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LIQUID SOAP PREPARATION FORMULATION USING A COMBINATION SUNFLOWER SEED OIL and Virgin Coconut Oil (VCO)

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Abstract
Sunflower seed oil and virgin coconut oil (VCO) have important benefits for the skin, making them attractive ingredients in liquid soap formulations. Sunflower seed oil contains vitamin E and essential fatty acids that maintain skin moisture and health, while VCO has antimicrobial, antioxidant, and skin softening properties. The combination of these two oils is expected to produce a liquid soap with superior quality in terms of softness, moisture, and skin cleansing. This study aims to find the optimal formulation by testing the physical properties and stability of various liquid soaps containing the combination for maximum benefits for the skin. VCO oil using a combination of sunflower seed oil is formulated in the form of a liquid soap preparation with variations in the addition of sunflower seed oil F0 base, F1 5 ml, F2 10 ml, F3 15 ml and K +. The liquid soap preparation was tested for physical properties such as organoleptic tests, pH tests, homogeneity tests, viscosity tests, foam height tests and physical stability tests. Organoleptic tests showed that F0 was clear, F1 was clear cloudy, F2 was cloudy, F3 was pale yellow, and K + was light brown, all in the form of homogeneous liquids with a distinctive aroma. The pH test showed that F0 had a pH of 8.5; F1 and F2 pH 8.3; F3 pH 8.2; and K+ pH 9.3. All formulations were homogeneous. The viscosity test was consecutive: F0 664.1 mPa.s, F1 556.6 mPa.s, F2 426.1 mPa.s, F3 981.5 mPa.s, K+ 475.6 mPa.s. The foam height was consecutive: F0 56 mm, F1 59 mm, F2 59 mm, F3 56 mm, K+ 59 mm. The physical stability of all formulations did not show significant changes in organoleptic, pH, foam height, homogeneity, and viscosity. The making of liquid soap with a combination of sunflower seed oil and VCO showed changes in physical properties such as viscosity, pH, and foam power, but these changes were not significant. This combination remains stable and effective for liquid soap formulations.
Keywords: liquid soap, sunflower seed oil, VCO, Physical properties test.

INTRODUCTION

Infectious skin diseases are one of the increasing health problems. Skin infections are caused by parasites, viruses, fungi and bacteria. Staphylococcus aureus is a gram-positive pathogenic bacteria that can cause infections such as osteomyelitis, gastroenteritis, pneumonia, endocarditis and abscesses. Staphylococcus aureus is a gram-positive bacteria that lives as a saprophyte in the human body's membrane channels, lives on the surface of the skin, sweat glands, and intestinal tract (Yuniar, 2022).
The saponification reaction using alkali is the reaction of triglycerides with alkali which produces soap and glycerin. Liquid bath soap products that are commercialized in society generally have a fragrant aroma with the aim of attractingbuyer (Djoru & Neonufa, 2023). There is a need to develop natural ingredients that are safe for health in liquid soap. This is intended to provide a positive impact or increase the added value of the liquid soap products produced. The added value includes giving a soft and smooth impression, moisturizing the skin and having antimicrobial activity when applied (Widyasanti *et al.*, 2017).
VCO contains 70% lauric acid, a type of saturated fatty acid that is easily digested and plays a role in energy production. This lauric acid compound has effective antibacterial activity against bacteria such as Staphylococcus aureus.(Mukin, 2019).Sunflower seed oil contains emollients which are substances that protect the skin from dryness. Emollients can be obtained from natural ingredients such as sunflower seed oil which is a healthy natural oil that contains fatty oils. Sunflower seed oil is rich in unsaturated fatty acids and vitamins, and has low cholesterol levels (Simanullang *et al.*, 2021).
Research shows that liquid soap with a combination of oils from natural ingredients, especially Pure Coconut Oil (VCO), is effective in soaping thanks to the lauric acid content which has clean and antimicrobial properties. Liquid bath soap is made through saponification between alkali salt and oil (Widyasantie *et al.*, 2017). There has been no research on liquid soap preparations using sunflower seed oil and VCO.

METHOD

Types of research

The study was conducted using an experimental method with statistical analysis using a Completely Randomized Design (CRD). In this study, there were four types of treatments with three repetitions.

The types of treatments for adding sunflower seed oil (Sunflowerseed Oil) and Virgin Coconut Oil (VCO) were treatments F0, F1, F2, F3 and K +.

Population and Sample

The population in this study was Virgin Coconut Oil (VCO) and sunflower seed oil (Helianthus annuus L). The samples used in this study were Virgin Coconut Oil (VCO) from NaturalPedia and Sunflower seed oil (Sunflowerseed Oil) from NaturalPedia.

Data collection technique

Data collection in this study was carried out using an observational method or conducting direct observations related to tests conducted on the stability of liquid soap preparations with sunflower seed oil formulation.

Time and Place of Research

This research was conducted in March at the Pharmaceutical Technology Laboratory of the ITEKES Cendekia Utama Kudus to make a liquid soap preparation with a combination formulation of Sunflower Seed Oil and Virgin Coconut Oil (VCO).

Instruments

The tools used are digital scales, beaker glass, measuring cup, magnetic stirrer, hot plate, thermometer, pH meter, dropper pipette, petri dish, water bath, refrigerator, oven, and Brookfield viscometer.
The ingredients used include sunflower seed oil from NaturalPedia, Virgin Coconut Oil (VCO) from NaturalPedia, KOH 40%, glycerin, distilled water, propylene glycol, Cocomid DEA, and fragrance.

Liquid Bath Soap Quality Testing

Liquid bath soap quality testing is divided into two types, the first is a physicochemical quality test in accordance with SNI Liquid Bath Soap 06-4085-1996 including Viscosity, pH value, foam height test, and stability. The second is an organoleptic test of color, aroma, viscosity, and amount of foam. The results of the quality test are continued with the determination of the weighting value by determining the subjective importance value which is measured based on the importance assessment.

Tabel 1.1 Liquid Bath Soap Formulation Based on sunflower seed oil with VCO combination

Material	Formulation (v/v)						
	F0 v/v	**F1 v/v**	**F2 v/v**	**F3 v/v**	**K+ v/v**	**Function**	**References**
Sunflower seed oil	0	5	10	15	Coconut Soap	Prevent dry skin	(Simanullang et al., 2021)
VCO	25	25	25	25		Smoothing the skin	(Zahro et al., 2023)
40% KOH solution	17.5	17.5	17.5	17.5		Helps the saponification process	(Zahro et al., 2023)
Glycerin	3.41	3.41	3.41	3.41		Moisturizes the skin	(Zahro et al., 2023)
Propylene Glycol	7.5	7.5	7.5	7.5		As a solvent	(Zahro et al., 2023)
Cocomid DEA	1.82	1.82	1.82	1.82		Foam stability	(Zahro et al., 2023)
Fragrance	qs	qs	qs	qs		Aroma therapy	(Zahro et al., 2023)

Source: *Zahro et al., (2023)*

Information:
F0 = 0:25 as negative control
F1 = 5:25 as F1 control
F2 = 10:25 as F2 control
F3 = 15:25 as F3 control
K+ = As a positive control

Making Liquid Soap Using Hot Method

Virgin coconut oil (VCO) and sunflower seed oil (Sunflowerseed) are placed in a beaker glass and heated on a magnetic stirrer. Heating is carried out until the oil mixture is at a temperature of 50-70°C. Next, a 40% KOH solution is added and stirred at a rotational speed of 350-700 rpm until homogeneous. After the soap dough is formed, the next process is to let the soap dough sit for 6-10 hours at room temperature (25-27°C) in a closed state. Furthermore, dilution or liquefaction is carried out to become

liquid soap. The materials used to dilute the soap dough are distilled water, glycerin, and propylene glycol (PG). The initial stage of dilution is to mix 60 g of glycerin into a 500 mL beaker glass and then heat it on a hot plate at a temperature of 50-70°C at a speed of 125-360 rpm. Next, the soap dough is added little by little into it. After 2-3 hours of stirring, 35 g of PG is added to the liquid soap and stirred until the mixture is homogeneous.

Physical Test of Liquid Soap

1. Organoleptic test: Organoleptic test is carried out by means of macroscopic observation including the shape, smell and color of the liquid soap.
2. Homogeneity test: Test the homogeneity of liquid soap by taking 1 mL of liquid soap and applying it to a glass object.
3. Foam height test: Test the height of liquid soap foam by putting 1 g of liquid soap and 10 mL of distilled water into a reaction tube. Then shake it for 20 seconds and measure the height of the foam formed.
4. pH test: The pH test is carried out using a digital pH meter (ATC).

Data analysis

The research data in the form of physical property test results were analyzed statistically using the IBM Statistical product of Service Solution (SPSS) 26.0 program for Windows with a confidence level of 96% ($\alpha = 0.05$). The data obtained from the research results were first tested for normality and homogeneity. The test performed was Shapiro-Wilk. If the data obtained turned out to be normal and homogeneous, then the one-way anova test was continued. Then continued with the post-hoc test with bonferroni.

RESULTS AND DISCUSSION

Table 2.1 Organoleptic Test

Formula	color	Smell	Form
F0	Clear	Jasmine aroma	Homogeneous Fluid
F1	Clear Cloudy	Jasmine aroma	Homogeneous Fluid
F2	Cloudy	Jasmine aroma	Homogeneous Fluid
F3	Faded yellow	Jasmine aroma	Homogeneous Fluid
K+	Light brown	Coconut aroma	Homogeneous Fluid

Source: Processed Primary Data (2024)

Based on the organoleptic test table, the results showed that the liquid soap formulation F0 (base) was clear in color, homogeneous liquid form, and smelled of jasmine. The clear colored base was obtained from the heating process of VCO and KOH to obtain paste soap, then dilution was carried out and no sunflower seed oil was added. While the F1 formulation (addition of 5 ml of sunflower seed oil) produced a clear cloudy liquid soap, homogeneous liquid form, smelled of jasmine, because of the addition of 5 ml of sunflower seed oil which made the clear color cloudy. Liquid soap formulation F2 (addition of 10 ml of sunflower seed oil) produced a cloudy liquid soap, homogeneous liquid form, smelled of jasmine because of the addition of 10 ml of sunflower seed oil which made the color cloudy. Liquid soap formulation F3 (addition of 15 ml of sunflower seed oil) produced a faded yellow liquid soap, smelled of jasmine and a homogeneous liquid form, because of the addition of 15 ml of sunflower seed oil which made the color fade yellow. liquid soap formulation K+ (positive control) produced a liquid soap that was pale brown in color, in homogeneous liquid form, with a coconut aroma because the soap was obtained from commercial products that were already on the market containing VCO (coconut oil). Based on the results obtained, the results of this study are in accordance with the standards set by SNI (SNI, 2017).

Table 2.2 pH Test

Formula	Results	SNI Standard	Information
F0	8.5	4-10	Qualify
F1	8.3	4-10	Qualify
F2	8.3	4-10	Qualify
F3	8.2	4-10	Qualify
K+	9.3	4-10	Qualify

Source: Processed Primary Data (2024)

Based on the tests conducted, the F0 formula in liquid soap preparations has a pH of 8.5, the F1 formula in liquid soap preparations has a pH of 8.3, the F2 formula in liquid soap preparations has a pH of 8.3, the F3 formula in liquid soap preparations has a pH of 8.2, the K+ formula in liquid soap preparations has a pH of 9.3. This shows that all liquid soap preparation formulas that have been made are in accordance with the requirements of the skin's pH value, which means that all liquid soap formulas produced meet the criteria for good liquid soap and do not cause irritation and dry skin (SNI, 2017).
The difference in the decrease in pH value for each concentration of liquid soap with the addition of sunflower seed oil experienced an insignificant decrease because sunflower seed oil is acidic and comes from oleic acid (Pramushinta & Hardani, 2021).
The pH test is carried out to determine the liquid soap preparation made according to SNI standards, the pH of the soap is 4-10. This is because liquid soap is in direct contact with the skin and can cause problems if the pH does not match the skin's pH. If the pH produced is below 4, it will cause skin irritation, and if the pH produced is above 10, it can cause dry skin because it has a high free alkali level (Annita *et al*., 2022).
Based on the results of statistical tests on the hypothesis test, the data is normally distributed and homogeneous, so the data is parametric data so that it is continued with the one-way anova test to determine the differences in the test group. In the one-way anova test, it is known that p <0.05, meaning that there are differences in each group. Then the post hoc bonferroni test is continued to determine the differences between each group. It is known that the significance value of p> 0.05 for formula F1 is 0.537 and F3 is 0.253, while formula F2 is ,000 below 0.05 so it can be concluded that the pH data of the liquid soap combination of sunflower seed oil and VCO is normally distributed because the normally distributed data is more than 50%.

Table 2.3 Homogeneity Test

Formula	Results
F0	Homogeneous
F1	Homogeneous
F2	Homogeneous
F3	Homogeneous
K+	Homogeneous

Source: Processed Primary Data (2024)

Based on the table above, the homogeneity test of the liquid soap preparation was carried out by applying the liquid soap preparation on transparent glass, then observing the surface, whether there was a separate layer or not, based on the results of the homogeneity test of the liquid soap preparation in the F0 formula (base), F1 formula (addition of 5 ml sunflower seed oil), F2 formula (addition of 10 ml sunflower seed oil), F3 formula (addition of 15 ml sunflower seed oil) and K + formula, namely liquid soap containing VCO. shows that F0, F1, F2, F3, K + preparations are homogeneous, so it can be said that the liquid soap preparation meets the requirements for the homogeneity test of the preparation, this is indicated by the absence of coarse grains and no separation of the water and oil phases when the preparation is applied to transparent glass (Zahro *et al*., 2023).

Table 2.4 Viscosity Test

Formula	Results	SNI Standard	Information
F0	664.1mPa.s	400-4000 mPa.s	Qualify
F1	556.6mPa.s	400-4000 mPa.s	Qualify
F2	426.1mPa.s	400-4000 mPa.s	Qualify
F3	981.5mPa.s	400-4000 mPa.s	Qualify
K+	475.6mPa.s	400-4000 mPa.s	Qualify

Source: Processed Primary Data (2024)

Based on the results of the viscosity test, the results of the F0 formula, namely the base of the liquid soap preparation, were 664.1 mPa.s, in the F1 formula with the addition of 5 ml of sunflower seed oil, the liquid soap preparation was 556.6 mPa.s, in the F2 formula with the addition of 10 ml of sunflower seed oil, the liquid soap preparation was 426.1 mPa.s, in the F3 formula with the addition of 15 ml of sunflower seed oil, the liquid soap preparation was 981.5 mPa.s and in the K + formula as a positive control of the liquid soap preparation was 475.6 mPa.s. The viscosity test showed no significant difference in viscosity between the base and the formulations that were added with 5 ml, 10 ml and 15 ml of sunflower seed oil. Variations added in the formula affect the viscosity of the preparation but not too much, meaning that there is an effect of addition to the viscosity of the preparation but not too

much, because what significantly affects the viscosity of a preparation in a soap formula is stirring during the process of making liquid soap. This shows that inconsistent stirring can affect the viscosity of the liquid soap preparation (Yulianti *et al*., 2015).
Based on the results of statistical tests on the hypothesis test, the data is normally distributed and homogeneous, so the data is parametric data so that it is continued with the one-way anova test to determine the differences in the test group. In the one-way anova test, it is known that p <0.05, meaning that there are differences in each group. Then the post hoc bonferroni test is continued to determine the differences between each group.
It is known that the significance value of p>0.05 was obtained for formula F1, which is 0.972, then for formula F2, which is 0.640 and F3, which is 0.952, the significance value of formulas F1, F2 and F3 shows p>0.05 so it can be concluded that the data on the height of liquid soap foam from a combination of sunflower seed oil and VCO is normally distributed because there is no significant difference between F1, F2 and F3.

Table 2.5 Foam Height Test

Formula	Results	SNI Standard	Information
F0	56mm	12-220mm	Qualify
F1	59mm	12-220mm	Qualify
F2	59mm	12-220mm	Qualify
F3	56mm	12-220mm	Qualify
K+	59mm	12-220mm	Qualify

Source: Processed Primary Data (2024)

For foam height and stability test Based on SNI, the foam height requirement of liquid soap is 12-220 mm. Foam height testing uses a test tube, Foam height measurement is done by mixing a liquid soap sample with water in a ratio of 1: 1 into a container then shaking it quickly for 20 seconds then waiting 5 minutes then measuring the foam height. The foam height requirement for liquid soap is in the range of 12-220 mm so that it still meets the requirements of liquid soap, from the results of observations the foam height was obtained from the F0 base formulation which is 56 mm, F1 formulation with the addition of 5 ml of sunflower seed oil which is 59 mm, F2 formulation with the addition of 10 ml of sunflower seed oil which is 59 mm, F3 formulation with the addition of 15 ml of sunflower seed oil which is 56 mm, and K + formulation with commercial product samples which is 59 mm. for the foam height of each formulation is not too significant so it is still within the specified standard limits. Foam in soap serves to lift oil or fat on the skin, if the foam owned by the soap is too high then it can make the skin dry, VCO oil has the potential to produce good foam in liquid soap. The content of saturated fatty acids helps in the formation of abundant and long-lasting foam. However, excessive foam can cause dry skin (Zahro *et al*., 2023).
Based on the results of statistical tests on the hypothesis test, the data is normally distributed and homogeneous, so the data is parametric data so that it is continued with the one-way anova test to determine the differences in the test group. In the one-way anova test, it is known that p <0.05, meaning that there are differences in each group. Then the post hoc bonferroni test is continued to determine the differences between each group.
It is known that the significance value of p>0.05 for formula F1 is 0.147 then for formula F2 is 0.174 and F3 is 0.806, the significance value of formulas F1, F2 and F3 shows p>0.05 so it can be concluded that the data on the height of liquid soap foam from a combination of sunflower seed oil and VCO is normally distributed because there is no significant difference between F1, F2 and F3.

Table 2.6 physical stability test

Physical properties test	Formula	Before	After
organoleptic	F0	Clear, jasmine aroma, homogeneous	Clear, jasmine aroma, homogeneous
	F1	Clear cloudy, jasmine aroma, homogeneous	Clear cloudy, jasmine aroma, homogeneous
	F2	cloudy, jasmine scent, homogeneous	cloudy, jasmine scent, homogeneous

	F3	Faded yellow, jasmine scent, homogeneous	Faded yellow, jasmine scent, homogeneous
	K+	Light brown, jasmine aroma, homogeneous	Light brown, jasmine aroma, homogeneous
Homogeneous	F0	Homogeneous	Homogeneous
	F1	Homogeneous	Homogeneous
	F2	Homogeneous	Homogeneous
	F3	Homogeneous	Homogeneous
	K+	Homogeneous	Homogeneous
pH	F0	8.5	8.5
	F1	8.3	8.3
	F2	8.3	8.4
	F3	8.2	8.3
	K+	9.3	9.3
Viscosity	F0	664.1	593.2
	F1	556.6	599.4
	F2	426.1	520.0
	F3	981.5	893.9
	K+	475.6	522.3
Foam height	F0	56mm	59mm
	F1	59mm	59mm
	F2	59mm	56mm
	F3	56mm	56mm
	K+	59mm	56mm

Organoleptic test aims to determine and observe the physical appearance of liquid soap preparations including the shape, color and smell of the preparation. In table 4.6 the results of organoleptic test observations can be seen that in each formula before and after accelerated storage there was no change in terms of shape, smell. The results obtained showed that F0 tends to be clearer because it only uses VCO oil, while F1 the color tends to be clear and cloudy resulting from the addition of 5 ml of sunflower seed oil, F2 the color becomes cloudy resulting from the addition of 10 ml of sunflower seed oil, F3 the color becomes faded yellow resulting from the addition of 15 ml of sunflower seed oil, K + which is a positive sample has a light brown color and after the stability test all formulas remain homogeneous. The color of the preparation will follow the color of the more dominant extract. For odor, the preparation has a distinctive odor according to the aroma, namely jasmine used in the formulation. The quality requirements for liquid soap according to SNI 06-4085-2017 organoleptically are that the preparation is in liquid form and has a distinctive color and odor. Based on the organoleptic test results obtained, the sunflower seed oil and VCO liquid soap preparations have met the quality requirements for liquid soap (SNI, 2017).

In the second test, a homogeneity test was carried out which aims to determine the even mixing of each composition of ingredients in the formula so that there are no solid particles when applied to the skin. In table 3, the observation results show that the homogeneity of the preparation before and after accelerated storage did not change the homogeneity of the preparation for each formula, meaning that F0, F1, F2, F3 and K + can be said to be stable liquid soap preparations. This shows that the homogeneity of liquid soap is in accordance with the statement stated in the Indonesian Pharmacopoeia Edition IV, topical preparations must show a homogeneous composition and not show any solid particles. The homogeneity of liquid soap is produced due to continuous stirring (Usman & Baharuddin, 2023). One of the quality requirements for liquid bath soap according to SNI 06-4085-2017 is homogeneous. So F0, F1, F2, F3 and K+ meet SNI requirements (SNI, 2017).

Based on the results of the pH measurements, it shows that the five formulas have pH values that are still within the standard and these values are still within the pH range required by SNI 06-4085-2017 for liquid bath soap, namely between pH 4-10, so they are safe to apply to the skin because at this pH it is hoped that there will be no irritation to the skin (Usman & Baharuddin, 2023). Based on the table above, the results of observations of the foam height before and after accelerated storage show that there is a very small change in foam height at F0 and F3, while F2, F4 and K+ are quite stable because there is no change in the height of the liquid soap. Although F0 and F3 have changed, the value of the foam

height formed is still within the range of requirements that have been set according to SNI 06-4085-2017 for liquid soap

The results of the physical quality of the viscosity of the liquid soap preparation in the F0 formulation are 664.1 mPa.s, then the F1 formulation is 556.6 mPa.s, then the F2 formulation is 426.1 mPa.s, then the F3 formulation is 981.5 mPa.s and the K + formulation is 475.5 mPa.s. The viscosity of the liquid soap preparation formulations F0, F1, F2, F3 and K + can be stated to meet the standards because they are included in the viscosity range of liquid soap, which is 400-4000 mPa.s. In the viscosity test of liquid soap using spindle 4 with a speed of 60 rpm. The decrease in viscosity can be influenced by an increase in the ratio of water or soap, this is because the viscosity can be influenced by the water content in the soap. The lower the water content in the soap, the higher the viscosity will be and vice versa, the higher the water content in the soap, the lower the viscosity will be (Shakila *et al*., 2021).

CONCLUSION

a. The combination of sunflower seed oil and VCO can be formulated into a liquid soap that meets quality standards. This liquid soap is not only effective in cleaning, but also provides additional benefits for the skin, such as softness and moisture. This formulation also shows good stability during storage, making it a potential product for further development.
b. The addition of sunflower seed oil and VCO increases the physical stability of liquid soap, maintaining pH, viscosity, foaming ability, water content, and storage stability well. This combination is effective in maintaining the physical quality of liquid soap during storage.
c. Liquid soap with a combination of sunflower seed oil and VCO has good physical characteristics, including pH according to human skin pH, ideal viscosity for comfortable use, good foaming ability, stable water content, and good physical stability during storage found in formula F3.

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