

**FORMULASI DAN UJI MUTU FISIK SABUN PADAT KOMBINASI MINYAK  
SERAI WANGI (*Cymbopogon nardus* L.) DENGAN EKSTRAK BAJAKAH TAMPALA  
(*Spatholobus littoralis* Hassk) TERHADAP BAKTERI *Staphylococcus aureus***

**NASKAH PUBLIKASI**

**Diajukan Oleh :**

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**PROGRAM STUDI S1 FARMASI**

**FAKULTAS FARMASI**

**UNIVERSITAS MUHAMMADIYAH KALIMANTAN TIMUR**

**JANUARI 2024**

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**LEMBAR PERSETUJUAN**

**Formulasi dan Uji Mutu Fisik Sabun Padat Kombinasi Minyak Serai Wangi  
(*Cymbopogon nardus*) dengan Ekstrak Bajakah Tampala (*Spatholobus  
littoralis* Hassk.) Terhadap Bakteri *Staphylococcus aureus***

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## NASKAH PUBLIKASI

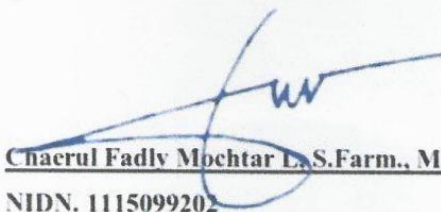
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# **FORMULATION AND PHYSICAL QUALITY TESTING OF SOLID SOAP COMBINATION OF CITRONELA OIL (*Cymbopogon nardus*) WITH EXTRACT BAJAKAH TAMPALA (*Spatholobus littoralis Hassk*) AGAINST BACTERIA *Staphylococcus aureus***

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## **ABSTRACT**

*Soap is an essential product in daily life for cleansing the body from dust and dirt that adheres to the skin. Citronella oil and Bajakah Tampala are plants that possess antibacterial activity that can be utilized as raw materials for the production of solid antibacterial soap. This research aimed to determine the physical quality characteristics of citronella oil solid soap with the combination of Bajakah Tampala extract and the antibacterial activity test. The method employed was experimental, involving the formulation of solid soap, and several preliminary tests such as organoleptic testing, pH testing, homogeneity testing, and foam stability testing. The antibacterial activity test was conducted using the disc diffusion method. The results of this research indicate that the addition of citronella oil and Bajakah Tampala extract to solid soap influenced antibacterial activity against *Staphylococcus aureus*, exhibiting a very strong inhibitory effect in Formula 3 at 100%. In the physical quality testing of the solid soap formulation, the results obtained were in accordance with the Indonesian National Standard (SNI). The conclusion of this research is that the physical quality characterization of the soap is in line with the established standards, and the solid soap formulation has proven antibacterial activity.*

**Keywords:** *Citronella, Bajakah tampala, Staphylococcus aureus, Solid soap*

## **INTRODUCTION**

Soap is one of the essential products in people's daily lives, used to cleanse the body from dust and dirt that adhere to the skin (Hamzah et al., 2021a). Diseases such as skin diseases caused by bacteria and fungi can be treated with soap. In other words, soap can be used as a remedy by cleansing the body, thus reducing the likelihood of disease (Rifqi et al., 2021). The use of antibacterial soap is considered a solution as it is believed to cleanse the skin and prevent skin infections (Oktiana et al., 2021).

The skin is an organ located on the outer part of the body. Its function is to protect tissues and organs, hence the need for protection for the skin, one of which is by using soap (Rusli et al., 2019). A common bacterium that infects the skin is *Staphylococcus aureus*. *Staphylococcus aureus* is a Gram-positive coccus, the most prevalent skin pathogen, and also the most common bacterium found on human skin. It is a normal member of the skin and mucosal flora in humans and a common cause of infections (Jayuska and Alimuddin, 2020).

Preventing skin infections can be addressed by using soap containing antibacterial compounds (Rizka Mastura, 2021). Therefore, an active ingredient is needed to provide benefits in soap, and cleansing agents can act as antioxidants and prevent infections and microbes.

*Citronella* (*Cymbopogon nardus* L) is a plant with numerous benefits, including treating coughs, headaches, stomachaches, diarrhea, acting as an antipyretic, repelling mosquitoes, and providing warmth. It is also used as a fragrance in soap, sprays, polishes, and disinfectants (Nadirah and Destiara, 2022). Citronella plants have been proven to have antibacterial activity against *Staphylococcus aureus*, and they are also known to contain flavonoids, polyphenols, saponins, and essential oils (Susilowati and Syukur, 2022). Bajakah contains phytochemicals such as saponins, phenolics, flavonoids, tannins, and acts as an antibacterial by inhibiting nucleic acid synthesis and cell membrane function, and disrupting energy metabolism (Azahara and Khadafi, 2023).

From the description above, this serves as a reference for formulating solid soap preparations aimed at determining the physical quality characteristics of citronella oil solid soap combined with bajakah tampala extract and assessing its antibacterial activity.

## RESEARCH METHODS

### Equipment and Materials

The equipment to be used in this research includes beaker glass, measuring glass, funnel, dropper pipette, hand-blender, water bath, porcelain cup, volumetric flask, digital scale, perforator, pH meter, autoclave, paper discs, silicone soap mold, Erlenmeyer flask, filter paper, test tube, evaporating dish, ose/loop, hot plate, cotton swab, petri dish, ruler, micropipette.

The materials to be used are *citronella oil* and bajakah tampala extract, NaOH, distilled water, coconut oil, Nutrient Agar, 96% ethanol, *Staphylococcus aureus* bacteria.

### Research Procedure

#### Collection and Preparation of Test Materials

The testing equipment has been prepared in the Microbiology Laboratory and Natural Material Chemistry Laboratory at Muhammadiyah University of East Kalimantan, and for the collection of test materials, citronella essential oil was obtained from an e-commerce platform, while bajakah tampala extract was collected from the laboratory's collection.

#### Formulation and Method of Making Solid Soap

Prepare the equipment and materials for making solid soap. Weigh all the ingredients according to the formulation. Prepare a NaOH solution by mixing 22.08 grams of NaOH with 51.52 ml of distilled water and stir until dissolved. Then, mix 120 grams of coconut oil, followed by adding citronella oil and bajakah extract, and stir until homogeneous using a hand-blender until a thick mixture is formed. Next, pour the mixture into the mold and let it sit. Leave the soap preparation at room temperature for 1-3 days to solidify completely (Purwati and Safitri, 2021).

**Table 1.** Formulation of Solid Soap Preparation From Combination of Citronella Oil and Bajakah Tampala Extract.

Material Name	F1	F2	F3	Utility	Reference
<i>Coconut Oil</i>	120 g	120 g	120 g	Fatty Acid	(Rowe et al., 2009)
<i>NaOH</i>	22,08 g	22,08 g	22,08 g	Alkali	
<i>Distilled Water</i>	51,52 ml	51,52 ml	51,52 ml	Solvent	
<i>Citronella Oil</i>	0 %	2 %	1 %	Active Ingredients	
<i>Bajakah Tampala extract</i>	0%	1 %	2 %	Active Ingredients	

### **Physical Quality Test**

According to research conducted by (Purwati and Safitri, 2021), the physical quality testing performed on solid soap preparations may include several aspects as follows:

1. *Organoleptic Test*

This test is conducted by observing the smell, color, and texture.

2. *pH Test*

In this test, the solid soap was weighed at 0.1 gram. Then the soap is soaked in 10 ml of distilled water, after a few steps the pH of the soap is checked using a pH meter. Then observations were made on the pH of the distilled water before and after soaking in solid soap. If the pH of the soap reaches 9-11, then the soap meets the pH standard.

3. *Homogeneity Test*

This test is conducted by first dissolving the sample in a glass or other transparent container. The preparation must have a homogeneous composition and should not contain small or coarse particles that are visible.

4. *Foam Stability Test*

This test is conducted by weighing 1 gram of soap sample, placing it into a measuring glass containing 10 ml of distilled water, and shaking it for 30 seconds. Measure the height of the foam formed using a ruler (initial foam height). The foam height is then measured again after 5 minutes (final foam height), and the stability is calculated using the following formula:

$$\text{Missing foam} = \frac{\text{final foam height}}{\text{initial foam height}} \times 100\%.$$

$$\text{Foam Stability} = 100\% - \text{missing foam}$$

The criteria for good foam stability is achieved when the foam retains approximately 60-70 - 100% of its initial height after 5 minutes.

### **Making Bacterial Subcultures**

5 grams of NA powder is weighed out. It is then dissolved in 250 ml of distilled water and mixed in an Erlenmeyer flask. Afterward, it is heated to boiling and dissolved on a water bath. The medium is sterilized at a temperature of 121 °C in an autoclave for 15 minutes. Then, the medium is poured into petri dishes and allowed to solidify (Fijriati and Maulana, 2022).

### ***Staphylococcus aureus bacterial suspension***

*Staphylococcus aureus* bacteria were taken using ose/loop that had been heated with a Bunsen flame and put into a test tube filled with 10 ml of sterile NaCl then shaken until homogeneous (Putri et al., 2019).

### **Antibacterial Activity Test**

The antibacterial activity test is conducted using the disc diffusion method. The diluted bacteria are evenly spread on the agar surface using a cotton swab. Discs containing the preparation, along with discs containing positive and negative controls, are placed on the agar containing the bacterial suspension. Then, they are incubated for 24 hours at 37°C. After incubation, bacterial growth is observed, and the diameter of the inhibition zone is measured (Bhernama, 2020).

### **Inhibition Zone Test on *Staphylococcus aureus* Bacteria**

The method to measure the inhibition zone involves measuring the outer edge of the disc with calipers or a ruler until reaching the outer boundary of the inhibition zone (Safitri and Fatmawati, 2021).

## **RESULTS AND DISCUSSION**

In this research, solid soap preparations were made using citronella oil as the active ingredient combined with bajakah tampala. Three formulas of solid soap were prepared with different concentrations. F1 was made with a soap base consisting of NaOH and coconut oil, F2 was made with a



soap base with the addition of 1% citronella oil and 0.5% bajakah extract, and F3 was made with a soap base with the addition of 0.5% citronella oil and 1% bajakah extract. The results of the solid soap are shown in Figure 1 below.



**Figure 1.** Results of Citronella Oil Solid Soap and Bajakah Tampala Extract, (A) F1 Basis, (B) Formula 2, (C) Formula 3

**Physical Quality Test**

**Organoleptic Test**

**Tabel 2.** Organoleptic Test For 4 Weeks

Testing	Formula	4 weeks time				Conclusion
		M1	M2	M3	M4	
Color	F1	Milky white	Milky white	Milky white	Milky white	Do not change
	F2	Light brown	Light brown	Light brown	Light brown	
	F3	Dark brown	Dark brown	Dark brown	Dark brown	
Smell	F1	Typical soap aroma	Typical soap aroma	Typical soap aroma	Typical soap aroma	Do not change
	F2	Aroma of citronella oil.	Aroma of citronella oil.	Aroma of citronella oil.	Aroma of citronella oil.	
	F3	Aroma of citronella oil.	Aroma of citronella oil.	Aroma of citronella oil.	Aroma of citronella oil.	
Texture	F1	Solid	Solid	Solid	Solid	Do not change
	F2	Solid	Solid	Solid	Solid	
	F3	Solid	Solid	Solid	Solid	



In Table 2, the results of a 4-week storage evaluation of solid soap formulations combining Bajakah tampala extract and citronella oil, F1, F2, and F3, concluded that there were no changes observed in color, aroma, and texture from the testing.

Based on the results of the research conducted by (Zulbayu et al., 2020), the test results showed no changes from the first week to the fourth week, which is consistent with the researcher's findings.

**Homogeneity Test**

**Table 3.** Homogeneity Test Results Data

Formulation	Homogeneity				Conclusion
	M1	M2	M3	M4	
<b>Formula 1 (base)</b>	Homogeneous	Homogeneous	Homogeneous	Homogeneous	Do not change
<b>Formulasi 2</b>	Homogeneous	Homogeneous	Homogeneous	Homogeneous	Do not change
<b>Formula 3</b>	Homogeneous	Homogeneous	Homogeneous	Homogeneous	Do not change

Based on Table 3, the homogeneity test data for F1, F2, and F3 from the first week to the fourth week concluded that the tests resulted in homogenous outcomes, attributed to the absence of particles in the soap. According to the research conducted by (Suryadini et al., 2023), it was found that the solid soap remained homogeneous, with evenly mixed color and no other particles.

**pH Test**

**Table 4.** Data from pH test results

Formulation	Research time				Average
	M1	M2	M3	M4	
<b>Formula 1 (base)</b>	9,0	9,0	9,2	9,5	9,17
<b>Formula 2</b>	8,6	9,0	9,2	9,3	9,05
<b>Formula 3</b>	8,8	8,9	9,3	9,3	9,07

Evaluation of the data obtained over 4 weeks shows that for F1, the average pH from week 1 to 4 is 9.17, for F2 the average pH from week 1 to 4 is 9.05, and for F3, the average pH from week 1 to 4 is 9.07. According to the research by (Putri et al., 2021), the pH test has met the standard. This indicates results that are relatively safe for the skin.

**Foam Stability Test**

**Table 5.** Data on Foam Stability Test Results

Formulation	High foam preparation				Average
	M1	M2	M3	M4	
<b>Formula 1 (base)</b>	67,75%	76,93%	62,30%	58,63%	66,40%

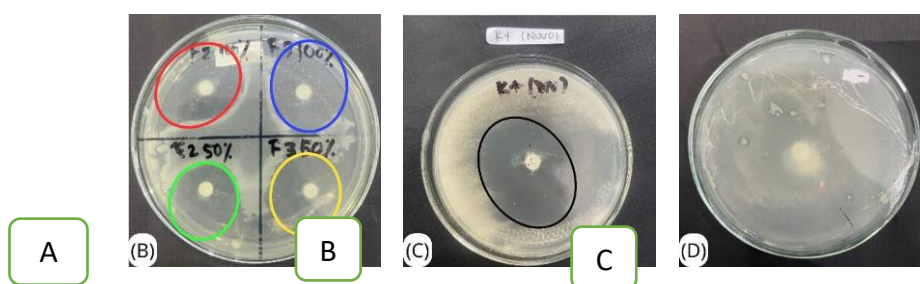
<b>Formula 2</b>	61,30%	93.85%	56,61%	74,14%	71,48%
<b>Formula 3</b>	62,23%	80%	48,34%	64,92%	63,87%

Based on Table 5, the evaluation of the foam stability test of solid soap formulations containing Bajakah tampala extract combined with citronella oil in formulations 1, 2, and 3 from week 1 to week 4 indicates that the soap formulations are stable. This is because F1, F2, and F3 have foam stability percentages of 66.40%, 71.48%, and 63.87%, respectively. According to the research conducted by (Fitri et al., 2023), the foam stability results are in line with the standard range of 60-70%.

### Antibacterial Activity Test

**Table 6.** Inhibitory Power Test Results Data

Formulation	Inhibition zone diameter			Average	Information
	R1	R2	R3		
<b>K-</b>	0mm	0mm	0mm	0mm	-
<b>K+</b>	48mm	48mm	48mm	48mm	Very strong
<b>F2 50%</b>	7mm	25,5mm	27,5mm	20	Strong
<b>F2 100%</b>	20,5mm	29mm	36,5mm	28,6mm	Very strong
<b>F3 50%</b>	6,5mm	31mm	37,5mm	25mm	Very strong
<b>F3 100%</b>	14mm	31,5mm	42,5mm	29,3mm	Very strong



**Figure 4.** Results of Observation of Inhibitory Power

In Figure 4, it shows the presence of inhibition zones formed by the soap preparations, indicated by the formation of clear zones around the paper discs (Wijianto et al., 2022). The diameter of the inhibition zones is classified into four groups based on their activity, namely:  $\leq 5$ mm diameter categorized as weak, 6-10mm categorized as moderate, 11-20mm categorized as strong, and  $\geq 21$ mm categorized as very strong (Safitri and Fatmawati, 2021).

In Table 8, the results of the resistance test from the average value of F2 50% are in the strong resistance category, and F2 100%, F2 50%, F3 100% have very strong resistance, as well as the 48 mm positive control in the very category. strong and for negative control, namely distilled water, there is no formation of an inhibition zone (Hamzah et al., 2021b).

According to the results of this research, it is stated that this research is in accordance with that carried out by (Rinaldi et al., 2021) who stated that *Staphylococcus aureus* bacteria with citronella plant soap preparations have a very strong inhibitory power because they have an inhibitory diameter that falls within the activity range, namely  $\geq 20$ mm. And according to the results of research conducted by (Latu, 2023) which also stated that the *Staphylococcus aureus* bacteria with the Bajakah Tampala plant has a very strong inhibitory power because it has an activity range of  $\geq 21$ mm.

## CONCLUSION

Based on the research results that citronella and bajakah tampala plants can be used as solid soap preparations, as well as the physical quality characterization of the preparations has been conducted according to established standards and the formulation of solid soap preparations has been proven to inhibit the growth of *Staphylococcus aureus* bacteria.

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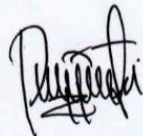
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