



Physical Properties Testing Soap from Citronella Oil with Red Spinach (*Amaranthus gangeticus*) Extract

Ayus Diningsih^(✉), Hasni Yaturramadhan, and Suryani Batubara

Universitas Aufa Royhan Di Kota Padangsidempuan, Padang Sidempuan City, Indonesia
ayusdiningsih1990@gmail.com

Abstract. Objective: Cosmetics production is estimated to increase by 7% due to consumer demand during the COVID-19 pandemic, one of which is soap production. The purpose of this research was to determine the citronella oil (Citronella oil) with the addition of red spinach (*Amaranthus gangeticus*) extract can be formulated in the manufacture of solid soap. **Method:** The method used in this research is a laboratory-based experimental method. The formula for solid soap is the ratio between citronella oil (Citronella oil) and red spinach (*Amaranthus gangeticus*) namely formula 1 = 1% and 2%, formula 2 = 1.5% and 2.5% and formula 3 = 2%, and 3%. The tests carried out in this study included Organoleptic Test, pH Test, High Foam, Irritation Test on Volunteers' Skin and Preference Test. **Result:** formula 1 with pink organoleptic test results, in solid form and produces lemongrass oil aroma, pH 9.0 test, high foam test with 60% foam stability, and irritation test on volunteer skin is no irritation. Formula 2 with organoleptic test results was pink in solid form and produced the aroma of citronella oil, pH 9.0 test, high foam test with foam stability 70%, and irritation test on volunteer skin was no irritation. Formula 3 with purplish pink organoleptic test results in a solid form and produces lemongrass oil aroma, pH test of 10,4, foam height test with 60% foam stability, and irritation test on volunteer skin is no irritation. **Conclusions:** The conclusion of this research is that formula 2 is the best.

Keywords: Oil · Lemongrass · Spinach · Red · Soap

1 Introduction

During this pandemic, cosmetic production is estimated to increase to 7% due to consumer demand in the pharmaceutical industry or in traditional medicine. Cosmetics are materials or tools used on the outside of the human body, namely the epidermis, hair, nails, lips, and genital organs (outside) or the teeth and mucous membranes of the mouth, especially to clean, perfume, change appearance, improve body odor, protect, or maintain the body in good condition. One of the cosmetics used by the community is soap. Soap is a mixture of sodium compounds with fatty acids used as body cleansers, in solid form, foam with or without other additives and does not cause irritation to the skin. Soap can be made by two methods, namely saponification and oil neutralization. In the

saponification process, a byproduct of glycerol is obtained, while the soap obtained by the neutralization process does not produce. One example of herbs that can be used is lemongrass, which is utilized from this plant is the oil and red spinach as a natural dye.

Citronella oil in soap making is used as aromatherapy, because citronella oil (Citronella oil) contains several essential oils such as citronellal, geraniol, citronellol, geraniol acetate, limonene, eugenol and sesquiterpenes. In addition to its function as aromatherapy, lemongrass oil (Citronella oil) can also be used to remove insect bites, treat itching, and as an antioxidant [1].

According to Kataren quoted by Anggraeni, The chemical constituents of lemongrass essential oil are: citronella (32–45%), geraniol (12–18%), citronellol (12–15%), geraniol acetate (2–4%), limonene (2–5%), eugenol and sesquiterpenes (2–5%) elements and cadinene (2–5%) [2].

From the research of Khairuddin, et al. the anthocyanin pigments in red spinach (*Amaranthus gangeticus*) at pH 4 experienced 79.07% pigment degradation, at pH 5 pigment degradation was 73.54% at pH 3 53.23% pigment degradation, while at pH 5 pH 2 did not experience significant pigment degradation with pH 3. This was because the level of acidity given to red spinach (*Amaranthus gangeticus*) determined the level of anthocyanin pigment degradation in red spinach (*Amaranthus gangeticus*) [3].

The purpose of this research was to determine the quality of the solid soap formulation from citronella oil (Citronella oil) with red spinach (*Amaranthus gangeticus*) extract and to find out that red spinach (*Amaranthus gangeticus*) can be used as a natural dye.

2 Method

The type of research used is the experimental method. This sampling technique was carried out by purposive sampling, namely sampling without considering the place of growth and geographical location. This research was conducted at the Chemistry Laboratory of the South Tapanuli Muhammadiyah University.

The tools used in this research are beaker glass, funnel, measuring cup, dropper, digital scale, pH meter, soap mold, stir bar, spatula, porcelain cup, soap packaging, water bath and erlenmeyer.

Ingredients used in the manufacture of colored solid soap are as follows: Citronella oil (Citronella oil), red spinach (*Amaranthus gangeticus*), stearic acid, glycerin, 30% NaOH, 96% ethanol, citric acid, coco- DEA, castor oil and aquadest.

2.1 Red Spinach Dye Making

By means of a blender, the red spinach leaves are washed thoroughly and then weighed as much as 500 g. Red spinach leaves are blended with a ratio of 1:1 addition of water, which is 500 ml of water added, then filtered 3 times using a filter cloth [4].

The formula for solid soap from citronella oil with red spinach is as in Table 1.

2.2 Soap Making Procedure

According to Wibowo in previous research, the manufacture of colored solid soap can be carried out using the following procedures: Preparing raw materials and additional materials as well as the tools needed for making solid soap [5].

Table 1. Soap Making Formulation

| Material (%) | Unit | F0 | F1 | F2 | F3 |
|----------------|------|------|------|------|------|
| Citronella oil | ml | - | 0,5 | 0,75 | 1 |
| Red Spinach | ml | - | 1 | 1,25 | 1,5 |
| Essesnsial oil | ml | - | 0,25 | 0,5 | 0,75 |
| Stearate Acid | gr | 2,7 | 2,7 | 2,7 | 2,7 |
| Castor oil | gr | 4 | 4 | 4 | 4 |
| NaOH | ml | 10,8 | 10,8 | 10,8 | 10,8 |
| Ethanol 96% | ml | 8,2 | 8,2 | 8,2 | 8,2 |
| NaCl | ml | 1,6 | 1,6 | 1,6 | 1,6 |
| Glycerin | gr | 6,9 | 6,9 | 6,9 | 6,9 |
| Citrit acid | gr | 1,6 | 1,6 | 1,6 | 1,6 |
| Cocamid-D EA | gr | 0,10 | 0,10 | 0,10 | 0,10 |
| Aquadest | ml | 50 | 50 | 50 | 50 |

Description:

F0: Blanko

F1: Citronella oil 1%, red spinach 2%. F2: Citronella oil 1,5%, red spinach 2,5%. F3: Citronella oil 2%, red spinach 3%.

A total of 2.7 g of dissolved stearic acid is mixed into 4 g of castor oil for 15 min. Add red spinach according to the formula as a dye while stirring. Adding 10.8 ml of 30% NaOH solution into the mixture for the saponification process. Adding 8.2 ml of 96% ethanol while stirring until homogeneous. After everything is dissolved, add 1.6 g of citric acid, 6.9 g of glycerin, 1.6 g of NaCl, and 0.10 g of Coco-DEA which has been dissolved first with hot aquadest to speed up the dissolving process, stir until homogeneous. After homogenizing, let stand until the temperature reaches 55 °C, then add olive oil according to the formula and lemongrass oil according to the formula. Stir again quickly until homogeneous. After homogeneous, the mixture is poured into the prepared mold, then let stand for 24 h until the soap hardens and then packaging.

2.3 Analysis Data

To generate data, there are 5 tests carried out, namely the organoleptic test, Test the degree of acidity (pH), high foam test, irritation test and preference test.

2.3.1 Organoleptic Test

Observations were seen directly organoleptically, namely the color, shape (texture) and aroma of the soap.

2.3.2 Acidity Test (pH)

1 g of soap was weighed into a beaker glass. Then put 10 ml of distilled water into a beaker glass, then heated. The calibrated pH meter was then dipped into the soap sample. Then note the pH value obtained after the pH meter is stable [6].

2.3.3 Foam Height Test

The measurement of the height of the foam in distilled water was carried out by weighing 1 g of chopped soap, put it in a 10 ml glass beaker, then heated it, then waited until it cooled down and then shaken until foam was formed. Then observed the height of the foam produced for approximately 15–45 min, the height of the foam formed was measured, allowed to stand for 5 min, the height of the foam was measured, then the height of the foam was recorded again.

3 Result

3.1 Organoleptic Test

The results of the observations can be seen in Table 2.

3.2 Degree of Acidity (pH) Test

See Table 3.

3.3 Foam Height Test

See Table 4.

Table 2. Organoleptic Test Results

| Formula | Organoleptic | | |
|---------|-----------------|----------------|-----------|
| | Color | scent | Shape |
| F0 | Yellowish white | No smell | Congested |
| F1 | Pink | Citronella oil | Congested |
| F2 | Pink | Citronella oil | Congested |
| F3 | purplish pink | Citronella oil | Congested |

Description:

F0: Blanko

F1: Citronella oil 1%, red spinach 2%. F2: Citronella oil 1,5%, red spinach 2,5%. F3: Citronella oil 2%, red spinach 3%.

Table 3. Degree of acidity (pH) Test Result

| Formula | pH |
|---------|------|
| F 0 | 9,3 |
| F 1 | 9,0 |
| F 2 | 9,0 |
| F 3 | 10,4 |

Description:

F0: Blanko

F1: Citronella oil 1%, red spinach 2%. F2: Citronella oil 1,5%, red spinach 2,5%. F3: Citronella oil 2%, red spinach 3%.

Table 4. Foam Height Test

| Form ula | First Minute Initial Foam Height (cm) | Foam Height After 45 min | Foam Stability (%) |
|----------|---------------------------------------|--------------------------|--------------------|
| F0 | 10,4 | 8 | 80% |
| F1 | 10,4 | 6 | 60% |
| F2 | 10,3 | 7 | 70% |
| F3 | 11 | 6 | 60% |

Description:

F0: Blanko

F1: Citronella oil 1%, red spinach 2%. F2: Citronella oil 1,5%, red spinach 2,5%. F3: Citronella oil 2%, red spinach 3%.

3.4 Irritation Test

From the results of research that has been carried out, it shows that there are no symptoms such as redness, itching and swelling in volunteers.

3.5 Preference Test

See Table 5.

4 Discussion

4.1 Organoleptic Test

Based on the results of observations that have been made as shown in Table 4, it shows that there are differences in color, odor and aroma in each colored solid soap preparation. This is due to the different concentrations of olive oil, lemongrass oil, and red spinach in the manufacture of each formula.

Table 5. Preferred test

| Scale | Formula | | | |
|----------------|---------|----|----|----|
| | F0 | F1 | F2 | F3 |
| Love the color | 3 | 7 | 8 | 3 |
| Love the shape | 8 | 5 | 8 | 5 |
| Love the scent | 3 | 5 | 5 | 2 |

Description:

F0: Blanko

F1: Citronella oil 1%, red spinach 2%. F2: Citronella oil 1,5%, red spinach 2,5%. F3: Citronella oil 2%, red spinach 3%.

According to Khairuddin et al. [3], the color produced by red spinach is reddish purple with a pH of 2 and 3, while for solid soap the pH produced according to SNI (Indonesian National Standard) is 9–11 [6]. Therefore, the solid soap color in this formula does not produce a reddish purple color but a pink color.

The aroma of solid soap obtained from citronella oil (Citronella oil) differs from the blank formula to formula 3 because of the different concentrations in each formula. This causes the aroma generated in formula 3 to be more pungent than formula 1.

The shape of this formula uses a simple mold and produces a soap that is slightly mushy and not hard or perfectly solid. According to Widiasanti et al. [7], the thing that causes soap to be not perfectly solid is that the amount of water mixed is very small, as a result the soap is not perfectly solid. The higher the water content in the soap, the higher the hardness of the soap, the lower the water content in the soap, the lower the hardness of the soap.

According to Agustini [8] the standard of soap hardness is 1.04–2.40 mm/second, this refers to SNI 19-0428-1989. In this study, the soap hardness test was only seen organoleptically without being tested according to soap standards according to SNI.

4.2 Results of the Degree of Acidity (pH) Test

The results obtained on pH examination showed that the solid soap preparations made without the addition of citronella oil and red spinach for each formulation were different. According to Sirait [9], the difference in the pH of the soap in the formulation can be influenced by the volume of the mixed base solution and is caused by the influence of the reaction temperature. When making solid soap formulations, adding alkaline solution to soap at different temperatures, the resulting pH will also be different. Each colored solid soap preparation in this study had a pH in accordance with the SNI (1994) standard of around 9–11.

4.3 Foam Height Test Results

The foam height test is one of the most important parameters in determining the quality of cosmetic products, especially soap. The purpose of the foam height test is to see the foam power of transparent solid soap. The foam is stable for the desired time because the foam can help cleanse the body. Each colored solid soap preparation has a pH that is in accordance with the SNI (1994) standard of around 9–11.

Based on the results of the high foam test carried out on the formulation of colored solid soap preparations a combination of citronella oil (Citronella oil) and red spinach (*Amaranthus gangeticus*) the foam height requirements according to SNI are 13–220 mm, which meets the high standard of solid soap foam and is safe to use.

4.4 Irritation Test Results

From the results of research that has been carried out, it shows that there are no symptoms such as redness, itching and swelling in volunteers. This is because the pH of the solid soap preparations with the formulation of citronella oil (Citronella oil) and red spinach (*Amaranthus gangeticus*) is within the pH range of the skin, so it is safe to use.

Surfactants can irritate the skin, such as sodium lauryl sulfate which is commonly used in soap making. This material functions as a surfactant (Surface active agent) or cleaning agent, so the fats that function to surround the skin also dissolve as a result the skin becomes dry and irritated. Another factor that causes skin irritation is the pH of the soap which is still high or in an acidic environment. In this formula, researchers did not add sodium lauryl sulfate as an ingredient in soap making and the pH of solid soap was also in accordance with SNI, so it did not cause irritation to the volunteer's skin.

4.5 Preferred Test Results

The preference test was conducted to determine which preparations with variations in concentration were the most preferred. Based on the preference test above, the most preferred is Formula 2, this happens because the higher the concentration, the sharper the aroma, and the darker the color.

5 Conclusion

The best colored solid soap formulation is formulation 2 and based on organoleptic test, pH test, high test, and irritation test are in accordance with SNI (Indonesian National Standard) for solid soap.

References

1. Nugraha, F.C, et al. Characteristics of Lemongrass Soap on Concentration Ratio of Coconut Oil-Stearic Acid and Refined Sugar-Ethanol. South Jakarta. Journal of Engineering and Management of Agroindustry Unund. 2015.
2. Anggraeni, et al. Essential oil. Tulungagung. Tulungagung College of Health Sciences. 2015.

3. Khairuddin, et al. Extraction and Stability Test of Natural Dyes from Red Spinach (*Alternanthera amoena* Voss). Hammer. Tadulako University. 2020.
4. Aryantie, A. Effect of Addition of Red Spinach Leaf Extract (*Alternantheraamoena* Voss) on Taste, Aroma, Color and Texture of Cow's Milk Yogurt. Yogyakarta. Sanatha Darma University. 2017.
5. Wibowo, S.C. Effect of Base Difference on Physical Characteristics of Ginger Oil Transparent Bar Soap. Yogyakarta. Sanata Dharma University. 2014.
6. Hutapea, A. Formulation of a Transparent Solid Soap Combination of Olive Oil and Citronella Oil. Medan. Scientific papers. 2019.
7. Widiasnti, et al. Making Transparent Solid Soap Using Palm Oil (Palm Oil) With the Addition of Active Ingredients White Tea Extract (*Camelia sinensis*). Lampung. Journal of Agricultural Engineering. 2016.
8. Agustini, et al. Characteristics And Antioxidant Activity Of Transparent Solid Soap Enriched With Carotenoid Extract Crude *Chlorolla pyrenoidosa*. South Jakarta. Journal of the Institute of SciencCONCLUSIONE and Technology. 2017.
9. Sirait, M. Making liquid soap with alkaline potassium ash from banana stems (*Musa Paradisisaca*). Medan. Journal Of The University Of North Sumatera Utara. 2018.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

