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Production of Hand Washing Soap from Ethanol Extract of Fern (*Pteridophyta*), Nampong Leaves (*Siegesbeckia orientalis*) and Thistle Plants (*Calotropis gigantea*)

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Abstract

Soap is an ingredient that comes from natural oils or fats reacting with caustic soda in the process known as lathering or saponification. Hand washing soap from fern (Pteridophyta) as the main ingredient is one of the antiseptic soaps that will be made, by comparing the drug Spirulina to determine the level of anti-bacteria produced. This study uses a hot process method with a soap heating time of about 20 minutes and a heating temperature of around 80°C. The results of testing the quality of hand washing soap as an antiseptic that meets the test standards are organoleptic test, acidity test (pH), foam resistance level test, and skin irritation test. So it's good to use as a hand sanitizer to get rid of bacteria and germs.

Keywords: *hand washing soap, fern plants (Pteridophyta), spirulina, hot process method*

1. Introduction

Soap is an ingredient that comes from natural oils or fats reacting with caustic soda in the process known as lathering or saponification (Swetman, 1995). Hand sanitizer liquid soap is a soap for cleansers made with or without the addition of other substances that do not cause irritation to the skin of the hands (SNI, 2017). The benefits of soap as a cleaning agent are related to the surfactant content. Surfactant is a molecule that has a polar group that likes water (hydrophilic) as well as a non-polar group that likes fat / oil (lipophilic), so that both groups can mix oil and water and remove the oil with water (Sumanto, 2016).

Fern plants are the oldest land plants that exist since the days of Devon and Carbon. It means that it has lived since 300-350 million years ago. Fern fossils are a source of coal on earth (Arini, 2017). Ferns grow in grasses and like wet or damp places (Kinho, 2012). Fern plants have been widely used, among others, as ornamental plants, vegetables and medicinal materials (Arini, 2017). Based on the type of spore, ferns are divided into homospores fern, heterospores, and transition from homospores into heterospores. Homosporic fern produce

spores of the same size that cannot be distinguished between male and female spores, for example *Lycopodium sp* (wire ferns). Heterospora fern produce spores of different sizes. Small male spores are called microspores and large female spores are called macrospores, for example *Selaginella sp* (rane fern), *Marsilea sp* (clover) (Sulistyaningsih, 2015).

Spirulina is a spiral blue green algae that contains phytonutrients that are quite complete and have the potential as an effective anticancer agent (Limantara, 2008). Algae are raw materials that have the potential to produce oil in large enough quantities. Blue green algae were chosen because the harvest time is very short and has a high lipid content compared to other types of algae (Yosta, 2010). Blue green algae are different from other algae in their cellular organization that are similar to bacteria, do not have a core membrane, the composition of cytoplasmic pigments is different, and do not have mitochondria, golgi apparatus, endoplasmic reticulum and the vacuole cell structures more similar to bacteria (Ilma, 2008). In addition, the characteristics of the environmental conditions in which Spirulina lives in accordance with weather conditions in Indonesia, namely pH tends to be alkaline, temperatures are 20-40 °C (Yosta, 2010).

Previous research conducted by Febry on making soap using basil leaves and essential oil. The research was conducted by the hot process method and which aims to eliminate the bacteria that are still remaining in the basil leaves.

Hand washing soap from fern (*Pteridophyta*) as the main ingredient is one of the antiseptic soaps that will be made by researchers, by making comparison with spirulina to determine the level of anti-bacteria produced. So that researchers know which ones can be used and which cannot be used for the community, so that the community is safe in using one of the two plants (fern and spirulina).

2. Experimental Section

This study uses a hot process method with a soap heating time of about 30 minutes and a heating temperature setting of around 80 °C, with six heating times for each material (Table 1). The materials used in this study were fern (Pteridophyta) types of Polypodium glycyrriza, Spirulina, Nampong Leaves (*Siegesbeckia orientalis*), Thistle plants (*Calotropis gigantea*), 70% Ethanol, Glycerin, Aquades, SLS (Sodium Lauryl Sulfate), preservatives, and NaOH.

3. Results and Discussion

After conducting research on hand washing soap using ferns (*Pteridophyta*) as an antiseptic from ethanol extracts of Nampong leaves (*Siegesbeckia orientalis*) and Thistle plants (*Calotropis gigantea*), the results obtained are as shown in Table 2.

Comparative analysis of two samples

Table. 1 shows the difference in treatment, with and without the use of NaOH in soap.

Table 1. Antiseptic handwashing soap formulation composition

	FORMULA					
	I	II	III	IV	V	VI
With NaOH	mL		Without NaOH	mL		
	fern (30)	nampong leaf (30)		nampong leaf (30)	fern (30, 40, 50)	
	nampong leaf (30)	thistle plants (30)		thistle plants (30)	nampong leaf (30, 40, 50)	
	thistle plants (30)	ethanol (30)		ethanol (30)	thistle plants (30, 40, 50)	
	ethanol (30)	SLS (30)		SLS (30)	ethanol (30, 40, 50)	
	SLS (30)	NaOH (20)		-	SLS (30, 40, 50)	
	NaOH (20)	-		-	-	
	Gram			Gram		
	glycerin (5)	spirulina (5)		spirulina (5)	glycerin (5)	
	preserva-tive (1)	glycerin (5)		glycerin (5)	preservative (1)	
	-	preserva-tive (1)		preserva-tive (1)	-	

Table 2. Test Results on Soap

ORGANOLEPTIC TESTS						
Formula		Form	Color	Smell	Change	
					Hour to 0-3	Hour to 4-7
With NaOH	I	liqiud	slightly bright green	strong scent	little lump	precipitation formed
	II	liqiud	light green	strong scent	little lump	precipitation formed
without NaOH	III	liqiud	slightly bright green	strong scent	no lumps	no precipitation
	IV	liqiud	dark green	strong scent	no lumps	no precipitation
	V	liqiud	dark green	strong scent	no lumps	no precipitation
	VI	liqiud	dark green	strong scent	no lumps	no precipitation

The results showed the presence of white deposits in the use of NaOH. Precipitation occurs due to SLS (Sodium Laury Sulfate) and NaOH which cannot be mixed. At the beginning of the soap heating, the two ingredients (SLS and NaOH) look well mixed and blend with other ingredients until the heating is done. However, when allowed to stand and let the temperature of the soap decrease, small white lumps that will settle down begin to appear. When the temperature in the soap decreases, the clumps increase until the temperature is really cold and the clots stop forming, congregating into white deposits on the soap. Whereas in studies using soap without the addition of NaOH, no sediment was produced. So the researchers chose the test sample in the form of soap without the addition of NaOH because it was feared that irritation would occur when carrying out the tests needed.

All soap samples have a different color. Soap with the addition of NaOH has a lighter color (clear). Whereas soap without the addition of NaOH has a darker color. Spirulina hand washing soap (without the addition of NaOH) also has a different color, which is slightly lighter than soap from ferns (Pteridophyta) without the addition of NaOH, which has a darker color. The addition of NaOH makes the color of the soap brighter (clearer) due to lumps of soap that are formed, blend with one of the research materials and lump into white deposits at the bottom, resulting in a brighter color. This can be a trigger for reduced levels of antiseptic in research, making the hand washing soap unusable.

Organoleptic Tests

Organoleptic test is done by observing the state of antiseptic handwashing soap visually by placing soap on plastic cups. The observed conditions are shape (thickness), color, odor, consistency and changes that occur over a period of 1 week.

Table 2 shows that the soap form remained liquid and thick during the observation period. While in color, in formula II it becomes bright because of the NaOH decay in the form of lumps to form white deposits. And the formula III becomes a little bright because of the difference in one of the ingredients used for research, so it affects the color change of the soap. The smell of hand washing soap becomes pungent, because researchers do not give perfume in the form of perfume seeds like other studies. While the changes only occur in formula I and formula II which show the presence of white deposits under the surface of the soap, because the SLS (sodium laury sulfate) and alkali (NaOH) do not blend into one and also decay with one of the other ingredients. This can be seen in the color changes that are slightly bright and bright.

Acidity test (pH)

The acidity (pH) test is carried out to determine the acidity level of each soap formulation. A very high or very low pH value can increase skin absorption so that it can be irritated. The pH standard for soaps ranges from 5-8. The pH value of antiseptic hand washing soap after formulation is obtained an average pH of 7, starting from formula III to formula V. Whereas in formula VI, hand washing soap has a pH value of 6. Based on these tests, there are variations in volume in formula V and formula VI shows that there is a difference in the average pH of the antiseptic hand washing soap even though it is only a difference of one digit. Tests produce a pH range of 6-7, this shows that the soap is gentle to the skin and will not cause irritation to the skin, making it a good hand washing soap.

Human skin consists of 3 layers, namely the epidermis, dermis, and hypodermis. Low pH soap is not able to clean properly, while human skin still needs to be cleaned properly from dust and dirt. Especially for the hands, because the hands are often directly related to all things such as eating, drinking, holding objects, touching objects that unconsciously there are germs on these items or objects. To overcome this, researchers created an alternative media to clean hands with pH levels in accordance with the specified pH standard, so that when used it can clean germs and bacteria, but still soften the skin to keep it safe from irritation and damage to the skin of the outer or inside layer.

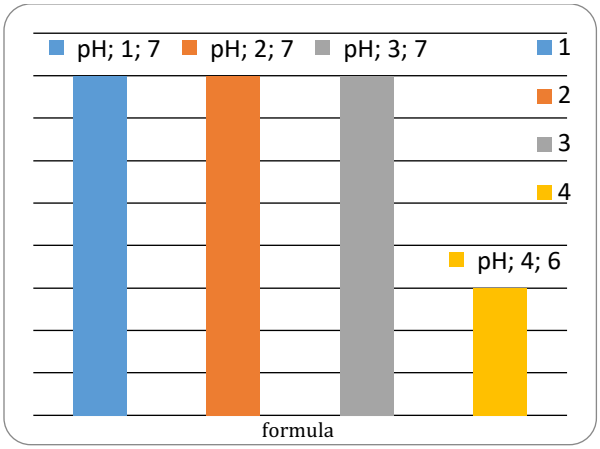

Figure 1. pH Test

Skin irritation test

The irritation test is done by gently applying the soap to the surface of the hand, then allowed to stand for 1 minute and immediately rinsed. This test is to find out whether the antiseptic hand washing soap will have a bad impact on the skin such as redness, itching, and swelling after applying it. The results of the irritation test have proven that the results were negative, nothing happened to the skin after three uses, in three volunteers. According to the three volunteers, the antiseptic hand washing soap used to make the hands rough (rather dry), comfortable, and not itchy, so that the hands feel like clean and free of various germs. The rough feeling (rather dry) is felt because the soap is combined with SLS (sodium lauryl sulfate) and glycerin. SLS (sodium lauryl sulfate) is an anionic surfactant that has a good cleansing power that is used on the skin to cleanse the body of impurities. While glycerin is an ingredient used as a humectant, which functions to moisturize and soften the skin. Because the use of soap can cause loss of skin moisture resulting in dryness and redness of the skin.

Therefore, researchers combined SLS (sodium lauryl sulfate) with glycerin to produce antiseptic hand washing soap that is comfortable when and after use by the wearer, without any complaints. Antiseptic itself is a chemical that is given to the skin or other living tissue to inhibit or kill microorganisms (both temporarily and permanently) thereby reducing the number of bacteria, such as giving 70% ethanol in hand washing soap. This is possible because the chemicals have worked well together in a solution and become hand washing soap that has been investigated by researchers. The absence of negative contents in the leaves of Nampong (*Siegesbeckia orientalis*) and the Thistle Plant (*Calotropis gigantea*) which has been used as an extract of hand washing soap which has previously been tested as an antiseptic by previous researchers.

The resistance test of the foam

Foam resistance test is carried out to see the amount of foam produced by antiseptic liquid hand washing soap. In this formulation, the substance that functions to produce and maintain foam stability is SLS (sodium lauryl sulfate). SLS (sodium lauryl sulfate) is a surfactant contained in formula III, formula IV, formula V, and formula VI. The difference in these formulas is the level of foam resistance, due to differences in the amount of SLS (sodium lauryl sulfate) added. In formula III it produces foam resistance for 1 minute 58 seconds by giving SLS as much as 30 mL, whereas in formula IV it produces foam resistance for 1 minute 52 seconds by giving SLS as much as 30 mL.

In formula V, it produces foam resistance for 2 minutes 10 seconds by giving SLS as much as 40 mL then in formula VI it produces foam

resistance for 2 minutes 38 seconds by giving SLS as much as 50 mL. The difference in the level of resistance of foams is estimated due to differences in the addition of SLS to each formula, giving rise to differences in the level of resistance of foams. The amount of foam produced is also different, after looking at the resistance of the foam.

4. Conclusion

Based on the results of research conducted, it can be concluded that handwashing soap from ferns (Pteridophyta) extracted with 70% Ethanol, Nampong Leaves (Siegesbeckia orientalis), and Thistle Plants (Calotropis gigantea), both used as hand soap. The results of testing the quality of hand washing soap as an antiseptic that meet the test standards are organoleptic test, acidity test (pH), foam resistance level test, and skin irritation test.

After conducting the research, there are still shortcomings in the study. When testing the hand washing soap, there is one test that has not been done by researchers because of the limitations of the researchers' tools, namely the antibacterial test. Antibacterial test is done by using a petri dish as a medium that has been given a bacterial suspension. However, because the tools needed to carry out antibacterial tests are not available in physics and biology laboratories, researchers only conduct tests that can be performed such as acidity (pH) test, foam resistance level, irritation test, and organoleptic test as the feasibility tests for hand washing soap when used by the community, without causing side effects.

Expectations from researchers, that research into making hand washing soap using ethanol extracts of ferns, Nampong leaves (*Siegesbeckia orientalis*) and the Thistle Plant (*Calotropis gigantea*), can be developed to be even better and cover up or correct deficiencies carried out by previous researchers.

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