Production and Analysis of Soap Using Variations of Palm Oil, Virgin Coconut Oil, and Ylang Flower Extract

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ABSTRACT

Soap is a mixture of oil or fat with alkali or base through saponification, namely the hydrolysis of fat into fatty acids and glycerol under alkaline conditions. This solid bath soap from ylang flower extract is made in 8 formulas. The temperature used in the soap-making process for each formula is the same, namely 90 °C. The stages of this research included the steps of providing raw materials (palm oil, virgin coconut oil, olive oil, castor oil, cocamide DEA, glycerin, ylang extract, and distilled water) with various oils, namely palm oil and virgin coconut oil, variations in the mass of NaOH 25 gr and 35 gr and the addition of ylang flower extract. The added ylang flower extract is an active ingredient, antibacterial, and deodorizer. This research contributes to analyzing the soap produced from palm oil and virgin coconut oil. In the water content test, the highest water content was 1.0737% with a variation of virgin coconut oil with a mass of 35 grams NaOH with the addition of extract. In the pH test, the highest pH that complied with SNI 3532-2016, namely 11, was produced in variations of palm oil with a mass of 25 grams NaOH without extract. In the free fatty acid test, free fatty acids were the highest and fulfilled according to SNI 3532-2016, which was 1.9199% produced in the virgin coconut oil variation with a NaOH mass of 25 grams with the added extract. In the stability test of solid soap foam, it was obtained that foam stability complied with SNI 3235-2016, a variation of virgin coconut oil with a mass of 25 gr NaOH with an extract of 61.4285%.

KEYWORDS
Palm oil
Soap
Virgin coconut oil
Ylang flower extract

1. Introduction

Soap is a material that cleans dirt and bacteria from the skin. Today, the use of soap as a skin cleanser is increasing and various. The diversity of soaps sold commercially can be seen in the types, fragrances, colors, and benefits offered [1].

The process of making soap with the saponification reaction is divided into two, namely, the hot process and the cold process. The difference between the two processes is that soap made by the cold process is carried out at room temperature or without heating. In contrast, the hot process involves a saponification reaction with heat at 70-80 °C [2]. The production of soap from shear butter and palm kernel with purified alkali made from plantain ash was successfully achieved using an improved conventional method for black soap production [3].

Palm oil is a plantation commodity crop that is quite important in Indonesia and still has bright prospects for development. Palm oil is a reliable vegetable oil-producing plant because the oil it produces has many advantages compared to the oil produced by other plants. These advantages include having low cholesterol levels, even without cholesterol [4]. From previous research, transparent solid soap can be produced from a palm oil-based and the addition of white tea extract as active ingredients [5]. Palm oil also can be used as biodiesel [6], [7]. Besides oil, palm produces biomass from palm shells and empty fruit bunch, which can convert into energy through gasification [8].

Virgin Coconut Oil is oil derived from old coconut milk without the heating process and the addition of chemicals. High-quality oil is rich in vitamin C and lauric acid. Lauric acid can soften the skin when applied directly to the skin's surface. The vitamins in virgin coconut oil are also used as moisturizers and can accelerate wound healing [9]. Therefore, virgin coconut oil is very good when used as a raw material

for making solid soap [10], [11]. Besides coconut milk, coconut plants produce biomass from coconut shells, coconut husks, and coconut trees. The gasification process can convert this biomass into energy [12].

Ylang flower essential oil is used in aromatherapy and is believed to be effective in treating depression and high blood pressure. Ylang flower extract is used as a fragrance in soap and a component with active compounds that can trap free radicals. The combination of ylang flower extract, oil (Olive, Palm, Coconut) resulted in the idea of making an antibacterial solid soap that has gentle properties and a naturally fragrant scent. The typical chemical composition of ylang oil generally consists of sesquiterpene hydrocarbons, alcohols, esters, ethers, phenols, and aldehydes. This oil is usually used for making medicines, cosmetics, fragrance ingredients, and as a mixture of food ingredients [13]. Ylang flower also can can be formulated as a liquid antibacterial soap [14].

The contribution of this research is the quality of soap from palm oil and virgin coconut oil using with or without ylang flower extract based on SNI 3532-2016.

2. Method

2.1. Material and Research Instrument

The tools used in this study were glass stirrers, burettes, 500 cc and 250 cc beakers, Erlenmeyer, analytical balances, drip pipettes, spoons, soap molds, electric stoves, pH paper, thermometers, porcelain cups, statives, glasses. Measure, Ruler, and Oven. While the ingredients used are Virgin Coconut Oil (VCO), Olive Oil, Palm Oil, Castor Oil, Aquadest, Stearic Acid, Ethanol, 0.1 N HCl, 25% and 35% NaOH, PP Indicator, Cocamide DEA, Glycerin, and ylang flower extract.

2.2. Research Procedure

The first step to make soap is to prepare the raw materials and additional materials needed to produce solid soap. The raw materials needed are stearic acid, oil (virgin coconut oil, palm, olive, and castor), aquadest, and NaOH. The additional ingredients that must be prepared are cocamid DEA, ylang flower extract, and glycerin. Then mix 69 ml of water and 35 or 25 grams of NaOH, stir until dissolved, and then heat at 90 ℃.

Making a soap formulation by mixing the fat fraction, namely NaOH solution that has been heated with virgin coconut oil or palm oil, then stirring until homogeneous. When this NaOH is added, the dough will become hard and sticky, indicating the formation of soap samples. The other additives such as olive oil, castor oil, cocamid DEA, glycerin, and ylang flower extract are added to the soap sample (if the sample is a sample with added extract).

The solution was then stirred until homogeneous. Next, pour a little ylang flower extract into the mold (if the sample is a sample with the addition of extract, but if the sample is not a sample with the addition of extract then add olive oil to the mold), then pour the solution into the soap mold, then store it for two days until the soap hardens completely.

3. Results and Discussion

From the research conducted, we obtained eight samples of soap with variations, namely sample 1 virgin coconut oil with a mass of 25 gram NaOH without extract, sample 2 virgin coconut oil with a mass of 35 gram NaOH without extract, sample 3 virgin coconut oil with a mass of 25 gram NaOH with the addition extract, sample 4 virgin coconut oil with a mass of 35 gram NaOH with the addition of extract, sample 5 palm oil with a mass of 25 gram without extract, sample 6 palm oil with a mass of 35 gram without extract, sample 7 palm oil with a mass of 25 gram with the addition of extracts and samples of 8 palm oil with a mass of 35 grams with the addition of extracts.

3.1. pH Analysis

The pH value of solid bath soap is important, because the pH value determines whether solid body wash is suitable for use. Soap that is too alkaline will irritate the skin, while soap that is too acidic will cause dry skin. Based on SNI 3532-2016 the pH value of commercial solid soap is 9-10. The pH value is influenced by the raw materials used, namely the type of palm oil and virgin coconut oil, the addition of

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ylang flower extract, and the use of NaOH mass. The best concentration of NaOH in solid soap is as much as 25 grams because, at a mass of 35 grams of NaOH, solid soap tends to be harder and has a pH above 11. The pH test results on each variation of soap are shown in Table 1.

Table 1. pH Analysis

Soap formulation	pH	
	Result	Standard
VCO + 25 grams of NaOH without extract	9	9-10
VCO + 35 grams of NaOH without extract	11	9-10
VCO + 25 grams of NaOH + 4 ml of extract	10	9-10
VCO + 35 grams of NaOH + 4 ml of extract	13	9-10
Palm Oil + 25 grams of NaOH without extract	11	9-10
Palm Oil + 35 grams of NaOH without extract	14	9-10
Palm Oil + 25 grams of NaOH + 4 ml of extract	12	9-10
Palm Oil + 35 grams of NaOH + 4 ml of extract	13	9-10

3.2. Water Content Analysis

Moisture content is a parameter used in assessing the shelf life of a product. The gravimetric method is used to analyze the water content contained in solid soap. Another way to analyze the water content is by grain moisture meter (GMM) [15]. The gravimetric method is a quantitative analysis that aims to determine the amount of substance based on the weighing of the reaction results after the material being analyzed is treated in a particular reaction. The results of the water content analysis for each variation of soap are shown in Table 2.

Table 2. Water Content Analysis

Sample	Soap formulation	Water Content	
		Result	Standard
1	VCO + 25 grams of NaOH without extract	0.7878%	Maks. 15%
2	VCO + 35 grams of NaOH without extract	0.7781%	Maks. 15%
3	VCO + 25 grams of NaOH + 4 ml of extract	0.8049%	Maks. 15%
4	VCO + 35 grams of NaOH + 4 ml of extract	0.7559%	Maks. 15%
5	Palm Oil + 25 grams of NaOH without extract	0.8099%	Maks. 15%
6	Palm Oil + 35 grams of NaOH without extract	1.0737%	Maks. 15%
7	Palm Oil + 25 grams of NaOH + 4 ml of extract	0.7679%	Maks. 15%
8	Palm Oil + 35 grams of NaOH + 4 ml of extract	0.8045%	Maks. 15%

Based on the results of Table 2, overall, the water content of the soap produced meets the requirements of SNI 3532-2016 because the maximum water content in solid soap is 15%. Excess water content from the SNI standard will cause the soap to smell rancid and soft.

From the research that has been done, all samples show that they meet the requirements for water content according to SNI 3532-2016. However, in the soap formulation raw materials virgin coconut oil and palm oil in samples 1, 2, 3, and 4, the water content value decreased with increasing concentration of NaOH used in soap making. This is because the higher the concentration of NaOH, the less water added. [16]. However, samples 5, 6, 7, and 8, which contained ylang flower extract, showed that the water content of soap increased from samples 1, 2, 3, and 4, which did not contain ylang flower extract. This is because the addition of ethanol extract to ylang flowers will cause the water content in the soap to increase.

3.3. Free Fatty Acid Analysis

The free fatty acid analysis is carried out to know the quality of the fat or oil. The higher the free fatty acids in the oil, the lower the quality of the oil. The free fatty acid analysis results for each variation of soap are shown in Table 3.

SNI 3532-2016 shows that solid soap-free fatty acids are <2.5%. In this study, solid soap-free fatty acids that met SNI 3532-2016 requirements were samples 1, 2, 5, and 7, while samples 3, 4, 6, and 8 did not meet SNI 3532-2016 requirements because they had free fatty acid values. >2.5%. The value of free fatty acids in palm oil is higher than the value of free fatty acids in Virgin Coconut Oil. One of the causes of an increase in free fatty acids in Crude Palm Oil (CPO) is the activity of lipase-producing microorganisms in the oil palm fruit. Lipase is a biocatalyst that accelerates oil hydrolysis reactions.

Table 3. Free Fatty Acid Analysis

Sample	Soap formulation	Free Fatty Acid Analysis	
		Result	Standard
1	VCO + 25 grams of NaOH without extract	0.4234%	Maks. 2.5%
2	VCO + 35 grams of NaOH without extract	1.8600%	Maks. 2.5%
3	VCO + 25 grams of NaOH + 4 ml of extract	3.0660%	Maks. 2.5%
4	VCO + 35 grams of NaOH + 4 ml of extract	5.2900%	Maks. 2.5%
5	Palm Oil + 25 grams of NaOH without extract	1.9199%	Maks. 2.5%
6	Palm Oil + 35 grams of NaOH without extract	3.1390%	Maks. 2.5%
7	Palm Oil + 25 grams of NaOH + 4 ml of extract	1.2702%	Maks. 2.5%
8	Palm Oil + 35 grams of NaOH + 4 ml of extract	3.5624%	Maks. 2.5%

Meanwhile, Virgin Coconut Oil contains many saturated fatty acids that are chemically stable so that free fatty acid levels do not easily increase. The Virgin Coconut Oil extraction process does not use high heat to protect heat-sensitive phytochemicals and prevent the hydrolysis of triglycerides into free fatty acids. In addition, the value of free fatty acids with 35 grams of NaOH is greater than that of free fatty acids using 25 grams of NaOH. This is because the levels of free fatty acids in soap with 25 and 35 grams of NaOH will increase as the concentration of NaOH increases.

As for samples 5, 6, 7, and 8, which contained ylang flower extract, it showed that the value of soap-free fatty acids had increased from samples 1, 2, 3, and 4, which did not contain ylang flower extract. This is due to the concentration of using ylang flower extract, which greatly affects the value of free fatty acid levels. The higher the ylang flower extract composition, the higher the concentration of free fatty acids obtained.

3.4. Foam Stability Analysis

The soap produced was used to form lather in water and the time taken for the foam to collapse was determined using a stopwatch [17]. The results of foam stability analysis for each variation of soap are shown in Table 4.

Table 4. Foam Stability Analysis

Sample	Soap formulation	Foam Stability Analysis	
		Result	Standard
1	VCO + 25 grams of NaOH without extract	78.2051%	60-70%
2	VCO + 35 grams of NaOH without extract	92.5000%	60-70%
3	VCO + 25 grams of NaOH + 4 ml of extract	31.5068%	60-70%
4	VCO + 35 grams of NaOH + 4 ml of extract	4.2553%	60-70%
5	Palm Oil + 25 grams of NaOH without extract	61.4285%	60-70%
6	Palm Oil + 35 grams of NaOH without extract	94.7368%	60-70%
7	Palm Oil + 25 grams of NaOH + 4 ml of extract	6.3829%	60-70%
8	Palm Oil + 35 grams of NaOH + 4 ml of extract	4.0816%	60-70%

According to SNI 3532-2016, good foam stability is if, within 5 minutes, a foam stability range of 60-70% is obtained. In this experiment, within 5 minutes, the foam content was obtained between 4-94%; in this case the soap that met the requirements was palm oil + 25 grams of NaOH without ylang extract. The parameter used was to see the height of the dense soap foam in the test tube and observe the decrease in foam every 5 minutes. The results of foam stability per minute showed that formulas with the addition of the same cocomid DEA (10%) in each formulation containing different concentrations of ylang flower extract with different concentrations showed different average values of foam stability in all formulas. Based on previous research palm oil gave a natural orange coloration, which became heterogeneous during the maturation process, the right formulation gave birth to nice soaps, with the right consistency and pleasant texture and aroma [18]. The higher the foam produced is not good because high foam causes the fluid's viscosity to increase; high viscosity will cause collisions between thin layers in adjacent fluids to decrease, making it more difficult for surfactants to enter the rock pores. The lower foam can wash away the oil in this rock which is expected to form from a surfactant.

4. Conclusion

Based on the results of the study, it can be concluded that solid soap with a mass variation of 25 gram NaOH fulfills almost all quality standard tests according to SNI 3532-2016, while solid soap with a variation of 35 gram NaOH is considered not to fulfill all standard quality tests according to SNI 3532-2016. The most optimum solid soap, when viewed from all standard quality tests according to SNI, is shown in sample 5 (virgin coconut oil with 25 grams NaOH and 4 ml of extract added). Solid soap made from virgin coconut oil tends to be whiter in color and has more foam than solid soap made from palm oil which tends to be yellowish white, and foams not as much as solid soap made from virgin coconut oil.

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