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Effect of Temperature and Extraction Time on Yield, Moisture Content, and Coconut Coir Methoxyl Pectin

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Abstract
This study aims to see the effect of temperature and extraction time on moisture content, yield and methoxyl pectin content of coconut coir. This research was conducted with a factorial experiment in a completely randomized design (CRD), which consisted of two treatments, namely extraction temperature and extraction time with three replications. The results of this study indicate that the extraction temperature greatly affects the pectin yield, water content and methoxyl pectin while the extraction time affects the pectin water content. At a temperature of 70OC and an extraction time of 60 minutes, the highest average yield of pectin was obtained, namely 4.31%, while the lowest average yield of pectin was obtained from the treatment of an extraction temperature of 90OC and an extraction time of 90 minutes. The highest average methoxyl content was obtained from a temperature treatment of 70OC and an extraction time of 30 minutes, while the lowest average percentage of methoxyl content was obtained from a temperature treatment of 90OC extraction and an extraction time of 90 minutes, namely 8.03% and 7.61%, respectively. From the results obtained, it was concluded that the pectin obtained belonged to the pectin group with high methoxyl content, namely >7%. The lowest average percentage of pectin content was obtained at 90OC and 90 minutes of extraction time, namely 10.19%, while the highest was obtained from the treatment of 70OC extraction temperature and 30 minutes of extraction time. From the results of the analysis of water content, it was found that the water content of cocopeat pectin obtained in this study fulfilled the requirements for dry pectin moisture content, namely 10-14%.

Keywords— Coconut Coir Methoxyl Pectin, Extraction, Moisture, Temperature, Time on Yield

Introduction

Coconut (Coco Nucifera LINN) is one of the agricultural industrial plants which is currently being developed by the government in line with efforts to increase foreign exchange through non-oil and gas export commodities which have an important role in the economy in Indonesia. The benefits of the coconut plant do not only lie in the flesh of the fruit which can be processed into copra, coconut milk and coconut oil, but all parts of the coconut plant have great benefits for human life. The benefits of this coconut plant are so great that some call it the "tree of life" or the tree of life (Banzon and Velasco, 1982). Coconut coir is one part of the coconut fruit, which until now in Indonesia most of the sasih is waste in utilization. coconuts. As a part of coconut fruit, the amount of coconut coir follows the amount of coconut production. According to Somaatmadja (1984) in producing one ton of copra it also produces 1.8 tons of coconut coir. The average copra production per year is around 1,519,440 tons. This means every year we produce 2,734,992 tons of coconut coir. Until now the level of utilization of coconut coir is still very low and is generally used as fuel or simply thrown away as waste. Only a small portion is used in the fiber industry and some handicrafts on a limited basis.

Besides fiber, coconut coir contains a variety of substances with high levels, including pectin. Pectin is a compound that has the ability to form gels and based on these properties it is mainly used in the manufacture

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of jelly, jam and marmalade (Berk, 1976). Generally, commercial pectin is made from the rest of the fruit processing industry, for example citrus fruit peels, apple pulp, grape skins and so on.

According to Beyn (1951) the pectin content of coconut coir varies from 4.8 to 12% depending on the age of the fruit. Meanwhile, according to Fardiaz (1984) naturally the pectin content in various plant products is different from one another. However, it all depends on how the process is carried out for extracting pectin from plant tissue. The process of extracting pectin from plant tissue is usually done by extracting the plant tissue but. This also depends on the treatment given to the extracted plant tissue. This condition of giving the best treatment will be revealed through this research.

As the research object, coconuts of the Galam variety with cultivar Mapanget 99 were used with a harvest age of 12 months. With the provision of temperature treatment and the length of the extraction process on the tissue material.

Literature Review

Things Observed:

The dry pectin obtained was weighed

Methoxyl Pectin, Moisture Content of Pectin, Degree of Esterification, Level of Galacturonic and Weight. equivalent.

Pectin yield.

Pectin yield was calculated based on weight comparison. dry pectin and the initial weight of the material. The calculation of pectin yield is:

Dry Pectin Weight

dry pectin weight

$\%\ Rendemen = x\ 100$

first weight

The mashed material is weighed in a porcelain cup as much as 1-2 grams. Placed in the oven and heated at 100-105°C for 5 hours. Cooled in a desiccator and weighed. This treatment was repeated until the weight was constant.

first weight– start – final weight

$\%$ water content $= x\ 100$

first weight– start

Methoxyl content (Ranggana, 1977) Dissolve 0.5 g of pectin in 100 ml of CO_2-free distilled water, then add 1 gram of NaCl and 6 drops of red phenolphthalein indicator. Then the solution is neutralized. with 0.1 N NaOH until the indicator changes color (neutral pH). The neutral solution was added with 25 ml of 0.25 N NaOH, stirred and allowed to stand for 30 minutes at room temperature in a closed state. Then 25 ml of 0.25 N HCl was added to the solution and titrated with 0.1 N NaOH until the color changed to red and lasted 30 seconds. The amount of methoxyl content is calculated by the following equation:

31 10 0

Weighting to determine the amount of pectin that can be extracted then the amount of pectin that can be extracted then analyzed the yield of pectin, content

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$$\% \ Metoksil = \frac{}{dry\ pectin\ weight}$$

Research Method

Place and Time This research was carried out at the Laboratory of the Department of Agricultural Technology and Laboratories Sam Ratulangi University Chemistry, for 1 month.

Materials and Tools

The main material used in this research is coconut shell (Cocos nucifera LINN).

The chemicals used: 1M Aluminum Chloride, 0.02 N Hydrochloric Acid, 48 Ammonium Hydroxide, phenolphthalein indicator, 0.1 N Sodium Hydroxide, 85 8 Acid Alcohol, 95 Neutral Alcohol and Aquadas and chemicals for analysis: Ethanol 96, Sodium Hydroxide 0.25 N and Hydrochloric Acid 0.25 N.

The tools used are: scales, knife, scissors, beaker, measuring cup, pipette, stirrer, heater, measuring pipette, measuring flask, oven, pH meter, bottle container, thermometer, mortar, filter cloth and other tools tools for analysis are: burette, stativ, porcelain cup, exicator, watch glass, mufflefurnace, magnetic stirrer and erlenmeyer.

Experimental design

This research was carried out using a factorial experiment method in a completely randomized design (CRD) consisting of two factors and three replications.

Factor A is temperature treatment with three levels:

- The temperature of 70° C hereinafter referred to as A_1
- The temperature of 80° C is called A_2
- The temperature of 90° c is called A3

Factor B is the long extraction treatment with three levels:

- The next 30 minutes are called B_1
- 60 minutes is called B_2
- 90 minutes called B3

Cure Procedure

The work procedure was carried out by means of extraction according to Gregory (1982).

Dried coconut husk that has been separated from the shell, cut into pieces approximately 2 cm long. The pieces of coconut fiber are weighed and then the pieces of coconut fiber are ground. Extraction was carried out by heating the material in a 02 N HC1 solution (prepared by diluting 1.66 ml concentrated HC1 into 1 liter of solution).

Extraction was carried out at 70° C, 80° C and 90° C with extraction times of 30 minutes, 60 minutes and 90 minutes. The ratio of the material and the 0.02 N HC1 solution is 1: 10. After the extraction is complete, the solution is then filtered using a filter cloth. The extraction obtained was added with 6 ml/100 ml of 1 M Aluminum Chloride and 48 Ammonium Hydroxide to precipitate the pectin. The pH of the precipitation is adjusted between 3.8 - 4.0 by adding Ammonium Hydroxide 4 (made by diluting 4 ml of Ammonia into 100 ml of solution). The precipitate that occurs is filtered using a filter cloth. Furthermore, the precipitate was

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washed with 85% Acid Alcohol solution and continued with 95% Neutral Alcohol. Then the precipitate was dried in an oven at 370 - 40° C for 8 hours.

Things Observed:

The dry pectin obtained was weighed

Methoxyl Pectin, Moisture Content of Pectin, Degree of Esterification, Level of Galacturonic and Weight. equivalent.

Pectin yield.

Pectin yield was calculated based on weight comparison. dry pectin and the initial weight of the material. The calculation of pectin yield is:

Dry Pectin Weight

Dry pectin weight

$\%\ Rendemen = x\ 100$

First weight

The mashed material is weighed in a porcelain cup as much as 1-2 grams. Placed in the oven and heated at 100-105°C for 5 hours. Cooled in a desiccator and weighed. This treatment was repeated until the weight was constant.

First weight − Start – Final weight

$\%$ water content $= x\ 100$

First weight − start

Methoxyl content (Ranggana, 1977) Dissolve 0.5 g of pectin in 100 ml of CO_2-free distilled water, then add 1 gram of NaCl and 6 drops of red phenolphthalein indicator. Then the solution is neutralized. with 0.1 N NaOH until the indicator changes color (neutral pH). The neutral solution was added with 25 ml of 0.25 N NaOH, stirred and allowed to stand for 30 minutes at room temperature in a closed state. Then 25 ml of 0.25 N HCl was added to the solution and titrated with 0.1 N NaOH until the color changed to red and lasted 30 seconds. The amount of methoxyl content is calculated by the following equation:

31 10 0

Weighing to determine the amount of pectin that can be extracted then the amount of pectin that can be extracted then analyzed the yield of pectin, content

$\%\ Metoksil =$

Dry pectin weight

Results and Discussion

1. Pectin yield

The average yield of coconut coir pectin extracted based on different temperatures and extraction times is presented in the table 1

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Perlakuan		Ulangan			Rata-rata
Suhu (A)	Lama (B)	1	2	3	%
70°C	30'	3,80	3,87	3,73	3,80
	60'	3,97	3,95	3,86	3,92
	90'	3,90	3,90	3,84	3,88
80°C	30'	4,27	4,27	4,29	4,27
	60'	4,30	4,37	4,27	4,31
	90'	4,27	4,28	4,19	4,24
90°C	30'	3,57	3,62	3,67	3,62
	60'	3,63	3,65	3,69	3,65
	90'	3,59	3,59	3,59	3,59

Table 1 shows that the highest average yield of dry cocopeat pectin, namely 4.31%, was obtained from a temperature treatment of 80°C and an extraction time of 60 minutes, while the lowest average yield of dry cocopeat pectin, namely 3.59%, was obtained from treatment temperature 90° C and extraction time 90 minutes.

The results of the analysis of variance for the yield of dry cocopeat pectin (appendix 1) showed that the extraction temperature did not have a significant effect, while the interaction between temperature and extraction time did not have a significant effect on the yield of dry pectin.

2. Methoxyl Levels

The results of the average methoxyl pectin content of dry coconut coir from different temperature treatments and extraction times are presented in the following table: (table 2)

Perlakuan		Ulangan			Rata-rata
Suhu (A)	Lama (B)	1	2	3	%
70°C	30'	7,9938	7,9973	8,1075	8,0328
	60'	7,9075	7,9835	7,9981	7,9521
	90'	7,9604	7,9671	7,9806	7,9693
80°C	30'	7,7852	7,7841	7,7841	7,7844
	60'	7,7603	7,7745	7,7432	7,7593
	90'	7,7431	7,7632	7,7316	7,7459
90°C	30'	7,6540	7,7617	7,6678	7,6411
	60'	7,6321	7,6371	7,6458	7,6381
	90'	7,6175	7,5975	7,7273	7,6143

Table 2 shows that the highest average methoxyl pectin content of dry coconut coir was obtained from the treatment with an extraction temperature of 70° C and an extraction time of 30', while the lowest average methoxyl pectin content of dry coconut coir was obtained from the treatment with a temperature of 90° C and an extraction time 90 minutes. From the table above it was also found that the value of methoxyl pectin content of dry coconut coir was obtained in the study. This belongs to the group of pectins with high methoxyl content, which is greater than 7. The results of the analysis of methoxyl pectin levels of dry coconut coir showed that

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the extraction temperature treatment had a very significant effect, while the extraction treatment was the extraction time and the interaction between the temperature treatments.

3. Pectin Moisture Content

The average results of the analysis of the water content of dry coconut coir pectin are produced based on different temperature treatments and extraction times are presented in table 3.

Perlakuan		Ulangan			Rata-rata
Suhu (A)	Lama (B)	1	2	3	%
70°C	30'	13,80	13,67	13,62	13,69
	60'	12,67	12,56	12,53	12,58
	90'	12,59	12,48	12,45	12,50
80°C	30'	11,85	11,92	11,89	11,88
	60'	11,73	11,75	11,69	11,72
	90'	11,65	11,68	11,62	11,65
90°C	30'	11,40	11,45	11,46	11,43
	60'	10,36	10,32	10,39	10,35
	90'	10,18	10,21	10,19	10,19

Table 3 shows that the average percent water content

The highest dry pectin obtained from coco coir was 13.69 from the extraction temperature treatment of 70°C and 30 minutes of extraction time, while the lowest average percentage of water content was 10.19 obtained from the treatment of 90°C extraction temperature and 90 minutes of extraction time.

This is because at 70°C, the amount of water that evaporates from the extract is still small compared to the amount of water that evaporates at 80°C and 90°C.

Conclusion

1. Extraction temperature affects yield, water content and methoxyl pectin content.
2. Extraction time affects pectin
3. Dried coconut coir pectin obtained in this study is classified as high methoxyl pectin.
4. The moisture content of the dry pectin of coconut coir obtained in this study met the requirements for the moisture content of dry pectin, namely 7 - 14 8.
5. The highest yield of pectin was obtained at an extraction temperature of 800C and an extraction time of 60 minutes ($A2B_2$), while the lowest was obtained in the treatment of extraction temperature of 90°C and extraction time of 90 minutes (A3B3)

Suggestion

It is necessary to carry out further research on dry pectin of coconut coir with treatment of extraction temperature and extraction time to obtain more optimum results by paying attention to or looking for better extraction time ranges to obtain optimum pectin yields. Also use or try other solvents that might give more optimum results.

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