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Formulation and Standardization of Face Wash Using Watermelon Rind Extract (*Citrullus lanatus*)

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Abstract

The purpose of this study was to determine the utilization of watermelon rind waste as an active ingredient in the manufacture of liquid soap preparations and to obtain the best formulation of watermelon rind extract liquid soap that is physically stable. Watermelon rind waste contains many nutritious substances, such as antioxidants, that are beneficial for skin health but have not been widely utilized. This study utilizes citrulline compounds in watermelon rind, which act as antioxidants and potential vasodilators, to be used as active ingredients in the manufacture of bath soap preparations with the aim of removing dirt and stimulating blood circulation. Research method includes the preparation of thick watermelon rind extract, the preparation of salt solution, and the preparation of liquid soap preparation formulas with varying concentrations of watermelon rind extract. Evaluation includes an organoleptic test, pH, viscosity, foam height, foam stability, homogeneity, and spreadability to obtain a liquid soap formula with stable physical properties. Result showed that watermelon rind extract has the potential to be an active ingredient in liquid soap preparations in order to utilize waste and provide benefits for skin health.

Keywords: liquid soap; watermelon rind; antioxidant.

INTRODUCTION

Soap is a compound of sodium or potassium with fatty acids from vegetable oils or animal fats in solid, soft or liquid, and foamy form. Soap is produced by the saponification process, namely the hydrolysis of fat into fatty acids and glycerol under alkaline conditions (Jalaluddin et al., 2018). Soap can be in solid or liquid form and can clean the skin from dirt, oil and bacteria. One type of soap that is popular is liquid soap because it is practical and relatively cheap (Rasyadi et al., 2020). Liquid soap has several advantages over solid soap, which is based on consumer opinion that liquid soap is more hygienic, liquid soap products are more profitable, practical and economical for consumers and soap production is easier and profitable for consumers (Rosmainar, 2021). Liquid soap is able to emulsify water, dirt or oil. Liquid soap is effective for removing dirt that sticks to the surface of the skin, both water-soluble and fat-soluble and cleans the odor on the skin and provides a fragrant fragrance (Dimpudus, et.al., 2017). Soap as a cleaning product is often used by people in everyday life (Fitri et al., 2023).

Soap making is generally done through a saponification process, namely a reaction between a base or alkali and fatty acids. Liquid soap is made by reacting potassium hydroxide (KOH) with vegetable oil or animal fat. Through the neutralization saponification reaction process with KOH alkali solution, soap is produced as a foaming agent with the K-oleate type (Rivai et al., 2017). The use of natural ingredients as active ingredients for soap has great potential for development (Muti'ah et al., 2022). One of them is utilizing the citrulline compound in watermelon rind waste as a natural antioxidant (Akhyar et al., 2019). There is a need to diversify and innovate liquid soap products by utilizing the potential of abundant local waste such as watermelon rinds. This can create added value to the product and reduce environmental pollution due to waste disposal. Soap is a mixture with surfactants that is processed using water for washing and cleaning. Basically, there are various forms of soap currently known, including liquid soap, opaque solid soap, transparent solid soap, and paper soap. In the industrial world, solid soap is more often used by society in general (Bunga, et al. 2014). In the industrial world, 3 things that good soap does not only clean the skin from dirt, but also contain substances that do not damage the skin and can protect the skin, one of which is from the effects of free radicals. Compounds that can ward off free radicals are antioxidants. Antioxidants are actually able to slow down or inhibit the oxidation of substances that are easily oxidized even in low concentrations (Green, 2008). Watermelon is a fruit that is popular with the public. Watermelon rind which has a thickness of 1.5-2.0 cm always becomes waste (Nintyas, 2007). Albedo is the thickest and white part of the fruit skin (Puspitasari, 2014). The white layer on the watermelon rind is less desirable for people to consume and is thrown away as less waste which can be used to make soap in general to cleanse the body of dirt (Ismayanti and Bahri, 2013), (Aula, 2019).

Body skin is the outermost and largest part of the body that has an important role. Skin is alive, responsive and can change according to stimulation from the external environment (Aisyah et al., 2020). Skin has many important functions as protection from the external environment, as well as a sense of touch. Skin is a valuable part of the body with various important roles attached to it. Protecting and caring for the skin is a mandatory thing that must be done to maintain healthy skin function. Disorders that occur on the skin can be treated by using soap on the body. Soap can cleanse germs and other things that make the body dirty (Margareth et al., 2021). Apart from being able to clean the body's skin, soap can also soften the skin and maintain healthy skin in extract watermelon rind (Wahyudi, 2018). Watermelon (*Citrullus lanatus*) is a summer fruit that is widely consumed by the public (Aderiye et al., 2020). In general, watermelon is consumed only in the red or yellow flesh, while the white portion is still less desirable for consumption by the public and is only thrown away as unused waste (Yusuf, 2021). Watermelon rind waste is still less than optimal in its utilization. The white part of the rind of watermelon contains many compounds that have an important role for health. Watermelon rind waste contains many nutritious substances such as antioxidants which are beneficial for skin health, but have not been widely utilized (Ermawati et al., 2022). Watermelon rind contains citrulline compounds which act as antioxidants and potential vasodilators (Aderiye et al., 2020). The inner skin or what is called albedo, which is white, is a form of waste that is not utilized by the community and can pollute the environment. This is because the albedo of watermelon has a taste that tends to be bland and sour for consumption (Sirait et al., 2023).

The waste produced from watermelon is quite a lot, namely 30% of the fruit itself. The white layer on the skin of watermelon contains substances that are really needed by the skin, including citrulline which is an antioxidant (Rochmatika, et al. 2012). Watermelon rind is also rich in vitamins, minerals, enzymes and chlorophyll. The vitamins found in watermelon rind include vitamin A, vitamin B2, vitamin B6, vitamin E, and vitamin C. The content of vitamin E, vitamin C, protein, and 6 ppm of lycopene which is quite a lot in watermelon rind can be used as an antioxidant. The watermelon plant (*Citrullus lanatus*) is one of the many fruit-producing plants found in Indonesia. Its function is not only to quench thirst, but also as a good antioxidant (Sugiyanta, 2013). Watermelon (*Citrullus lanatus*) belongs to the Cucurbitaceae family which includes cucumbers, pumpkins, and pumpkins. The first records of its cultivation in the Mediterranean region date from around 3,000 years ago. Watermelon is a popular fruit, which is usually consumed fresh. In addition, it can be processed into juice, jam, or pickle peel, and the seeds (from seed cultivars) are also consumed (Abidin et al., 2016). The majority of people only consume the fresh red or yellow flesh of the fruit, while the skin and white flesh of watermelon are only thrown away as waste without any further use (Niwanggalih et al., 2014). Watermelon (*Citrullus vulgaris Schrad*) is a natural and rich source of the non-essential amino acid citrulline. Citrulline is used in the nitric oxide system in humans and has potential antioxidant and vasodilatory roles. Citrulline content ranged from 3.9 to 28.5 mg/g dry weight and was similar between seeded and seedless types (16.6 and 20.3 mg/g dry weight, respectively). Red-fleshed watermelon has slightly less citrulline than yellow- or orange-fleshed watermelon (7.4, 28.5 and 14.2 mg/g dry weight, respectively) (Rimando & Perkins-Veazie, 2005). The results of phytochemical screening show that the white pulp extract of watermelon contains alkaloids, flavonoids, tannins and polyphenols (Djala et al., 2016). The amino acid citrulline in watermelon can be converted into arginine in the body if consumed in large quantities (Niwanggalih et al., 2014). Consuming citrulline can increase arginine levels in the body, which is an important amino acid in the process of forming nitric oxide. The nitric oxide formed helps increase blood flow (vasodilation), muscle energy metabolism, and mitochondrial respiration during exercise. Citrulline plays a role in improving sports performance through both aerobic and anaerobic metabolic pathways (Rizal & Segalita, 2018; Setiawan & Widyastuti, 2016).

The citrulline compound can be used as an active compound in making bath soap preparations for muscle relaxation. Soap is a cleanser made by a chemical reaction between potassium or sodium and fatty acids from vegetable oils or animal fats. Liquid soap is more popular with the public compared to solid soap because it is more practical to use, more economical, not contaminated with bacteria, easy to carry and easy to store (Agusta, 2016; Arfiansyah, 2015). Liquid bath soap has advantages, including a relatively easier manufacturing process, cheap production costs, and easy storage and use so that the soap is not easily damaged (National Standardization Council, 1996). This research uses the white flesh of watermelon which contains citrulline to be used as bath soap. It is hoped that this soap preparation can remove stubborn dirty attached to the surface of the skin, stimulates blood and nerve circulation, and restores freshness to the body. The aim of this research is to formulate a relaxing bath soap from the white flesh of watermelon that meets the requirements according to SNI standards (National Standardization Council, 1996). The differences in physical properties and chemical properties with the aim of comparing the characteristics of soap, both physically and chemically for analysis and theoretical suitability (Harold, 1982) as follows:

Table 1. Physical and Chemical Properties of Soap.

No.	Physical Properties	Chemical Properties
1.	Specific heat of soap = 0.56 cal/gram.	Soap is alkaline.
2.	The density of pure soap is between 0.96-0.99 grams/mL.	Soap produces foam when the saponification reaction.
3.	The viscosity of soap depends on the temperature of the soap and the composition of the fat or oil mixed with it.	Soap has cleaning properties.

Based on the explanation of the benefits of watermelon rind which contains the compound citrulline, it is known that this ingredient has many benefits for the health of the body's skin. There are several studies that have used watermelon rinds as an ingredient in making liquid soap (Yusuf et al., 2021). In research (Muti'ah et al., 2022), people's needs regarding the availability of natural soap are increasing day by day, natural ingredients in the form of watermelon rinds have not been utilized as formulation ingredients for making liquid soap. Therefore, the aim of this research is to determine the use of watermelon rind waste as an active ingredient in making liquid soap preparations and to obtain the best liquid soap formulation from watermelon rind extract which is tested based on organoleptic tests, pH, viscosity, foam height, foam stability, homogeneity and spreadability to obtain a liquid soap formula with stable physical properties.

MATERIALS AND METHODS

Tool and Material

The ingredients used in this research include watermelon rind extract, sodium laureth sulfate (SLS), sodium chloride (Merck), glycerin, stearic acid, distilled water (Chemical Indonesia), red food coloring, fragrance, and vitamin C. The instruments used in this research were a falling ball viscometer (Thermo Scientific), a viscometer (Brookfield), a pH meter (Eutech Instruments pH 700), a 5 mL pycnometer (Pyrex).

Making Watermelon White Skin Thick Extract

The extract was made using the maceration method, namely soaking 500 grams of watermelon rind simplicia powder (Citrullus lanatus) in a separate beaker and then adding sufficient water as a solvent. The white skin of the watermelon was first washed until clean and cut into small pieces to macerate with water as a solvent. Weighed 500 grams of watermelon white skin, mashed with a blender. Cover with aluminum foil, then leave for 24 hours and stir occasionally. After 24 hours, let it sit, then filter using a funnel lined with filter paper to obtain a filtrate and put it in a brown bottle. The dregs obtained were macerated 2 times with the same procedure. The filtrate obtained was concentrated using a rotary evaporator.

Preparation of Salt Solution

Making a salt solution was done by dissolving 4 grams of NaCl salt with 30 mL of distilled water. Stirred and dissolved until homogeneous into a salt solution.

Making Liquid Soap Preparations

Making liquid soap preparations was done by dissolving 10 grams of texapon using 70 mL of distilled water as a solvent. Next, stir until homogeneous to form a Texapon solution. Next, 4 grams of glycerin was dissolved in 30 mL of distilled water to make a glycerin solution. Stir until homogeneous to form a glycerin solution. If the texapon solution and glycerin solution are mixed in a 500 mL beaker and stirred until homogeneous. Add the salt solution little by little and stir until homogeneous. Add citric acid solution and stir until homogeneous. Add watermelon white skin extract, 3 mL of coloring, and stir until homogeneous. Leave it until the soap foam forms, then the liquid soap preparation from watermelon rind extract is finished.

pH Test

The pH test began by calibrating the pH meter using a buffer solution of pH 7 and pH 4. One gram of the soap preparation for pH testing was dissolved in 100 mL of distilled water in a beaker, then insert the pH meter, wait until the pH meter indicator is stable and shows constant pH value. The pH check was carried out three times in replication. If the pH was too alkaline, dilution can be carried out to lower the pH in accordance with SNI 16-3499-1996. The acceptable pH for facial skin is between 4.5-8.0 (Lumentut et al., 2020).

Viscosity Test

The viscosity test, it was measured using a Brookfield viscometer with spindle number 1. The watermelon rind extract liquid soap preparation that had been made was put into the cup and spindle number 1 was installed. The rotor was run at a speed of 30 rpm with a viscosity range value adjusted by SNI 16-4399- 1996. The permissible viscosity range is between 2000 to 50,000 Cp (Centipoise) (Rahayu, 2016).

Homogeneity Test
The homogeneity test was carried out by testing 1 gram of watermelon rind extract liquid soap preparation on glass and pressing quite hard with the palm of the hand to observe the homogeneity of the liquid soap preparation (Tumbelaka et al., 2019). A good soap preparation if there are no coarse grains in the liquid soap preparation (Lumentut et al., 2020).

Foam/Foam Height Test
The foam height test was carried out by testing one gram of watermelon rind extract liquid soap by dissolving it in 10 mL of distilled water, then shaking for 20 seconds, and measuring the height of the foam formed.

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$$Foam\ Test = \frac{Final\ foam\ height}{Initial\ foam\ height} x\ 100\%$$

Source: Yusuf et al., 2021.

Foam/Foam Stability Test
The foam stability test was carried out by dissolving one gram of liquid soap in 10 ml of distilled water, then shaking for 20 seconds. Next, measure the height of the foam formed and leave it for 5 minutes. Then measure the height of the foam that remains until the desired foam stability is obtained. The foam stability results are obtained using the following formula:

$$Foam\ Stability = \frac{Final\ foam\ height}{Initial\ foam\ height} x\ 100\%$$

Source: Istiharoh, 2022.

Organoleptic Test
Organoleptic testing includes repeated examinations focusing on color consistency, aroma and texture. Watermelon rind extract liquid soap was prepared visually by testing the questionnaire method with 125 respondents aged 13-50 years (Lumentut et al., 2020).

Spreadability of Foam Test
Testing the spreading power of foam is carried out by measuring the spreading diameter of a 0.5 gram sample placed in the middle with one of the spreading power glasses. After that, leave it for 1 minute and get the diameter of the spread by calculating the area of spread. A good range of spreading power is provided with a distance of 3-5 cm (Mahdi et al., 2022).

RESULTS AND DISCUSSION

Soap Test Results
Test results of liquid soap from watermelon rind extract using various tests following SNI 16-3499-1996 testing, namely organoleptic tests, pH, viscosity, foam height, foam stability, homogeneity, spreadability as follows:

pH Test Results
In pH testing carried out using a pH meter, pH value data was obtained with several concentrations of watermelon rind extract as follows:

Tabel 1. Hasil Pengujian pH.

Watermelon Rind Extract Concentration	Test Result pH	Standard Quality Standard
Soap C (No Extract)	7,87	
Soap A (Extract 20%)	7,65	4,5-7.8
Soap B (Extract 40%)	7,27	

From the pH test data that has been carried out, it can be seen that the pH test value of watermelon rind extract soap has a pH that is still within the quality standard threshold, namely 4.5-7.8 according to SNI 16-4380-1996 concerning facial skin cleansers. The higher or lower the pH of a product, the greater the acid or base concentration of the product. Facial cleansers that are too acidic or alkaline can hurt the skin. To maintain the skin's pH, it is better to use a skin cleanser with a neutral pH value (Rachmadani et al., 2022), (Sholikha, 2021).

Viscosity Test Results
In viscosity testing, it is necessary to determine the time to measure density and dynamic viscosity using a falling ball viscometer by presenting time with temperature differences using the average:

Table 2. Viscosity Test Results using Falling Ball.

Variable Liquid	Temperature (°C)	Time (t_1) (s)	Time (t_2) (s)	Average Time
Soap A (Extract 20%)	30	15,01	15,30	15,16
	40	14,78	15,10	14,94
	50	14,25	14,30	14,27
Soap B (Extract 40%)	30	14,87	15,10	14,98
	40	14,81	14,90	14,85
	50	14,28	14,30	14,29
Soap C (Extract 0%)	30	14,73	14,65	14,69
	40	14,69	14,52	14,60
	50	14,37	14,11	14,24

Table 3. Density Measurement Results.

Variable Liquid	Pycnometer Mass (gr)	Temperature (°C)	Pycnometer Mass and Variables (gr)	Volume (mL)	Density (gr/mL)
Soap A (Extract 20%)	12,3765	30	18,7130	5	1,27
	12,3765	40	18,6923	5	1,26
	12,3765	50	18,6812	5	1,26
Soap B (Extract 40%)	12,3765	30	18,7142	5	1,27
	12,3765	40	18,6934	5	1,26
	12,3765	50	18,6823	5	1,26
Soap C (Extract 0%)	12,3765	30	18,7201	5	1,27
	12,3765	40	18,6941	5	1,26
	12,3765	50	18,6845	5	1,26

Table 4. Dynamic Viscosity using a Falling Ball Viscometer.

Variable Liquid	Spherical Constants (g/cm^3)	Spherical Density (g/cm3)	Temperature (°C)	Soap Density (gr/mL)	Time (s)	Dynamic Viscosity
Soap A (Extract 20%)	0,7	8,1	30	1,27	15,16	72,4800 Cp
	0,7	8,1	40	1,26	14,94	71,5327 Cp
	0,7	8,1	50	1,26	14,27	68,3247 Cp
			Average Dynamic Viscosity			70,7791 Cp
Soap B (Extract 40%)	0,7	8,1	30	1,27	14,98	71,6194 Cp
	0,7	8,1	40	1,26	14,85	71,1018 Cp
	0,7	8,1	50	1,26	14,29	68,8036 Cp
			Average Dynamic Viscosity			70,5082 Cp
Soap C (Extract 0%)	0,7	8,1	30	1,27	14,69	70,2329 Cp
	0,7	8,1	40	1,26	14,60	69,9048 Cp
	0,7	8,1	50	1,26	14,24	68,1811 Cp
			Average Dynamic Viscosity			69,4396 Cp

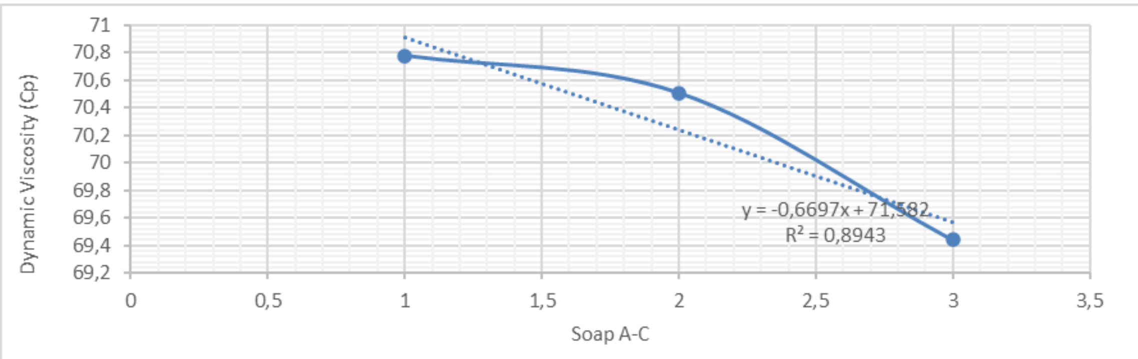

Figure 1. Dynamic viscosity using a Falling Ball Viscometer.

In this experiment, the first step was to measure 100 mL of soap A. Then, put it in a 300 mL beaker, then heat it until it reaches a temperature of 30ºC, 40ºC and 50ºC. This is so that when the density is measured using a pycnometer or falling ball it will produce the desired temperature. The working principle of a pycnometer is to measure the concentration of a solution by comparing the density of the solution with the density of a ball using the formula:

$$n = \frac{2r^2(\rho b - \rho f)}{9v} \; or \; n = K(\rho t - \rho 2).t$$

Information:
r = density (gr/ml)
m = mass (g)
v = volume (mL)

After weighing, the empty weight of the 5 mL pycnometer was 12.3765 grams. Then put it at a temperature of 30ºC into a pycnometer, then weighed and the resulting weight was 18.7130 grams, so the net weight of soap A was 6.3365 grams. Then, enter it into the density formula and the resulting density of soap with temperatures of 30ºC, 40ºC, 50ºC is 1.27 gr/mL, and 1.26 gr/mL. Next, the soap with a temperature of 40ºC is put into a falling ball tool. Then, the time the ball reaches the bottom is recorded and repeated three times then the average time is calculated. Next, it is calculated using the viscosity formula, namely 72.480 Cp at a temperature of 30ºC, while at a temperature of 40ºC, it is 71.5327 Cp, and at a temperature of 50ºC, it is 68.3247 Cp for soap A. This is in accordance with the theory that temperature affects the viscosity value, where if as the temperature increases, the viscosity will decrease, and vice versa, if the temperature decreases, the viscosity will increase or be high (Damayanti et al., 2018), (Lumbantoruan et al., 2016). In viscosity testing, it is necessary to determine the time to measure density and dynamic viscosity using a Brookfield viscometer with test results, namely:

Table 5. Brookfield Viscosity Test Results.

Variabel Liquid	Suhu (ºC)	LV Series Viscometer	Spindle 1 (cp)
Soap A (Extract 20%)	30	96,9	19.380
	40	96,7	19.340
	50	96,5	19.300
Soap B (Extract 40%)	30	96,4	19.280
	40	96,2	19.240
	50	96	19.200
Soap C (Extract 0%)	30	95,9	19.180
	40	95,7	19.140
	50	95,5	19.100

Organoleptic Test Results

The organoleptic testing on the manufacture of liquid soap from watermelon rind extract with a sample of 125 people with 3 assessment criteria of color, aroma and texture with assessment criteria from very like to dislike using the following average:

Table 6. Viscosity Test Results.

Assesment	Criteria Rating	Sample	Point	Average
Colour	Really like	49 people	245	4 (**Like**)
	Like	38 people	152	
	Enough	38 people	114	
	Dislike	0 people	0	
	Really Dislike	0 people	0	
Aroma	Really like	28 people	140	3,8 (**Enough**)
	Like	45 people	180	
	Enough	51 people	153	
	Dislike	1 people	2	
	Really Dislike	0 people	0	
Texture	Really like	8 people	40	3,6 (**Enough**)
	Like	62 people	248	
	Enough	56 people	168	
	Dislike	0 people	0	
	Really Dislike	0 people	0	

Table 7. Assessment Criteria (Organoleptic Test).

Criteria Rating	Point	Range Point
Really like	5	5,0
Like	4	4,0-4,9
Enough	3	3,0-3,9
Dislike	2	2,0-2,9
Really Dislike	1	1,0-1,9

Organoleptic values follow 3 assessment criteria, namely color, aroma and texture. When observing color by testing 125 people with various average calculations, the results obtained from organoleptic testing of color, namely point 4 with the predicate "**Like**" from a sample of 125 people. Then, in the aroma assessment by testing 125 people, the results obtained from the organoleptic testing of the aroma were 3.8 points in the "**Enough** " category, so an evaluation was needed with product development in terms of aroma in liquid soap made from watermelon rind extract. Furthermore, in the texture assessment by testing as many as 125 people, the results obtained from organoleptic testing of the texture were 3.6 points with the predicate "**Enough**", so an evaluation was needed with product development in terms of texture in liquid soap made from watermelon rind extract. Therefore, it is necessary to improve the quality in terms of aroma and texture of liquid soap preparations from watermelon rind extract.

Test Results for Measurement of High Foam and Foam Stability

Table 8. Foam Stability Test Results.

Watermelon Rind Extract Concentration	Foam Height (cm)		Stability Foam
	Beginning	End	
No Extract	9,0	7,2	80%
Extract A (20%)	8,5	7,0	82%
Extract B (40%)	7,5	6,5	87%

The test results for face wash foam height were obtained in the range of 6.5-9.0 cm. Based on SNI 16-3499-1996, the height requirement for foam/foam from liquid soap is 1.3-22 cm. The function of the foam in soap is to transport oil or fat to the skin. If the foam in soap is too high it can make the skin dry. When the fat in the skin is lost, it will make the skin more susceptible to irritation (Hutauruk et al., 2020). Meanwhile, the foam stability test showed different results. The stability of the foam is indicated by the amount of foam lost during soaking for 5 minutes. The less foam is lost, the more stable the foam formed.

Spreadability Test Results

Table 9. Spreadability Test Results.

Watermelon Rind Extract Concentration	Extract Soap Mass (gr)	Spreadability Test Results (cm)
No Extract	0,5	4,5
Extract A (20%)	0,5	4,4
Extract B (40%)	0,5	4,4

The spreadability test is carried out to determine how much liquid soap is able to spread on the skin. In the spreadability test, 0.5 grams of each liquid soap preparation formulation of watermelon white rind extract was taken and placed on a large watch glass, then another smaller watch glass and a weight were placed on top of the preparation. Next, let it sit for 1 minute, then the diameter of the spread is obtained by calculating the area of spread. According to (Komala et al., 2020), the range of good spreadability for liquid soap preparations is between 3 – 5 cm. In this experiment, a value of 4.5 cm was obtained for F1 and 4.4 cm for F2 and F3. Thus, these results show that all liquid soap formulas produced meet the criteria for good liquid soap.

Homogeneity Test Results

Table 10. Homogeneity Test Results.

Watermelon Rind Extract Concentration	Homogeneity Results
No Extract (F1)	Homogeneous
Extract A (20%) (F2)	Homogeneous
Extract B (40%) (F3)	Homogeneous

Homogeneity test is carried out to obtain results that there are no visible grains in the liquid soap preparation. In the homogeneity test of liquid soap preparations, homogeneous results were obtained for each formula.

The results are said to be homogeneous if the preparation does not have coarse grains (Santoso et al., 2020). Based on the table above, the data obtained from observing the homogeneity of watermelon white rind extract liquid soap preparations F1, F2, and F3 shows that the liquid soap produced remains homogeneous, this is indicated by the absence of particles on the surface of the liquid soap.

CONCLUSIONS

From this research it can be concluded that watermelon rind extract has the potential to be used as an active ingredient in making liquid soap preparations. Watermelon rind extract contains natural antioxidants in the form of citrulline compounds. Liquid soap formulations with the addition of watermelon rind extract provide good physical characteristics based on tests including pH, viscosity, foam height and organoleptic tests. Making liquid soap from watermelon rind extract can be optimal at an extract concentration of 20%. Increasing the extract concentration tends to reduce the foam height and pH of liquid soap. Research on making watermelon rind extract liquid soap shows the potential for utilizing watermelon rind waste which has not been utilized optimally. Further formulation is needed with antibacterial properties testing to improve the quality and benefits of soap. Use trials need to be carried out to ensure the safety and effectiveness of the soap on the skin.

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