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APPLICATION OF ARECA NUT EXTRACT AS A NATURAL COLORANT IN THE PROCESS OF IN ECO-FRIENDLY SOAP MAKING

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A B S T R A C T

The use of synthetic dyes can be harmful to health. While natural dyes are non-toxic, easily degradable and environmentally friendly. Areca nut extract contains tannins and anthocyanins, which are natural pigments that have potential as natural dyes. Natural coloring from areca nut extract is applied to solid soap. Areca seeds are extracted and then dried with three different drying methods, namely the oven, dehydrator and Freeze dryer methods to produce powdered dyes. Different drying of areca nut extracts will produce areca nut extracts with different chemical content. This study aims to determine the results of chemical analysis of soap added with areca nut extract with several different drying methods and determine the best formulation of soap added with areca nut extract and SNI test of solid soap produced by using areca nut extract powder. The research method used is experimental laboratory. The analysis of solid soap preparations carried out includes pH test, water content, foam power and organoleptic test. The research results were processed using descriptive analysis. The results showed that the pH of solid soap added with areca nut extract with different drying met the SNI requirements. The water content of areca nut extract solid soap meets SNI requirements, which is no more than 15%. And based on the results of the liking of solid soap according to the organoleptic results of areca nut extract soap with the treatment of drying areca nut extract with dehydrator formula 2 produces areca nut extract solid soap that is most liked by panelists,

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INTRODUCTION

Most soaps sold on the market are soaps with the addition of synthetic ingredients as active ingredients. According to (Yandri et al., 2024) Synthetic dyes are toxic when inhaled, inhaled or absorbed through the skin, resulting in oxidative stress on cells and tissues. Soap products based on natural ingredients are still rarely found on the market. Solid bath soap added with natural ingredients is very popular because it is safe for the skin. Research on making solid soap with the addition of natural ingredients is solid soap with the addition of moringa leaves. (Husnah et al., 2019).

Natural dyes are dyes derived from plant parts, namely roots, logs, bark, leaves, flowers, and fruit, which if extracted can produce dyes. One of the potential natural dyes that can be used as a natural dye is areca nut seed dye. (Eskak & Salma, 2020). Based on the results of research (Chadijah et al., 2021) areca nut seeds contain tannins and anthocyanins which can be used as natural dyes. Research that utilizes areca seeds as dyes includes research using areca nut extracts as dyes, namely areca nut extracts for fabric dyes (Prabawa, 2015). The application of areca nut powder extract in soap has been carried out by (Yernisa, 2013), namely on transparent soap and the areca nut extract used is areca nut extract using the *spray drying* method. The drying method of areca nut extract powder is *spray drying*. In this study, areca nut extract was dried using 3 different drying methods, namely the oven, *dehydrator* and *Freeze dryer* methods. And then applied to the manufacture of solid soap.

According to (Saleh & Yusnaini, 2022) The advantages of drying using an oven are that the temperature and speed of the drying process with an oven can be adjusted, sanitation and hygiene can be controlled. And the advantages of using dehydrator drying are that the temperature and air flow in the dehydrator can be adjusted more effectively and the material is dried more evenly and does not experience excessive physical or chemical damage.(Melinda et al., 2024) While the advantage of drying method with *Freeze dryer* is that it can maintain the quality of the drying results. (Nofrianti, 2013)

Soap used as a cleanser must have quality requirements so as not to irritate the skin. (Pine et al., 2023). Parameters that indicate the quality and criteria for soap that is feasible or not to use are pH and moisture content. (Setiawati et al., 2021).. This study aims to determine the best formulation based on organoleptic test and SNI test of solid soap produced with the use of areca nut extract powder.

RESEARCH METHODS

Materials and Tools

Materials for the manufacture of areca nut extract are yellow ripe areca nuts obtained from Agam Regency. Ethanol 96% ethanol 70%, NaOH, palm oil brand Sunco, coconut oil, olive oil, soap fragrance, distilled water.

The tools used in this study include: Blender, analytical balance, evaporator, electric heating flask, 100ml glass, 250 ml Erlenmeyer, oven, thermometer, stirring rod, test tube, drop pipette, *Freeze dryer*, *dehydrator*. Bath, magnetic stirrer, funnel, thermometer, pH paper,

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Time and place of research

This research was conducted at the Dharma Andalas University Agricultural Industrial Technology Laboratory and the LLDIKTI Region X Laboratory, which was conducted in August - October 2023.

Research Procedure

The research method used is *experimental laboratory* which aims to determine the formulation and physical and chemical quality and organoleptic quality of areca nut extract soap. The drying of the thick extract of areca nut is carried out by three methods, namely drying using a *Freeze dryer*, Dehydrator and oven so as to produce a powder colorant. The areca nut extract powder obtained was then added to solid soap as a colorant. Analysis of areca nut extract powder extract is color (L value, a, b) using a *chromameter*. Analysis of solid soap added with areca nut extract is carried out to produce soap with quality according to SNI standards.

Preparation of Thickened Areca Seed Extract

Areca seeds were crushed and sieved with 45 mesh size, then weighed 50 grams, then put into a 1000 ml glass cup. Into the glass goblet was added 96% ethanol solvent. then heated with a water bath whose temperature can be controlled (waterbath) while stirring with a stirrer. The extraction temperature was 50-60º C and the extraction time was 5 hours. ºThe extraction results obtained were cooled and then filtered and put into an evaporator with a temperature of 50-60 ° C to separate the extract and solvent, so that a thick extract of areca nut was obtained.

Drying of Areca Nut Condensed Extract

The thick extract of areca nut seeds obtained was then dried using 3 drying methods:

1. Dehydratorr
2. Oven
3. *Freeze dryer*

Solid soap making

NaOH was dissolved into distilled water and stirred until it dissolved to a temperature of 43º C. Vegetable oils were mixed and heated to a temperature of 43º C, then the NaOH solution was mixed with the oil mixture and stirred until evenly distributed. Previously, 0.5% (dissolving 50.5 grams of powdered extract into 100 ml of distilled water) and 1% (dissolving 1 gram of powdered extract of areca nut into 100 ml of distilled water) solutions were made. A total of 1 ml of 0.5% areca nut extract solution was mixed into formula 1 soap preparation, and 1 ml of 1% areca nut extract solution was mixed into formula 2 soap preparation. The mixture was stirred until it thickened to form soap and then molded. The areca nut extract solid soap preparation formula can be seen in Table 1 below.

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Table 1. Solid soap preparation formula

Bahan	Formula 1	Formula 2
Areca nut extract	0,5 %	1 %
Coconut oil (gr)	16.7	16.7
Palm oil (gr)	30	30
Olive oil (gr)	10	10
NaoH (gr)	8,3	8,3
Aquades (gr)	20	20
Fragrance (gr)	-	1,6

Chemical, Physical and Organoleptic Analysis of Areca Nut Extract Soap

The analysis carried out on areca nut extract powder is a color test and the analysis of soap added with areca nut extract includes water content, foam height test, pH and organoleptic.

a. Moisture Content Analysis

Water content is calculated based on SNI 3532: 2016 (Badan Standarisasi Nasional, 2016). First weigh a petri dish that has been dried in an oven at a temperature of (105 ± 2) ºC for 30 minutes (b0); then weigh (5 ± 0.01) g of test sample into the petri dish above (b1); Heat in an oven at a temperature of (105 ± 2) ºC for 1 hour Cool in a desiccator to room temperature and then weighed (b2); Repeat the workings of letters c and d until the weight remains.

b. pH

The pH test was carried out by weighing 1 gram of soap and dissolving the soap with 10 ml of distilled water. Then dip the universal pH indicator paper into the soap solution and compare the pH value of the soap with the scale indicated on the universal pH indicator paper packaging. (Kisno Saputri et al., 2022)

c. Foam Height

Foam height is done by weighing 1 g of soap and putting it in a measuring cup and dissolving the soap with distilled water as much as 10 ml then closed. Shake for 20 seconds and calculate the height of the foam formed (Lilyawati et al., 2019)

d. Organoleptic

The organoleptic test conducted is a physical test of solid soap including color, odor, and texture. The analysis was carried out by 25 untrained panelists who were students of the TIP Unidha study program.

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RESULTS AND DISCUSSION

Areca Powder Extract

1. Color Test

The results of the color test on areca nut powder extract can be seen in (Table 2).

Table 2. Color Test of Areca Nut Powder Extract by Drying Method

Drying method	Color		
	L	a	b
Oven	17,53	9,19	6,34
Dehydrator	17,66	8,48	6,79
Freeze dryer	11,38	7,21	3,97

The results showed for the degree of redness (a) of areca nut powder extract obtained 7.21 - 9.19. The highest value of the degree of redness comes from the extract of areca nut powder using oven drying, it can be concluded that the extract of areca nut powder with the oven method produces the most intense red color compared to the *dehydrator* and *freeze dryer* methods. According to (Agni Wulansari et al., n.d.)Tannin pigments contained in areca nut extract produce a red color.

The research results for the degree of brightness (L) of areca nut seed extract were obtained from 11.38 to 17.59. The highest degree of brightness of areca nut powder extract was obtained in the extract of areca nut powder using a *dehydrator*. And the lowest degree of brightness is obtained in the extract of areca nut powder with the *Freeze dryer* method, the smaller the water content, the lower the degree of brightness. According to (Yernisa, 2013) The color assessment using the Hunter notation system includes the L value, a value and b value. The L value states the brightness level from the value 0 (black) to 100 (white), the a value states the green color (a<0) and the red color (a>0) while the b value states the blue color (b<0) and the yellow color (b>0). The drying results of areca nut powder extract based on 3 different methods obtained colors as shown in (Table 3).

Table 3. Drying results of areca nut powder extract

No.		Oven	Dehydrator	*Freeze dryer*
1	Drying Time	9 hours	9 hours	
2	Temperature	70	70	-80
3	Color	Yellowish Brown	Yellowish Brown	Chocolate

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Areca Nut Extract Soap

1. Water Content

The new soap that is ready to be made from various formulations will produce a moisture content of more than 50% so that to obtain a moisture content according to the standard, the soap needs to be allowed to stand for one week. (Nurrosyidah et al., 2019)The water content of areca nut extract soap was measured, after the soap was allowed to stand for 5 days. The results of the water content test of the areca nut extract soap produced can be seen in Table 4.

Table 4. Moisture content of solid soap dyed with areca nut extract *powder*

Treatment	Formulation 1	Formulation 2
Control	11.7	9.39
Dehydrator	9.7	8.99
Oven	8.6	8.19
Freeze dryer	10.9	7.89

Based on Table 4. Shows the water content of areca nut extract soap for formula 1 ranging from 8.6% - 11.7% and formulation 2 ranging from 7.89% - 9.39%. The results of the lowest water content of areca nut extract soap are produced in soap with the addition of areca nut extract dried by oven drying method in formula 1 and by *Freeze dryer* drying method in formulation 2. And soap in formula 2 produces lower water content compared to formula 1 because the amount of concentration of areca nut extract added in formulation 2 is greater, namely 1%.

The decrease in water content in the solid soap produced is due to the areca nut extract containing saponin compounds. Based on qualitative analysis in previous studies, it was found that areca nut extract contains saponins. According to (Pramushinta & Ajiningrum, 2018) saponin is a glycoside compound, and the hydrolysis of saponin produces glycone (sugar) and aglycone (non-sugar). Sugar can absorb water vapor because it is hygroscopic. So that the more concentration of areca nut extract that is added, the water content will decrease in the soap.

Based on the results of the research, areca nut extract soap formulation 1 and formulation 2 have met the SNI standard water content. According to SNI 3532: 2016 (National Standardization Agency, 2016). The maximum moisture content of solid soap is a maximum of 15%. Some research on well-known soap brands in Indonesia, from 5 examples of bath soaps, have a moisture content of 9.64% - 11.80%. (Habib et al., 2016)

2. *pH*

pH or degree of acidity is one of the important parameters in assessing the feasibility of soap to be used as a bath soap because if the pH of the soap is very alkaline it can damage the acid mantle on the skin which acts as a barrier to bacteria and viruses, (Setiawati et al., 2021) The results of pH testing of areca nut extract soap produced can be seen in Table 5.

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Table 5 pH of solid soap of areca nut powder extract

Treatment	Formulation 1	Formulation 2
Control	10	11
Dehydrator	10	10
Oven	10	10
Freeze dryer	9.5	10

Based on the table, it can be seen that the areca nut extract solid soap in this study is in the range of 9-5 - 10 and the pH of the solid soap formula 1 and the range of 10-11 in the solid soap formula 2. These results already meet the requirements of safe soap pH. According to (Setiawati et al., 2021) Safe soap is soap that contains a pH of 9 - 11 in the *American Society for Testing and Materials International*. And added (Rusli et al., 2019) pH soap with a range of 9-11 is relatively safe for the skin. Based on this, it can be concluded that areca nut extract solid soap is safe for the skin.

3. Foam height

The amount of foam produced in soap is one of the important parameters in determining the quality of soap (Nurrosyidah et al., 2019) The results of the foam height test on areca nut extract soap produced can be seen in Table 6.

Table 6. Froth Height Test of Solid Soap Dyed with Areca Nut Powder Extract

Treatment	Formulation 1	Formulation 2
Control	2.3	2.5
Dehydrator	2.5	2.9
Oven	3	2.3
Freeze dryer	2.5	3

The foam height test results in this study ranged from 2.3 - 3 cm. According to ((Kisno Saputri et al., 2022) the requirements for good soap foam are soap foam between 1.3-22 cm, and the characteristics of foam in soap are influenced by the type of oil used. The manufacture of solid soap in this study uses the same type of oil, namely palm oil and coconut oil and olive oil. According to (Nurviana et al., 2022)The amount of foam is not proportional to the ability of the soap to clean dirt. The chemical content of the oil can affect the hardness of the soap and foam and the moisture of the skin. Palm oil contains palmitic acid which can produce hard solid soap and can stabilize the foam. Lauric acid in coconut oil can produce hard soap and soft foam, while oleic acid contained in olive oil can produce soap that can moisturize the skin. (Kisno Saputri et al., 2022)

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4. Organoleptic

Organoleptic tests of solid soap were conducted on 25 untrained and educated panelists based on the level of preference for color, aroma and texture parameters. The results of the organoleptic test on areca nut extract soap produced can be seen in Table 7.

Table 7. Organoletic analysis of areca nut powder extract dye soap

Treatment	Formulation 1			Formulation 2		
	Color	Flavour	Texture	Color	Flavour	Texture
Control	3.08	2.32	2.8	3.48	3.32	3.2
Dehidrator	2.84	2.52	2.72	3.64	3.52	3.2
Oven	3.12	2.56	2.84	3.2	3.36	3.08
Freeze dryer	2.92	2.48	2.76	3.48	3.48	3.28

Type: 5=Extremely like 4=Extremely like 3=Like 2=Little like 1=Don't like

The level of favorability is described using a hedonic scale of 1-5. The higher the hedonic scale, the more favorable the soap is to the panelists. Overall, both areca nut extract solid soap with formula 1 and formula 2 are acceptable to consumers/panelists. The average hedonic scale for areca nut extract solid soap formula 1 is 2.52 (like) - 3.12 (like) 4 and areca nut extract solid soap is 3.2 (like) - 3.64 (very like) which means that areca nut extract solid soap is favored by panelists.

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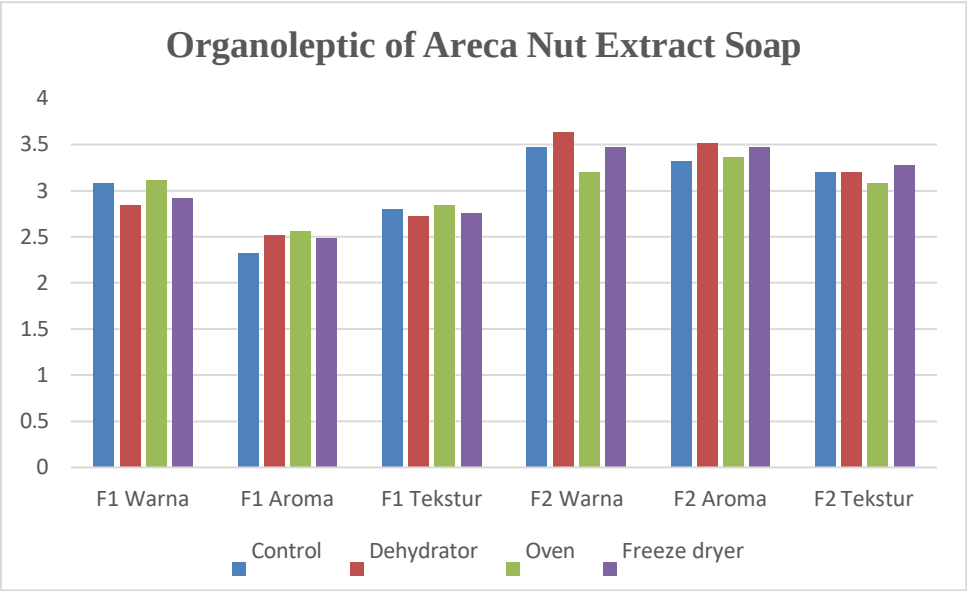

Figure 1. Histogram of Organoleptic Test of Areca Nut Extract Solid Soap

Based on Figure 1, it can be seen that the best formula from the available formulas, obtained that formula 2 has a higher favorability value compared to formula 1. Formulation 2 produces the highest value based on the results of panelists' liking of aroma, texture and color. Areca nut extract solid soap in formulation 2 produces a higher assessment of color than areca nut extract solid soap formula 1. This shows that the addition of natural coloring ingredients of areca nut extract affects the panelists' liking of the soap.

Figure 2. Areca nut extract solid soap Formula 1 and Formula 2

Based on the results of the liking of solid soap according to the organoleptic results of areca nut extract soap with the treatment of drying areca nut extract with oven produces areca nut extract solid soap that is most liked by panelists in formula 1 and the treatment of drying areca nut extract with dehydrator that is most liked by panelists in formula 2. And overall, solid soap added with areca nut extract by drying areca nut extract with a dehydrator in formulation 2 produced the most favorable areca nut extract solid soap for the panelists.

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CONCLUSIONS

Based on the results of the research conducted, it is concluded that the pH of areca nut extract solid soap meets the requirements of SNI 3532: 2016. The water content of areca nut extract solid soap meets SNI requirements, which is no more than 15%. And based on the results of the liking of solid soap according to the organoleptic results of areca nut extract soap with the treatment of drying areca nut extract with dehydrator formula 2 produces areca nut extract solid soap that is most liked by panelists.

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