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Transparent Soap Formulation Combination of Lemongrass Essential Oil (*Cymbopogon Citratus*) WITH Cinnamon Essential Oil (*Cinnamomum Burmannii*)

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Abstract: Lemongrass and cinnamon have antibacterial activity. Lemongrass has antibacterial activity against Staphylococcus aureus, while cinnamon has antibacterial activity against Staphylococcus aureus and Staphylococcus epidermidis and has antioxidant activity. The combination of lemongrass and cinnamon can be formulated in solid soap preparations. The purpose of the study was to determine the effect of variations in the concentration of active substances on the physical properties of soap. This study used an experimental method using 4 formulas and 1 control. Variation of active ingredients of lemongrass essential oil: cinnamon, F1 = 0.25%: 0.25%, F2 = 0.50%: 0.25%, F3 = 0.25%: 0, 50%, F4 = 0, 50%: 0.50%, control without active substance. Solid soap was physically evaluated for pH, water content, foam height, organoleptic, homogeneity, free alkali/free fatty acid, unsaponifiable fat and hedonic tests. The results of the physical test of soap were tested with SPSS. The results obtained that the formula is homogeneous, orange color, lemongrass has a distinctive aroma and solid form. pH value F1 = 9.87; F2 = 9.83; F3 = 9.72; F4 = 9.71; control = 9.0. Water content F1 = 20.74%; F2= 20.08%; F3= 21.70%; F4 = 22.12%; control 17.60%. Height of foam (after shaking) F1 = 9.1cm; F2= 9.1cm; F3= 9.8cm; F4=10.1cm; control = 9.2cm. Soap foam height (after 5 minutes) F1= 6.7cm; F2= 7cm; F3= 7.4cm; F4= 7.4cm; control = 7.4cm. Soap-free alkali F1= 0.25%; F2= 0.20%; F3= 0.10%; F4= 0.11%; Control= 1.17%. Unsaponifiable fat F1= 2.80%; F2= 2.17%; F3= 3.08%; F4= 2.78%; Control= 3.40%. The concentration of the active substance has an effect on pH, water content, foam height after shaking and free alkali, while it has no effect on foam height after 5 minutes and unsaponifiable fat test.
Keywords: lemongrass, cinnamon, transparant solid soap, physical test, essential oil

I. INTRODUCTION

Plants that have medicinal properties are continuously being developed to be used for their properties. Plants that have medicinal properties besides being used as drinking drugs are also widely developed in the form of cosmetics, one of which is in the form of bath soap. Bath soap has become a basic need of society in order to maintain cleanliness and health. Soap is a mixture of sodium or potassium compounds with animal fatty acids in the form of solid, soft or liquid, foaming which is used as a body cleansing agent by adding fragrances and other ingredients that are not harmful to health [1]. In soap, ingredients that have antibacterial and antioxidant activity are often added. One of the natural ingredients that have antibacterial and antioxidant activity are cinnamon essential oil and lemongrass essential oil.

The benefits of cinnamon include being able to be used as an anti-fungal, anti-viral, anti-parasitic, antiseptic and as an antibacterial [2]. The high levels of transcinamaldehyde (68.65%) are a source of antioxidant compounds with the ability to capture free radicals or scavenger radicals, so it can be seen that the essential oil and cinnamon oleoresin of the Cinnamomum burmannii species have antioxidant activity [3]. Cinnamon bark has antioxidant activity equivalent to the antioxidant activity of -tocopherol [4]. Cinnamon bark oil has antibacterial activity against Staphylococcus aureus and Staphylococcus epidermidis with very strong inhibitory power [5], [6]. The research conducted by Cui et all (2016) entitled "Antibacterial activity and mechanism of cinnamon essential oil and its application in milk" aims to determine and evaluate the antimicrobial activity and bactericidal mechanism of cinnamon essential oil by testing the minimum inhibitory concentration (MIC). and the minimum bactericidal concentration (KBM) of cinnamon oil. The results showed the lowest minimum inhibitory value was 0.025% and the minimum bactericide concentration was 0.05%. Cinnamon essential oil showed high antibacterial activity against bacteria in vitro [7].

Lemongrass essential oil showed antibacterial activity against Staphylococcus aureus (S. aureus),

Bacillus cereus (B. cereus), Bacillus subtilis (B. subtilis), Escherichia coli (E. coli), Klebsiella pneumoniae (K. pneumoniae) [8]. Clove essential oil provides better antibacterial activity on gram-positive than gram-negative bacteria [8], [9]. Lemongrass essential oil has also been developed into several soap dosage forms. The combination of surrender with cinnamon has also been developed into a liquid hand soap dosage form and has produced hand soap with good physical quality, except for the pH which has not met the parameters [10].

Based on the above background, a transparent solid soap was developed with a combination of cinnamon essential oil which has antibacterial and antioxidant activity and lemongrass essential oil which has antibacterial activity. The hope of this research is to produce soap preparations with natural ingredients, so that they can increase the wealth of cosmetic preparations by utilizing natural ingredients.

II. MATERIALS AND METHODS

2.1 Materials of essential Oil

The materials of essestial oil such as lemon essential oil, cinnamon essential oil and lemongrass essential oil from Rumah Atsiri indonesia.

2.2 Chemicals

The chemical agents such as distilled water, stearic acid, cocamid DEA, ethanol, glycerin, granulated sugar, HCl, phenolptalein indicator, KOH, NaCl, NaOH, and palm oil.

2.3 Preparation of transparent solid soap

The manufacture of transparent solid soap was carried out with 4 variations in the concentration of the combination of lemongrass essential oil and cinnamon in each formula with 3 replications and 1 control. Variations in the concentration of the active ingredients of citronella essential oil: cinnamon used are formula 1 0.25%: 0.25%; formula 2 0.5% : 0.25%; formula 3 0.25% : 0.5%; formula 4 0.5% : 0.5%. This variation in concentration was carried out with the aim of knowing whether there was an effect on the results of the physical evaluation of the transparent solid soap made. The control was made without adding the active ingredient in soap making with the aim of comparing and knowing the difference in physical evaluation between soap made with the active substance and soap made without the active substance.

Making transparent solid soap is done by preparing the ingredients and then weighing each ingredient to be used. Palm oil is heated over a water bath at a temperature of 60°C-70°C then added stearic acid until it dissolves in palm oil, then added NaOH 30% stir until a soap stock is formed in the form of a paste, then added glycerin, sugar syrup (sugar) which has been dissolved with distilled water), cocodea and NaCl stir until homogeneous and looks transparent. At a temperature of 50°C, the active ingredients of lemongrass essential oil, cinnamon and lemon were added and stirred until homogeneous and poured into the mold.

2.4 pH test

The pH test was carried out by weighing 0.1 grams of transparent solid soap and then soaking it in 10 mL of distilled water for 24 hours. After 24 hours, the pH was checked using a pH meter.

2.5 Water Content Test

The water content test was carried out using a moisture analyzer.

2.6 Homogeneity Test

The homogeneity test was carried out by cutting as thinly as possible the solid soap and then placing it on white paper or paper glass and observed whether there are still undissolved material particles.

2.7 Organoleptic Test

Organoleptic test was carried out by looking at the shape, color, and smell of transparent solid soap.

2.8 Foam height test

The foam height test was carried out by taking 1 gram of transparent solid soap sample, dissolved in 10 mL of distilled water in a measuring cup and shaken for 20 seconds. After that, observed the height of the foam produced and observed again after 5 minutes later.

2.9 Free alkali/free fatty acid test

The free alkali/free fatty acid test is carried out by preparing neutral alcohol by boiling 100 mL of alcohol in a 250 mL beaker. 0.5 mL of pp indicator was added and cooled to 70ºC then neutralized with 0.1 N KOH in alcohol. Weighed 5 g of soap and put it in the neutral alcohol above, and heated it to quickly dissolve on a water bath, boiled for 30 minutes. If the solution is not red, it is cooled to 70ºC and titrated with 0.1 N KOH solution

in alcohol, until a permanent color appears for 15 seconds. If the above solution turns red, it is checked not free fatty acids but free alkali by titrating with 0.1 N HCl in alcohol from a micro burette, until the red color quickly disappears (SNI, 1994).

2.10 Unsaponifiable fat test

The unsaponifiable fat test was carried out by taking samples from the free alkali/free fatty acid test, then adding 5 mL of 0.5 N alcoholic (excessive) KOH and heated for 1 hour, then cooled to 70°C and titrated with 0.5 N alcoholic HCl until the red color on the phenolphthalein indicator just disappeared (V, mL). The volume of 0.5 N alcoholic KOH used was calculated as V2 mL.

2.11 Hedonic Test

The hedonic test was carried out using 20 respondents in the four formulas to try to wash their hands with transparent solid soap and then fill in the dislike, dislike, like, and really like column for smell, color, shape, foam and comfort when used.

2.12 Data analysis

Data analysis was carried out by comparing the results of the physical evaluation of transparent solid soap with the literature and conducting normality and homogeneity tests using SPSS

III. RESULTS AND DISCUSSION

3.1 Essential Oil Analysis

The essential oil analysis was carried out at the Indonesian Essential Oil House located in Tawangmangu Karanganyar. The certificate of analysis results is a letter used to find out that the essential oil used is pure essential oil made directly by Rumah Atsiri Indonesia. In the certificate of analysis, it can be seen that the essential oil of citronella has several specifications, namely the form of a liquid, a pale yellow color and a solubility in alcohol of 95% 1:3. Cinnamon essential oil has specifications of liquid form, clear dark yellow color, solubility in alcohol 70% 1:2, cynamaldehyde content 68%, then lemon essential oil has specifications of liquid form, yellow color, citral content of 2.22%.

3.2 pH Test Result

The pH test was carried out to determine the degree of acidity of the transparent solid soap made. The skin is one of the sensitive parts of the body so that the topical preparations made are expected to protect the skin and not irritate it. The pH test was carried out by immersing a 0.1 gram soap sample in 10 mL of distilled water for 24 hours and then measuring it using a pH meter.

Table 1. pH Test Results of Transparent Solid Soap

F1	F2	F3	F4	Control
9,87 ± 0,06	9,83 ± 0,17	9,72 ± 0,19	9,71 ± 0,23	9,01 ± 0,07

The pH test results show that the transparent solid soap preparation has a pH in accordance with the range of SNI no. 06-3532-1994 which is between 9-11. The variation in the concentration of the active substance of essential oils affects the resulting pH, from the average pH test results it is found that the more essential oils used, the smaller the pH (acidic) although the difference is not too far because the levels of essential oils used are not too far away. the difference.

3.3 Water content test Result

The water content test was carried out by taking 2 grams of soap samples which were mashed and checked using a "moisture analyzer" tool. Water content analysis was carried out to determine the water content and volatile substances contained in the soap. Measurement of water content and volatile substances needs to be done because it will affect the quality of the soap [11]. The amount of water content that is too much will affect the comfort of the soap when used and will affect the humidity of the soap when it is stored. The water content can affect the hardness of the soap. The higher the soap water content, the softer the soap will be, conversely the lower the soap water content, the harder the soap will be. The amount of water in the soap affects the characteristics of the soap during storage. Soap with a high water content or >15% when stored in an open state will come into contact with the air which causes the soap to shrink in weight and dimensions [12]. The requirements for the water content test according to SNI No.06-3532-1994 are a maximum of 15%.

Table 2. Moisture Test Results of Transparent Solid Soap

F1(%)	F2(%)	F3(%)	F4(%)	Control(%)
20,74 ± 2,13	20,08 ± 1,38	21,70 ± 0,80	22,12 ± 2,89	17,60 ± 0,34

The results of the water content test for transparent solid soap combined with lemongrass essential oil and cinnamon are not in accordance with the SNI standard. 06-3532-1994 because the results obtained water content values above 15%. This can be caused by a fairly high amount of water content in the materials used which have not evaporated during heating, causing the value of the water content in the soap to remain high, besides that the increase in water content can be caused by the addition of raw materials used such as cocamid-DEA, glycerin, distilled water, to water used to dissolve sodium hydroxide [13]. To overcome the excess moisture content, the storage of transparent solid soap can be done for some time so that the water content in the soap can evaporate, if the soap is stored in an open state there will be contact with the air which causes the soap to experience weight and dimension shrinkage so that it is possible that the volume of water in the soap will decrease. will evaporate [12].

3.4 Homogeneity Test Result

The homogeneity test was carried out to determine whether during the manufacture of transparent solid soap the active substances and other ingredients could be mixed evenly or not. The homogeneity test was carried out visually to determine the homogeneity of the soap being studied. Homogeneity testing is done by cutting as thinly as possible the surface of the solid soap and then placing it on white paper or glass to observe whether there are undissolved material particles [14]. The results of the homogeneity test showed that in the four formulas there were no undissolved particles. This shows that the transparent solid soap made is homogeneous and complies with the requirement that transparent solid soap must be free of insoluble particles [14].

3.5 Organoleptic Test Result

Organoleptic testing was carried out to determine the physical characteristics of transparent solid soap a combination of lemongrass essential oil and cinnamon. The organoleptic test was carried out by visually observing the shape, color and smell of transparent solid soap [2]. The organoleptic test results showed that the form of transparent solid soap was consistent in solid and transparent form, orange color, and a distinctive smell of lemongrass.

3.6 Foam Height Test Results

The foam height test aims to determine the amount of foam and the stability of the foam produced by the transparent solid soap of citronella essential oil with cinnamon which is different from the four formulas. One of the attractions of soap is its foam content [12].

The characteristics of the foam produced by soap are influenced by the type of fatty acid used. In addition, the characteristics of the foam itself are influenced by the presence of active ingredients in soap or surfactants or foam stabilizers. In its use, soap foam plays a role in the cleaning process and imparts fragrance to the skin, but the large amount of foam is not always proportional to the cleaning power of soap. One of the factors that affect the saponification process is the quality of the oil and alkali used. The better the quality of the oil used, the better the quality of saponification. In addition, the stirring process also affects the saponification process.

Table 3. Foam High Test Result of Transparent Solid Soap

	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	Control (cm)
After Shaking	9,1 ± 1,80	9,1 ± 1,56	9,8 ± 0,68	10,1 ± 0,70	9,2 ± 0,52
After 5 minutes	6,7 ± 0,58	7,0 ± 0,85	7,4 ± 0,70	7,4 ± 0,81	7,4 ± 0,11

The formation of foam is the result of saponification of palm oil with stearic acid and NaOH which is part of alkali and triglycerides. The decrease in foam height when allowed to stand for 5 minutes occurs due to the nature of the foam which will shrink by itself when allowed to stand so this indicates that this condition is a normal condition at the time of soap making.

3.7 Free Alkali/Free Fatty Acid Test Results

Free alkali is an alkali in soap that is not bound as a compound [1]. Excess free alkali that is not up to standard can cause skin irritation [15]. A good free alkali content according to SNI no 06-3532-1994 is a maximum of 0.14%. Free fatty acids are fatty acids present in soap samples, but are not bound as sodium

compounds or triglyceride compounds (mineral fats) [1]. Free fatty acids are still present in the soap because it does not undergo a saponification reaction. A good free fatty acid in soap is < 2.5% (SNI 06-3532-1994). This test is carried out to determine the presence of excess free alkali or free fatty acids in transparent solid soap.
This free alkali/free fatty acid test shows that in the transparent solid soap sample there is free alkali, this is indicated by the red color that occurs when the sample is placed in neutral alcohol which is boiled together with phenolphthalein indicator. The soap sample is alkaline so it is titrated using 0.1 N HCl in alcohol until the red color just disappears.

Table 4. Free Alkali/Free Fatty Acid Test Results of Transparent Solid Soap

F1 (%)	F2 (%)	F3 (%)	F4 (%)	Control (%)
0,25 ± 0,12	0,20 ±0,08	0,10 ± 0,01	0,11 ± 0,05	1,17 ± 0,12

The results of the free alkali test showed that the samples of formula 1,2 and control soap had a fairly high level of alkali and were not in accordance with the standard of SNI No. 06-3235-1994. This can be caused by the use of palm oil in soap making which has low levels of FFA (Free Fatty Acid) causing poor soap quality. Because a good oil to be used as a raw material for soap is an oil that has a high Free Fatty Acid (FFA) content [15]. The excess level of alkali in formulas 1, 2 and control can be caused by the high alkali content of the material which is dominated by base content and essential oils used only in small concentrations which causes the alkali level to be quite high compared to formulas 3 and 4. Alkaline which is high enough can cause irritation when used [13].

3.8 Unsaponifiable Fat Test Results

According to SNI 1994, unsaponifiable fats are neutral fats/neutral triglycerides which do not react during the saponification process. The level of the unsaponifiable fraction is the total number of compounds contained in the oil/fat which remains in its original form after the formation of soap. The presence of an unsaponifiable fraction can reduce the ability to clean (detergent) in soap [16]. The requirement for unsaponifiable fat according to SNI No. 06-3235-1994 is a maximum of 2.5%.

Table 5. Unsaponifiable Fat Test Results of Transparent Solid Soap

F1 (%)	F2 (%)	F3 (%)	F4 (%)	Control (%)
2,80 ± 0,88	2,17 ± 0,72	3,08 ± 1,01	2,78 ± 0,55	3,40 ± 0,25

The results of the unsaponifiable fat test, transparent solid soap, combination of essential oil of kitchen lemongrass and cinnamon do not comply with the standard of SNI no. 06-3235-1994. The results of the unsaponifiable fat test showed that the fat content in the soap was more than 2.5% except for formula 2. This was due to the imperfect saponification process so that the level of unsaponifiable fat was high. The high unsaponifiable fat test results will cause the unsaponifiable fraction to inhibit the detergent's power of soap [17].

3.9 Hedonic Test Results

The hedonic test or preference test is a test carried out to determine the level of consumer acceptance of solid soap products produced from all different treatments. This hedonic test includes color, aroma, comfort and foam which is carried out by giving soap samples to be used on 20 panelists then each panelist gives an assessment according to the preferences of the four assessment criteria. There are 4 rating scales in this hedonic test, namely: (1) dislike, (2) dislike, (3) like and (4) like very much.

Table 6. Hedonic Test Results of Transparent Solid Soap

	F1	F2	F3	F4
Colour	3,5	3,5	3,5	3,1
Aroma	3,4	3,4	3,15	3,15
Convenience	3,45	3,3	3,2	3,2
Form	3,7	3,7	3,7	3,7
Foam	2,55	2,5	2,5	2,5

Of all the preference test parameters, the shape parameter is the most preferred parameter because in terms of shape it looks attractive and is not the same as the solid soap shape that is commonly used. Foam is a parameter that gets a less favorable value because at the time of testing the solid soap used was small, causing

not too much foam to be produced.

3.10 Statistical Test Results of Physical Properties of Transparent Solid Soap

Table 7. Statistical Test Results of Physical Properties of Transparent Solid Soap

Physical Parameters	Significance	Conclusion
pH test	0,005<0,05	Data is not normally distributed and homogeneous
Water Content Test	0,923>0,05	Data is normally distributed and homogeneous
Foam height test (after shaking)	0,000<0,05	Data is not normally distributed and homogeneous
Foam height test after 5 minutes)	0,001<0,05	Data is not normally distributed and homogeneous
Free Alkali test	0,000<0,05	Data is not normally distributed and homogeneous
Unsaponifiable fat test	0,004<0,05	Data is not normally distributed and homogeneous

The results of the physical statistical test of transparent solid soap showed that the pH test, high foam, free alkali and unsaponifiable fat had a significance value of <0.05 so that the data were not normally distributed and therefore continued with the Kruskall Wallis non-parametric test. The results of the Kruskall Wallis test obtained a significance value of <0.05 in the pH test, high foam after shaking and free alkali so that it can be concluded that differences in essential oil concentrations affect the physical properties of pH, foam height after shaking and free alkali. The results of the Kruskall Wallis test for high foam after 5 minutes and unsaponifiable fat obtained a significance value of > 0.05 so it can be concluded that the difference in volatile oil concentration has no effect on the physical properties of high foam after 5 minutes and unsaponifiable fat. The results of the statistical test of water content have a significance value of > 0.05 so that the data is normally distributed and followed by a parametric test with One Way ANOVA then obtained a significance value of < 0.05 so it can be concluded that differences in the concentration of active substances affect the water content of transparent solid soap.

Hedonic test statistics (liking) were performed using SPSS 22. The color hedonic test obtained a significance value in the sample > 0.05 so that the data obtained did not have a different significance value in the four samples, there was no need to continue with the post hoc test and it could be seen in Duncan's test which formula was preferred by the panelists. In Duncan's test results, it can be seen that formulas 1, 2, 3 and 4 have the same result, namely 3.5 so that none of the four formulas is preferred because when viewed visually for color there is no difference in the four formulas.

The statistical results of the hedonic test of aroma obtained a significance value in the sample <0.05 then followed by a post hoc test using Duncan to find out which formula had a significant difference. From the test results obtained, it shows that formulas 1 and 2 have significant differences while formulas 3 and 4. The hedonic aroma test that is most preferred by the panelists is formulas 1 and 2.

The statistical results of the hedonic test of convenience obtained a significance value of <0.05 then followed by a post hoc test using Duncan to find out which formula has a significant difference. From the test results obtained, it shows that formula 1 has a significant difference while formulas 3 and 4 while formula 2 does not have a significant difference in formulas 1, 2, 3. The hedonic comfort test that is most preferred by the panelists is formula 1.

The statistical results of the hedonic test of the form obtained a significance value in the sample <0.05 then followed by a post hoc test using Duncan to find out which formula had a significant difference. From the test results obtained, it shows that formulas 1 and 2 have significant differences with formulas 3 and 4. The hedonic test forms that are most preferred by the panelists are formulas 1 and 2.

The statistical results of the hedonic test of foam obtained a significance value in the sample > 0.05 so that the data obtained did not have a different significance value in the four samples so there was no need to continue with the post hoc test and it can be seen that the Duncan test was only used to see which formula preferred by the panelists. In Duncan's test results, it can be seen that formula 1 is the most preferred by the panelists.

IV. CONCLUSION

The results of the evaluation of transparent solid soap are homogeneous, colored transparent solid soap transparent orange, characteristic smell of lemongrass, solid form. pH test and foam height test are appropriate

with SNI standards. Free alkali test, and water content test does not comply with SNI. Unsaponifiable fat test results not according to SNI standard except formula 2. The results of the SPSS statistical test are known that difference in the concentration of the active substance of essential oils affect pH, water content, high foam after shaking, and alkali free and not effect on foam height after 5 minutes and unsaponifiable fat. Test results of hedonic test is known that there is no most preferred color, the most preferred scent formulas 1 and 2, the most preferred comfort formula 1, the most preferred form is formula1 and 2, the most preferred foam is formula 1.

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