomannan content was at a stirring speed of 600 rpm for 60 minutes, namely 81,52%. Then, the best results of glucomannan flour were applied by being used as an ingredient for making jelly candy added to carrageenan. The addition of carrageenan to making jelly candy is to strengthen the texture and thicken the food itself. Based on the organoleptic test results, the best jelly candy composition was found in the second variable, namely the composition of 6 gr of glucomannan flour with 4 gr of carrageenan.



Keywords—Porang flour, Glucomannan, Jelly candy, Carrageenan, Organoleptic

Copyright © 2024 by Authors, Published by Direktorat Riset dan Pengabdian kepada Masyarakat (DRPM), Institut Teknologi Sepuluh Nopember (ITS), Surabaya. This article is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/)

I. INTRODUCTION

Indonesia is one of the countries that produces porang tubers in the world. Data from the Ministry of Industry say that in 2020, porang tuber production in Indonesia will reach 142,000 tons from a land area of 19,950 hectares (ha), and it is targeted that in 2024 porang tuber production will reach 600,000 tons from a land area of 100,000 ha [1].

Porang is a plant that is classified as tubers. The porang plant belongs to the species *Amorphophallus oncophyllus*. This plant is generally found in the forest, after it was discovered that the porang plant had a high enough glucomannan content, this plant began to be cultivated by the community [2]. The biggest benefit of cultivating

porang plants is to get the tubers. Harvested porang tubers can be sliced or chipped and then dried. Porang slices/chips can then be processed into konjac flour or konyaku [3]. From this konjac flour glucomannan can be obtained. To obtain glucomannan from konjac flour, it is necessary to carry out a treatment that can separate the root material from calcium oxalate which is toxic to humans. The treatment can be in the form of chemical processes such as soaking the porang in NaCl solution, mechanical processes by grinding and drying the porang, as well as enzymatic processes [4].

To get glucomannan from porang flour, an extraction process is carried out. Extraction can be done in various ways, but generally using a solvent based on the solubility of the component to be extracted [5]. The choice of

¹ Departement of Chemical Engineering, Institut Teknologi Sepuluh Nopember, Sukolilo, Surabaya, 60111, Indonesia. *E-mail: juliastuti@its.ac.id

² Departement of Chemical Engineering, Institut Teknologi Sepuluh Nopember, Sukolilo, Surabaya, 60111, Indonesia. E-mail: meliyaaal7@gmail.com

J. Fund. Appl. Chem. Eng., 2024, 5 (1), 17-21
eISSN 2964-710X

³ Departement of Chemical Engineering, Institut Teknologi Sepuluh Nopember, Sukolilo, Surabaya, 60111, Indonesia. E-mail: gmochemmad@gmail.com

extraction solvent to increase the glucomannan content of porang flour depends on several things, namely the solubility of the components to be extracted, the penetration ability of the material and its interaction with the matrix of the sample and the dielectric constant of the solvent and dissolved material used [6]. In addition, the selection of the type of solvent is done by looking at the degree of polarity. To consider a good extractor material, a solvent that has the same polarity or close to the compound to be extracted is needed. This is because polar compounds only dissolve well in polar solvents and so do non-polar compounds. Non-polar compounds can dissolve well in non-polar solvents. The degree of polarity of a compound is determined by the dielectric constant of that compound. Compounds that have a high dielectric constant have a higher polarity [7].

Carrageenan is the name given to a family of linear polysaccharides obtained from red seaweed and important for food. In the carrageenan industry, it functions as a stabilizer (balance regulator), thickener, gel former and others [8]. In the food industry, carrageenan is categorized as a food additive. Extracted carrageenan can be obtained by precipitation with alcohol. The types of alcohol commonly used for purification are limited to methanol, ethanol, isopropanol [9]. Carrageenan is a water-soluble polymer of a linear chain of partially sulfated galactans that has high potential as an edible film former. Carrageenan is a potential hydrocolloid for making edible films, due to its ability to form gels, is stable, rigid and elastic, edible and renewable [10]. Hydrocolloids have advantages, including good ability to protect products against oxygen, carbon dioxide and lipids as well as the required mechanical properties [11]. The weakness of carbohydrates is that they are not good at holding back the migration of water vapor [12]. In addition, carrageenan is a non-calorie polysaccharide which is often called dietary fiber which is very good for digestion because of its relatively high crude fiber content. Consumption of high amounts of fiber will prevent various diseases such as colon cancer, cardiovascular disease and obesity [13].

Candy is a type of confectionery that is liked by children to adults. Candies that are widely circulated in the market are very diverse in shape, type, and taste, including gum (gum), lollipop candy, chewy candy (jelly), hard candy (hard candy), chocolate-based candy (bounty), caramel, caramel. chewing nuts, nougat, and ginger candy [14].

The National Standardization Agency (2008) stated that jelly candy is confectionery with a soft texture, which is processed by adding hydrocolloid components such as agar, gum, pectin, starch, carrageenan, gelatin and others. which is used for texture modification to produce a chewy product [15]. The dominance of gelatin as a component of the hydrocolloid forming jelly candy is 23% of the use of gelatin in the food industry of 154,000 tons [16].

This research study aims to study the effect of using glucomannan and carrageenan flour in the manufacture of jelly candy. Glucomannan and carrageenan flour are used as the main raw materials in the manufacture of jelly candy.

II. METHOD

Experiments were conducted in the following steps:

A. Glucomannan Percent Increase

Prepare 70 gr of Crude Konjac Flour for each variable and add 560 ml of ethanol with a concentration of 50% (v/v). Then stir the mixture for 60 minutes at room temperature at a speed of 600 rpm with 3 soakings. Then separate the solid (cake) of porang flour which will then be dried with filtrate (ethanol) which will be analyzed for its oxalate content using a vacuum pump. After that, repeat the procedure in steps 2 and 3 for variable stirring time (60 minutes, 90 minutes) then dry the material in the oven for 12 hours at 90 °C until dry. then grind and sift the dry ingredients using an 80 mesh sieve. After that save porang flour with a higher glucomannan content. Repeat the experimental steps with other variables that have been determined [8].

B. Jelly Candy Making Process

Pour konjac glucomannan according to the variables, carrageenan according to the variables, and 85 ml water into the pan. After that, stir the mixture until homogeneous over medium heat. Once completely mixed, add 35 gr of granulated sugar and stir again until the texture thickens. Then, add the lime juice of the calamansi and stir until it is completely mixed. Then, stir again quickly and then print. After molding, the jelly candy is dried for 3 x 24 hours at room temperature, namely 30 °C.

Then, the jelly candy is removed from the mold after the texture hardens. Finally, jelly candy is cut according to the size needed.

III. RESULTS AND DISCUSSION

This research was carried out in stages starting with the process of increasing glucomannan in Crude Konjac Flour (CKF) using 96% food grade ethanol solvent, using 50% ethanol concentration in 560 ml of solution, where the ratio of porang flour and solution was 1:8. Then, for the glucomannan flour obtained it is applied to food products in the form of jelly candy with the addition of carrageenan, where for the manufacture of jelly candy using comparison variations of glucomannan flour and carrageenan.

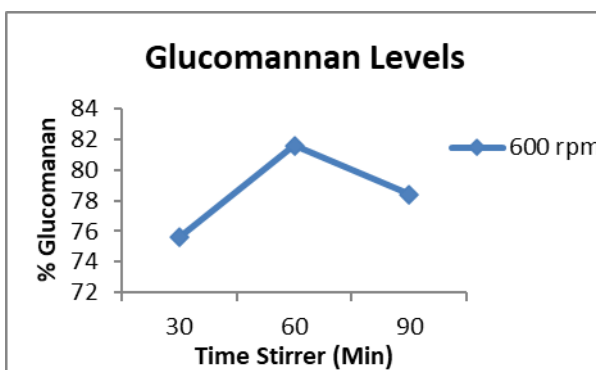


Figure 1. Analysis of Glucomannan Levels

The high or low levels of glucomannan are influenced by starch content, fiber content, and oxalate levels. The increase in glucomannan levels was in line with the decrease in other non-glucomannan components, such as

oxalate, protein, fat, ash, and starch. Good glucomannan has a high viscosity and low water, ash, protein, fat and starch content. Differences in the high or low levels of glucomannan produced may be caused by the solution used, how to process it and also the stirring speed and mixing time.

Continuous stirring greatly affects the results of increasing glucomannan levels. The stirring process will facilitate the release and dissolution of the impurity components on the surface of the porang flour. Stirring can expand the contact area with increasing stirring speed. Stirring also increases the homogeneity of a mixture. The glucomannan extraction process was carried out using ethanol as a solvent because ethanol can reduce impurities in the surface granules of porang flour. The choice of this solvent is based on the selectivity and physico-chemical properties to be extracted. Glucomannan can be extracted using water-miscible solvents such as ethanol which can dissolve in water but will not cause glucomannan to expand. Ethanol can remove micro fines remaining on the surface and impurities trapped in glucomannan particles such as ash, oxalate, starch, protein, etc.

The ingredients used in making food products are natural coloring and flavorings (orange), sugar (Gulaku), and thickening agents (Hakiki Halal gelatin, porang flour).



Figure 3. Blanco 2 (12 gr initial porang flour + 0.2 gr carrageenan)



Figure 2. Blanco 1 (12 gr gelatin + 0.2 gr carrageenan)

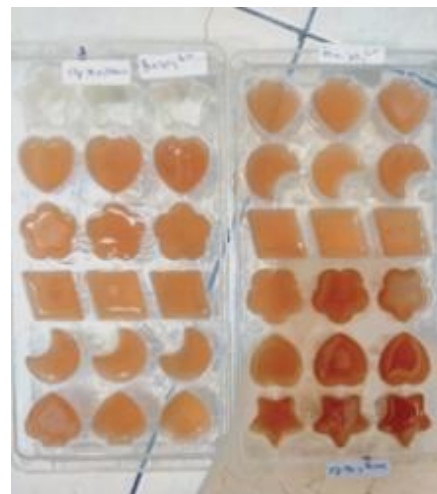


Figure 4. Blanco 3 (12 gr glucomannan flour + 0.2 gr carrageenan)

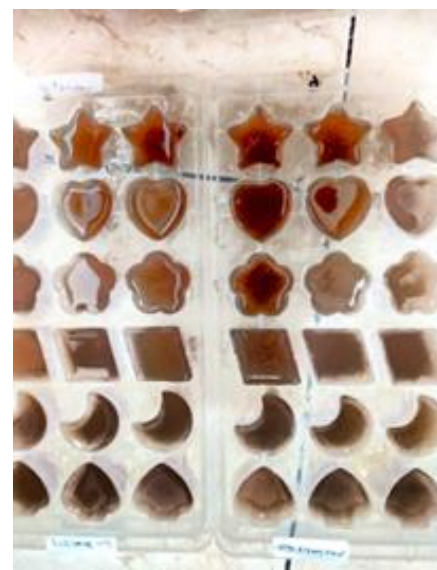


Figure 5. Blanco 4 (12 gr carrageenan)

TABLE 1.
COMPOSITION OF JELLY CANDY

Sample	Number	Content
Blanco	1	12 gr gelatin + 0.2 gr carrageenan
	2	12 gr initial porang flour + 0.2 gr carrageenan
	3	12 gr glucomannan flour + 0.2 gr carrageenan
	4	12 gr carrageenan
Variable	1	8 grams of glucomannan flour + 2 grams of carrageenan
	2	6 gr glucomannan flour + 4 gr carrageenan
	3	4 gr glucomannan flour + 6 gr carrageenan

Product manufacturing is carried out at the author's boarding house, namely Keputih, Surabaya to avoid contamination of materials and processes from unwanted things and to simplify the cooking and packaging process. J. Fund. Appl. Chem. Eng., **2024**, 5 (1), 17-21
eISSN 2964-710X



Figure 6. Variable 1 (8 gr glucomannan flour + 2 gr of carrageenan)



Figure 7. Variable 2 (6 gr glucomannan flour + 4 gr carrageenan)



Figure 8. Variable 3 (4 gr glucomannan flour + 6 gr carrageenan)

It can be seen from Figure 2 to Figure 8 that the mixture of glucomannan and carrageenan flour can be used as jelly

candy because there is gel in it, and glucomannan flour can meet the standard as a substitute for gelatin. Glucomannan has properties that can reduce the surface tension of a mixture of kappa carrageenan and glucomannan gel so that a more elastic gel is formed and reduce the brittleness of carrageenan gel so that the gel is stronger. A mixture of carrageenan and konjac can produce a good gel because there is a synergistic relationship in the gel formation process so that it can produce a gel with high gel strength and good texture and elasticity.

TABLE 2.
SKOR ORGANOLEPTIC ANALYSIS

Sample Variable	Taste (1- 5)	Texture (1-5)	Color (1-5)	Smell (1-5)
Blanco 1	3,4	2,9	3,1	3,4
Blanco 2	3,9	1,8	2,1	3,4
Blanco 3	3,4	2,4	3,5	3,1
Blanco 4	2,4	4,3	3,3	3,4
Variable 1	3,6	3,1	4	3,2
Variable 2	4,3	3,8	4,2	3,6
Variable 3	3,9	4,5	3,8	3,2

Organoleptic tests are also known as sensory tests. Organoleptic test is a method of testing using the human senses as the main tool for measuring the acceptability of a product. The characteristic that determines whether a product is accepted or not is the sensory nature of the product. The senses used in assessing the sensory properties of the Jelly Candy product made are the senses of sight, touch, smell and taste. Organoleptic testing is important in the application of quality. Organoleptic testing can provide an indication of the plus and minus values of the product being made. To help obtain values from this organoleptic test, a questionnaire is used. The questionnaire is a tool in the form of a list of questions that must be filled in by respondents or panelists (people) who will measure the desired parameters.

It can be seen that for the best results of jelly candy is the second variable, namely with a composition of 6 gr of glucomannan flour with 4 gr of carrageenan. Due to the parameters of texture, taste, color and odor, these variables are the best results and are preferred by the panelists among the others. The panelists liked the taste of jelly candy in variable 2 because in jelly candy products taste is the most important parameter consumed besides the texture of the jelly candy. Variable 3 gets a score on the highest texture parameter, namely 4,5 but the taste of the jelly candy is not liked. Likewise with blank 4 but the panelists did not like the taste parameter. So it can be concluded that of all the existing parameters, variable 2 gets a good score among the others.

IV. CONCLUSION

From the experimental results we can conclude some important points: Porang flour with the highest glucomannan content was 81.52% which was processed with a stirring speed of 600 rpm and a long stirring time of 60 minutes. The best results of jelly candy is the second variable, namely with a composition of 6 gr of glucomannan flour with 4 gr of carrageenan.

V. ACKNOWLEDGEMENT

The author would like to express his deepest gratitude to all parties who helped ensure the continuity of this research so that it could be carried out well.

VI. REFERENCES

- [1] Ali, A. M. M., Kishimura, H., & Benjakul, S. (2018). Physicochemical and molecular properties of gelatin from skin of golden carp (*Probarbus Jullieni*) as influenced by acid pretreatment and prior-ultrasonication. *Food Hydrocolloids*, 82, 164–172. <https://doi.org/10.1016/j.foodhyd.2018.03.052>
- [2] Alvita, L. R., Elsyana, V., & Kining, E. (2021). Formulasi Permen Jelly Jeruk Kalamansi dengan Substitusi Glukomanan Konjak. *Jurnal Gizi Dan Kuliner (Journal of Nutrition and Culinary)*, 1(2), 11. <https://doi.org/10.24114/jnc.v1i2.26863>
- [3] Arham, R., Metusalach, Salengke, & Tahir, M. M. (2017). Karakterisasi Edible Film Karagenan Dengan Pemplastis Gliserol Characterization of Carrageenan Edible films Plasticized with Glycerol. *Jurnal Pengolahan Hasil Perikanan Indonesia*, 20, 219–229.
- [4] Aryanti, N., Kharis, D., & Abidin, Y. (2015). EKSTRAKSI GLUKOMANAN DARI PORANG LOKAL (*Amorphophallus oncophyllus* dan *Amorphophallus muerelli blume*). *Metana*, 11(01), 21–30.
- [5] Behera, S. S., & Ray, R. C. (2016). Konjac glucomannan, a promising polysaccharide of *Amorphophallus konjac* K. Koch in health care. *International Journal of Biological Macromolecules*, 92, 942–956. <https://doi.org/10.1016/j.ijbiomac.2016.07.098>
- [6] Chua, M., Chan, K., Hocking, T. J., Williams, P. A., Perry, C. J., & Baldwin, T. C. (2012). Methodologies for the extraction and analysis of konjac glucomannan from corms of *Amorphophallus konjac* K. Koch. *Carbohydrate Polymers*, 87(3), 2202–2210. <https://doi.org/10.1016/j.carbpol.2011.10.053>
- [7] Desiana, & Hendrawati. (2015). Pembuatan Karagenan dari *Eucheuma cottoni* dengan Ekstraksi KOH Menggunakan Variabel Waktu Ekstraksi. *Seminar Nasional Sains Dan Teknologi* \, November, 1–7.
- [8] Han, E. S. et. a. (2019). Modul Diseminasi: Budidaya dan Pengembangan Porang (*Amorphophallus muelleri Blume*) Sebagai Salah Satu Potensi Bahan Baku Lokal. *Journal of Chemical Information and Modeling*, 53(9), 1689–1699. http://pre.ub.ac.id/files/modul_porang.pdf
- [9] Haryani Anwar, S., Br. Ginting, B. M., Aisyah, Y., & Safriani, N. (2017). PEMANFAATAN TEPUNG PORANG (*Amorphophallus oncophyllus*) SEBAGAI PENSTABIL EMULSI M/A DAN BAHAN PENYALUT PADA MIKROKAPSUL MINYAK IKAN. *Jurnal Teknologi Industri Pertanian*, 27(1), 76–88. <https://doi.org/10.24961/j.tek.ind.pert.2017.27.1.76>
- [10] Ibrahim, M. T., Purwadi, I., & Wahyudi, B. (2022). Peningkatan Kadar Glukomanan dari Umbi Iles-iles (*Amorphophallus variabilis*) pada Proses Ekstraksi dengan Pelarut Isopropil Alkohol. *ChemPro*, 3(1), 51–57. <https://doi.org/10.33005/chempro.v3i1.151>
- [11] Iqbal, M., Anam, C., & Ridwan A, A. (2015). Optimasi rendemen dan kekuatan gel gelatin ekstrak tulang ikan lele dumbo (*clarias gariepinus* sp). *Jurnal Teknosains Pangan*, 4(4), 8–10. www.ilmupangan.fp.uns.ac.id
- [12] Irawan, A. (2019). No Title. *Agrokompleks Kita*. <https://agrokomplekskita.com/modul-budidaya-porang-skala-lha-edisi-i-september-2019/>
- [13] Isengard, H. D. (2001). Water content, one of the most important properties of food. *Food Control*, 12(7), 395–400. [https://doi.org/10.1016/S0956-7135\(01\)00043-3](https://doi.org/10.1016/S0956-7135(01)00043-3)
- [14] Karangan, J., Sugeng, B., & Sulardi, S. (2019). Uji KEASAMAN AIR DENGAN ALAT SENSOR pH DI STT MIGAS BALIKPAPAN. *Jurnal Kacapuri: Jurnal Keilmuan Teknik Sipil*, 2(1), 65. <https://doi.org/10.31602/jk.v2i1.2065>
- [15] Karim, A. A., & Bhat, R. (2009). Fish gelatin: properties, challenges, and prospects as an alternative to mammalian gelatins. *Food Hydrocolloids*, 23(3), 563–576. <https://doi.org/10.1016/j.foodhyd.2008.07.002>
- [16] Karo, F. Y. E. B., Sinaga, H., & Karo, T. (2021). The use of konjac flour as gelatine substitution in making panna cotta. *IOP Conference*

Series: Earth and Environmental Science, 782(3).
<https://doi.org/10.1088/1755-1315/782/3/032106>