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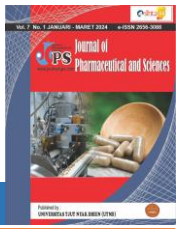

Effectiveness Test of Acne Facial Wash Gel Containing Ethanol Extract of Jackfruit Leaves (*Artocarpus heterophyllus* Lamk.) Against *Staphylococcus aureus* Bacteria

Uji Efektivitas Sediaan Facial Wash Acne Gel Ekstrak Etanol Daun Nangka (*Artocarpus heterophyllus* Lamk.) Terhadap Bakteri *Staphylococcus aureus*

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Abstract

Background: Jackfruit leaves (*Artocarpus heterophyllus* Lamk.) contain antimicrobial compounds such as flavonoids, tannins, and saponins, which can damage bacterial cytoplasmic membranes and denature cellular proteins. This potential supports the development of a facial wash gel using jackfruit leaf extract as a natural antibacterial alternative. **Objective**: This study aimed to evaluate the effectiveness of a facial wash gel containing jackfruit leaf extract (*Artocarpus heterophyllus* Lamk.) in inhibiting the growth of *Staphylococcus aureus* ATCC® 25923. **Methods**: This experimental study included sample preparation, identification, extraction, phytochemical screening, and gel formulation evaluation (organoleptic test, homogeneity, spreadability, foam height, pH, irritation, and cycling test). Antibacterial activity was tested against *S. aureus*, with a positive control (Himalaya (Brand) Facial Wash) and a negative control (DMSO). **Results**: The extract yield was 11.26%, positively detecting flavonoids, saponins, tannins, steroids, and triterpenoids. The gel formulations (F1-F3) were semi-solid, dark green, and had a characteristic jackfruit leaf aroma, with a pH of 5–6. Homogeneity tests confirmed uniform consistency, with the highest foam height in F3 (3.7 cm) and optimal spreadability in F1-F2 (6 cm). No irritation was observed, and the gel remained stable in cycling tests. The antibacterial test showed the highest inhibition at 12% extract concentration (92.3%), while the formulated gel also effectively inhibited *S. aureus* growth. **Conclusion**: Jackfruit leaves can be successfully formulated into a stable and safe facial wash gel with effective antibacterial activity against *Staphylococcus aureus*.

Keywords: *Jackfruit Leaf Extract, Gel, Antibacterial, Inhibitory Power, Facial Wash*

Abstrak

Latar Belakang: Daun nangka (*Artocarpus heterophyllus* Lamk) mengandung senyawa antimikroba seperti flavonoid, tanin, dan saponin yang mampu merusak membran sitoplasma dan mendenaturasi protein sel bakteri. Potensi ini mendasari pengembangan gel pembersih wajah berbasis ekstrak daun nangka sebagai alternatif antibakteri alami. **Tujuan**: Penelitian ini bertujuan untuk mengetahui efektivitas gel pembersih wajah dari ekstrak daun nangka (*Artocarpus heterophyllus* Lamk) dalam menghambat pertumbuhan bakteri *Staphylococcus aureus* ATCC® 25923. **Metode**: Penelitian eksperimental ini meliputi tahap penyiapan sampel, identifikasi, ekstraksi, skrining fitokimia, serta evaluasi sediaan gel (uji organoleptik, homogenitas, daya sebar, tinggi busa, pH, iritasi, cycling test). Uji aktivitas antibakteri dilakukan terhadap *S. aureus* dengan kontrol positif (produk *facial wash* Himalaya) dan negatif (DMSO). **Hasil Penelitian**: Ekstrak daun nangka menghasilkan rendemen 11,26% dan positif mengandung flavonoid, saponin, tanin, steroid, serta triterpenoid. Formula gel (F1-F3) memiliki bentuk setengah padat, warna hijau pekat, dan bau khas, dengan pH 5-6. Uji homogenitas menunjukkan keseragaman sediaan, tinggi busa tertinggi pada F3 (3,7 cm), dan daya sebar optimal pada F1-F2 (6 cm). Gel tidak menimbulkan iritasi dan stabil dalam cycling test. Uji antibakteri

menunjukkan daya hambat ekstrak tertinggi pada konsentrasi 12% (92,3%), sementara sediaan gel juga efektif menghambat pertumbuhan *S. aureus*. **Kesimpulan**: Daun nangka berhasil diformulasikan ke dalam sediaan facial wash gel yang stabil, aman, dan efektif sebagai antibakteri terhadap *Staphylococcus aureus*.

Kata Kunci: *Ekstrak Daun nangka, Gel, Antibakteri, Daya Hambat, Facial wash*

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Introduction

Skin is a part that must be maintained in its health; the most crucial part is healthy skin, which is elastic, glowing, bright, soft, and clean. Wholesome skin also does not suffer directly or indirectly from disease, whether within the body or skin disease. Can be seen from the structure, color, flexibility, thickness, and texture of the skin are some signs of healthy skin [1].

Dull skin, blemishes, blackheads, and acne are the most common skin problems. Acne Vulgaris is an acne condition that almost everyone has experienced. Acne begins when pores become clogged with oil buildup, which can lead to antibacterial activity and inflammation of the skin. Staphylococcus epidermidis, *Staphylococcus aureus*, and Propionibacterium Acnes are bacteria that commonly infect acne [2].

Caring for facial skin involves doing skin care to repair, maintain, and promote the health, beauty, and youthfulness of the skin [3]. Acne-prone facial skin can be repaired using cosmetics, but the primary purpose of facial care is to get healthy, smooth, and fresh facial skin. Treatment must be done to prevent abnormalities, maintain facial softness, skin elasticity, and help maintain moisture[4].

Dealing with acne-prone facial skin can be done using one method of caring for facial skin. Treatment is an effort made to maintain, repair, and improve the health, beauty, and youth of the skin [5]. Facial care aims to get facial skin that looks fresh, healthy, bright, and smooth. Facial care is needed to prevent abnormalities, maintain skin moisture, and help maintain skin elasticity. Treatment for acne-prone facial skin can be done using cosmetics [4].

In a study conducted by Pelu et al. (2022), it was found that ethanol extract from jackfruit leaves (*Atrocarpus heterophyllus* Lamk) contains compounds, namely tannins, flavonoids, and saponins, and saponins can dissolve in water, because they can damage the cytoplasmic membrane and denature cell proteins [6]. The results of phytochemical screening of jackfruit leaves show that the compounds of tannins, flavonoids, and saponins are excellent, and jackfruit leaves have a high flavonoid content [7]. Facial wash gel is one of the easiest cosmetic preparations to use and is easy to clean because it does not contain oil and has a lighter gel texture that can make the face feel fresh and cool. The ability of this facial wash gel can be used to clean pollution, dust, oil, and dirt on the face that can cause acne [8].

One way to prevent acne is to keep your facial skin clean, namely by washing your face at least twice a day with a facial. Wash that contains active compounds and can help kill acne-causing bacteria. Facial wash helps clean oil, dust, dirt, and cosmetics that stick to the face. To clean the face, various types of preparations have been developed, one of which is gel. Gel is a semi-solid system that contains a lot of water [9]. According to Sari (2012), antibacterial activity against *Staphylococcus aureus* bacteria has been tested in the ethanol extract of jackfruit leaves with a maximum inhibition zone against *Staphylococcus aureus* bacteria of 11.18 mm at an extract concentration of 80%, but the active compounds in jackfruit leaves are not yet known, especially active compounds from the flavonoid group [7].

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Experimental Section

Materials and Apparatus

Apparatus used included stirring rods, beaker glass (pyrex), rotary evaporator (IKA HB10), Autoclave, Bunsen, petri dish, porcelain dish (pyrex), porcelain crucible (porcelain crucible) Erlenmeyer (pyrex), measuring cup (Pyrex), water bath (HH-S11.4), wool thread, hotplate (IKA), incubator (memmert), cotton, magnetic stirrer (IKA) (parchment paper, mortar and mortar, oven, glass object, digital pH, micropipette, dropper pipette, test tube rack, marker, test tube, analytical balance (OHAUS PX224) and weights, calipers, ose wire, refrigerator.

The materials used are Aquadest, ethanol extract from jackfruit leaves, and suspension of *Staphylococcus aureus bacteria.* ATCC ® 25923, Dragendorff reagent, Bouchardat reagent, Mayer reagent, Muller Hinton Agar (MHA) Media, 96% ethanol, Mc Farland, sterile distilled water, 0.9% physiological NaCl, BaC12, H_2SO_4 amyl alcohol, concentrated HCL $FeCl_3$, $BaCl_2$, Dimethylsulfoxide(DMSO), concentrated sulfuric acid, nitric acid, Mg powder, positive control Himalaya preparation.

Plant Determination

Sample determination is identified at the Medanense Herbarium Laboratory, University of North Sumatra.

Characterization of Simple Ingredients

Several factors that can affect the examination of the characteristics of the simplicia are the raw materials of the simplicia, the manufacturing and storage process, as well as the examination of drying shrinkage and water content, total ash, acid-insoluble ash, water-soluble extract content, and ethanol-soluble extract content. The characterization test of the simplicia is carried out to ensure that the quality of the simplicia is uniform and meets the requirements of the simplicia and extract standards [10].

Phytochemical Screening

Phytochemical screening includes an alkaloid test [11], flavonoid test, tannin test, saponin test [12], steroid test [13], triterpenoid test [1].

Evaluation of Facial Wash Gel Preparation

Evaluation of facial wash gel preparations includes organoleptic test, homogeneity test [14], pH test [15], foam height/foam stability test [9], spreadability test [16], irritation test [17]Cycling stability test [18].

Formulation of Facial Wash Acne Gel

According to Table 1, Facial Wash Gel preparation is made by dissolving propylene glycol with distilled water and adding cocamidopropyl betaine, which has also been dissolved with distilled water. Then mix the two solutions until they are homogeneous. The next step is to dissolve Carbopol®-940 with hot water until it expands, and grind until a gel mass is formed. Next, add triethanolamine little by little into the gel mass, also add methyl paraben little by little, and grind until homogeneous. Then mix the propylene glycol and cocamidopropyl betaine solutions into the ground gel mass until homogeneous [19].

Table 1. Formulation of Facial Wash Acne Gel

Material	Concentration			
	F0	F1	F2	F3
Jackfruit leaf extract (gr)	-	6%	9%	12%
Carbopol®-940 (gr)	1	2	1.5	2
Triethanolamine(TEA) (ml)	3	3	3	3
Propylene glycol (ml)	1	1	1	1
Cocomidopropylbetaine (ml)	2.5	2.5	2.5	2.5
Methyl Paraben (gr)	0.2	0.2	0.2	0.2
Aquadest (ml)	Ad 100	Ad 100	Ad 100	Ad 100

Description: F0 is a facial wash without jackfruit leaf ethanol extract, while F1, F2, and F3 contain 6%, 9%, and 12% extract, respectively. The positive control is the commercial product Himalaya.

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Antibacterial Activity Test Using the Well Method

Staphylococcus aureus bacteria were inoculated into 4 petri dishes containing 15-20 mL of MHA media. Each petri dish was divided into 3 parts in the wells that had been made, then the extract was put in with a concentration of 6%, 9% and 12%, namely 10 ml, 7.5 ml, and 6.6 ml. In addition, 1 petri dish is divided into 2 parts for positive and negative control. Three treatments were carried out on each dish (Misna, 2016). Furthermore, the petri dish containing bacteria with various extract concentrations was incubated at 37 °C for 24 hours. The inhibition zone is formed, and the diameter of the inhibition zone is measured using a vernier caliper [20].

The level of antibacterial effectiveness of jackfruit leaf extract with concentration variations of 6%, 9%, and 12% can be determined by measuring the percentage (%) of inhibitory power using the equation:

$$E = \frac{D}{Da} x\ 100\% \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

E = Antibacterial effectiveness (%)
D = Diameter of the inhibition zone of jackfruit leaf extract (mm)
Da = Diameter of antibiotic inhibition zone (mm) [21].

Antibacterial effectiveness is grouped into 2 groups, namely ineffective and effective, as can be seen in Table 2:

Table 2. Antibacterial Percentage Table

Percentage	Effectiveness
≤50%	Ineffective
≥50%	Effective

Source : [21].

Results and Discussion

Determination Results

The results of the Determination of Jackfruit Leaves (Artocarpus heterophyllus Lamk) according to determination letter number 2434/MEDA/2024, carried out at the Plant Systematics Laboratory of the Medanense Herbarium, University of North Sumatra, show that the sample used in this study is indeed Jackfruit Leaves (*Artocarpus heterophyllus* Lamk).

Characterization Results of Jackfruit Leaves

Examination of the characteristics of the herbal medicine is carried out to ensure the uniformity of the active compound, its safety and usefulness, so the herbal medicine must meet the minimum requirements and to be able to meet the minimum standards, several factors influence, including the raw materials of the herbal medicine, the process of making herbal medicine, namely the storage method of the raw materials of the herbal medicine and the storage method of the finished herbal medicine. Examination of the characteristics of this herbal medicine includes determining the water content, water-soluble extract content, ethanol-soluble extract content, total ash content, and acid-insoluble ash content. Calculate the results of determining the standard parameters of herbal medicine. The following results of determining the standard parameters of simple drugs can be seen in Table 3:

Table 3. Results of characteristics of jackfruit leaf simplicia powder

No	Characteristics of Simple Ingredients	Simplicia	MMI Standard	Information
1.	Water content	7.9%	< 10%	qualify
2.	Water soluble content	20.02%	≥ 5.5%	qualify
3.	Ethanol-soluble extract content	16.9%	≥ 2.5%	qualify
4.	Total ash content	0.22%	≤ 3.5%	qualify
5.	Acid insoluble ash content	0.1%	≤ 1.5%	qualify

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Jackfruit Leaf Extraction Results

In the research, the process of extracting Jackfruit Leaves (Artocarpus heterophyllus Lamk.) was dissolved with 96% ethanol and then evaporated with a rotary evaporator. The thick extract obtained was calculated for its percent yield. The calculation results showed that the yield of the resulting extract was 11.26%, as shown in Figure 1.

Figure 1. Thick Extract

Phytochemical Screening

The results of phytochemical screening of jackfruit leaf simplicia powder were carried out to determine the group of secondary metabolite compounds contained therein. Phytochemical screening was performed on the Alkaloid, Flavonoid, Tannin, Saponin, Steroid, and Triterpenoid groups. The results of phytochemical screening of jackfruit leaf simplicia powder can be seen in Table 4.

Table 4. Phytochemical Screening Results

No	Phytochemical Test	Reagent	Results	Information
1.	Alkaloid	Mayer Bouchardat Dragendorph	No white/yellow sediment No brown sediment No brick red sediment	Negative
2.	Flavonoid	Concentrated HCI, mg powder, amyl alcohol	An orange-yellow layer forms on the amyl alcohol	Positive
3.	Tannin	$FeCl_3$	A blackish blue solution is formed	Positive
4.	Saponins	HCI 2 N	Foam is formed	Positive
5.	Steroid	acetic acid anhydrous, concentrated H_2SO_4	A bluish-green color is formed	Positive
6.	Triterpenoid	Acetic acid, sulfuric acid	The red color formed	Positive

Description: (+) : Positive contains compound; (-) : Negative contains compounds

Table 4 shows that jackfruit leaf extract contains active compounds such as Flavonoids, Tannins, Saponins, Steroids, and Triterpenoids. Alkaloid Test Results show negative results, which are indicated by the absence of white precipitate formation in the extract added with Mayer, Bouchardat, and Dragendorf reagents. The jackfruit leaf extract in this study did not contain alkaloid compounds. The negative jackfruit leaf extract did not contain alkaloid compounds in previous studies.

Results testing show Flavonoid compounds have orange-yellow sediment after being dripped with concentrated HCl and magnesium powder. According to Robinson (1995), the content of flavonoid compounds is proven by the appearance of a yellow color due to the reduction of glycoside bond compounds in flavonoids by the addition of HCl and magnesium powder [11].

The test results show that the tannin compound is blackish green after adding a little extract with FeCl3. According to Simaremare (2014), the hydroxyl group in the tannin compound will react with 1% $FeCl_3$ reagent, causing the extract to change to blackish green. [22].

The results of the saponin test are the formation of foam after shaking, the foam is stable for 10 minutes, then the foam does not disappear with the addition of 1 drop of 2N hydrochloric acid, and the height of the foam produced is 2 cm. According to Munawiroh et al. (2019), the saponin test is positive if it shows foam after shaking; this is indicated by the absence of foam on the sample. This is because saponin is a compound like soap, with hydrophilic and hydrophobic groups that can act as active surfaces in forming foam [23]. A

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foam test was carried out for the saponin test. This foam test shows the presence of glycosides that can form foam in water when hydrolyzed into glucose and other compounds[24].

The results of the steroid test show the formation of a bluish-green color after adding chloroform, anhydrous acetic acid, and concentrated sulfuric acid. Irianto et al. (2020) state that the steroid test produces a bluish-green colored solution. This is because the steroid group undergoes oxidation, which will form conjugated double bonds [25].

The results of the triterpenoid test show a red color after adding anhydrous acetic acid and a few drops of H_2SO_4. According to Ciulei (1984), a purple/red indicates a positive Triterpenoid test. The principle of this test is that the compound will react with sulfuric acid in anhydrous acetic acid and sulfuric acid solvents to form a color. During the test, H_2O is released and combined with carbocations Ciulei (1984).

Results of the Stability Evaluation Test *of Facial Wash* Gel

a. Organoleptic Observation Results

The results of organoleptic test observations in this study include shape, odor, and color, which can be seen in Table 5. Based on table 5 shows that the results of F0 do not contain jackfruit leaf extract and produce a thick, odorless, clear white color while F1 Jackfruit leaf extract gel with a concentration of 6% has a thick shape, a distinctive smell of jackfruit leaf extract, and produces a green color, and F2 jackfruit leaf extract gel with a concentration of 9% and F3 with a concentration of 12% has a thick shape, a distinctive smell of jackfruit leaf extract, and produces a dark green color. The results of organoleptic observations can be seen in Figure 2.

Table 5. Organoleptic Observation Test Results

Formula	Extract Concentration	Form	Smell	Color
F0	-	Thick	Odorless	Clear White
F1	6%	Thick	The distinctive smell of jackfruit leaves	Deep green
F2	9%	Thick	The distinctive smell of jackfruit leaves	Deep green
F3	12%	Thick	The distinctive smell of jackfruit leaves	Deep green

Based on Figure 2, it can be seen that the jackfruit leaf extract gel preparation has a thick form, has a distinctive smell of jackfruit leaf extract, and is dark green. According to Hidayaturahmah (2016), organoleptic observations include the shape, color, and odor of the gel preparation [27] .

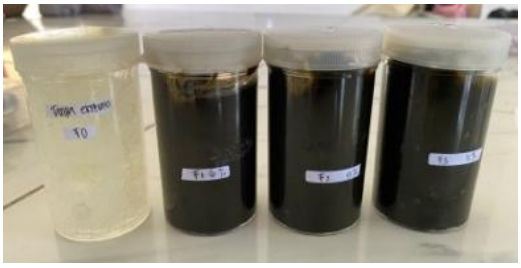

Figure 2. Organoleptic Test Results

b. Homogeneity Test Results

The purpose of this test is to see whether or not there are coarse grains or coarse particles in this preparation. The jackfruit leaf extract gel's homogeneity test results are homogenous, as seen in Figure 3. The jackfruit leaf extract gel formula shows a basic homogeneous formula without coarse particles on the glass object. In the uneven spots, it is possible that the herbal medicine penetrated the flannel cloth during maceration. According to Kumesan et al. (2013), a gel preparation was applied to a piece of glass, and the part that was not mixed was observed. Homogeneity is indicated by the absence of coarse grains [3].

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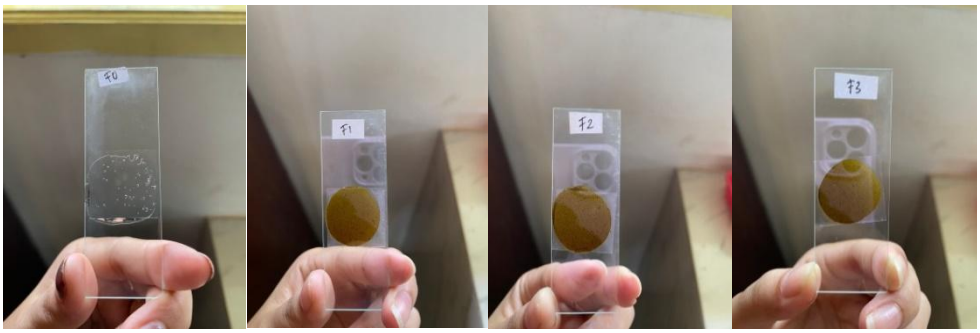

F0 F1 F2 F3

Figure 3. 1Test Results

c. pH Test Results

This test aims to determine the safety of the preparation before it is applied to volunteers. The pH test results can be seen in Figure 4:

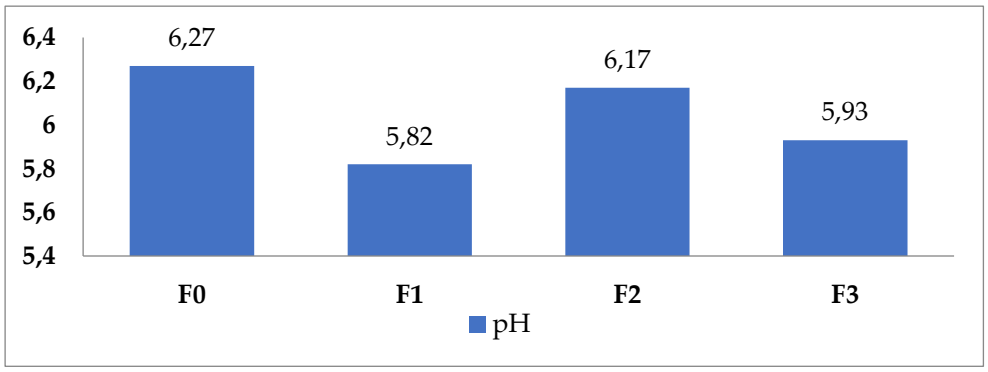

Figure 4. Graph of pH Test Results for Gel Preparations

Based on Figure 4, F0, FI, FII, and FIII results produce different pH values, but show that the values obtained meet the requirements with a pH of 4.5-7. In this study, the pH obtained for each formula was not less than 4.5 or more than 6.5, because Carbopol®-940 is acidic and dispersed in water, so it is neutralized first by adding a base or alkali agent, namely triethanolamine (TEA). According to Sulistianingsih et al. (2019), the gel preparation should not be too acidic because it can irritate the skin, and should not be too alkaline because it can make the skin dry and scaly [16]. According to Titaley (2014), pH value testing is a characteristic that needs to be considered in a topical preparation formulation [28]The pH test determines whether the skin can accept a preparation's pH value. The recommended pH value for a topical preparation is in the range of 4.5 - 6.5. Too acidic a preparation will cause skin irritation, while an alkaline preparation can make the skin scaly. According to the standard (SNI No. 06-2588), the pH value is 4.5 - 6.5.

d. Foam Height/Foam Stability Test Results

The foam height test is carried out to see the power produced, so that the preparation can create foam. In contrast, foam stability is expressed as the resistance of a wave to maintain the size and rupture of the film layer from the wave. The standard height of soap foam set by the Indonesian National Standard (SNI) is 1.3-22 cm, while for the foam stability test, a standard of more than 70% [29].

Table 6. Foam Stability Test Results

Formula	Initial foam height (cm)	Final foam height (cm)	Foam test(%)
F0	3	2.5	16.6
F1	2.5	2	20
F2	2.5	2	20
F3	3.7	3	18

Based on Table 6, the results of the foam height/foam stability test on the Jackfruit Leaf extract facial wash preparation showed no difference among the formulas produced, and the resulting values were not

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much different, namely with an average of 16.6% at F0, 20% at F1, 20% at F2 and 18% at F3. The foam stability did not enter the optimal stability range criteria of more than 70%. This happened because the surfactant used was coconut oil (Cocomidopropyl Betaine), which could produce less foam than SLS (Sodium lauryl sulfate).

e. Spreadability Test Results

This spreadability test determines the ability and speed of spreading a gel when applied to the skin. Table 7 shows the results of the spreadability test on the jackfruit leaf extract gel preparation can be seen in table 7.

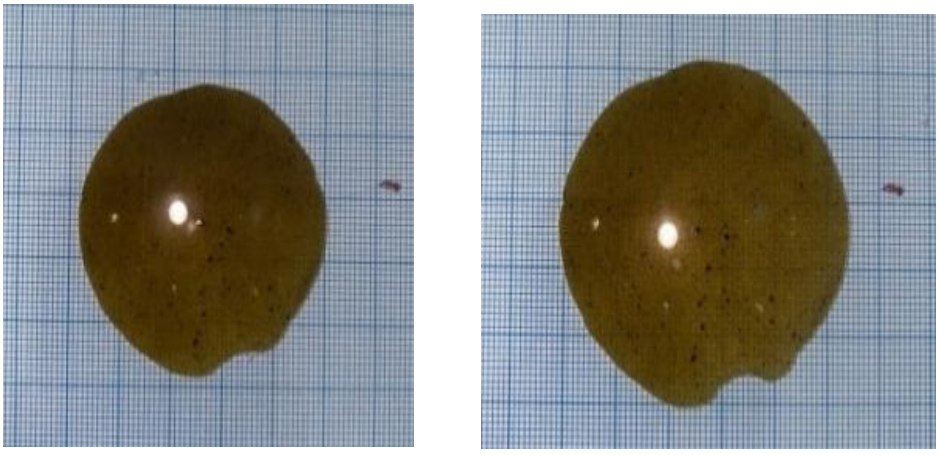
Table 7. Spread Power Test Results

Formula	Load 50gr	Load 100gr
F0	5 cm	5.7 cm
F1	5.4 cm	6 cm
F2	5 cm	6 cm
F3	5 cm	5.3 cm

Based on Table 7, the results of the test of the spreadability of this *facial wash gel preparation* obtained a spreadability of 5 cm to 6 cm, and the higher the spreadability, the higher the spreadability. The lower the concentration of the extract, the lower the spreading power. The results of the spreading power test can be seen in Figure 4.

According to Mappa et al. (2013), the test was conducted to ensure even distribution of the gel when applied to the skin. Gel as much as 0.5 grams was placed in the middle of a round glass scale, then on top of the gel, a round glass was placed and left for 1 minute, and the diameter of the spread was recorded. Add a load of 50 and 100 grams, and observe the spreading power. Good gel spreading power is between 5 and 7 cm [30].

Based on Figure 3, the spreadability of the gel applied to the surface of the glass looks even all over, and many have met the standards of the spreadability test. According to Irianto et al. (2020), each *gelling agent* has different properties that can affect the spreadability value. The preparation that has low spreading power (difficult to spread) and too high (too spread) will disturb the user's convenience [25].



(a)Given a load of 50 g (b) Given a load of 100 g

Figure 3. Spread Power Test Results

f. Irritation Test Results

Results Observation test irritation on stock F1, F2, and F3 does not irritate the skin, which is indicated by redness and itching in 5 respondents with normal and non-sensitive skin. Hence, this preparation is safe to use. The results of the irritation test on the jackfruit leaf extract gel preparation did not cause skin irritation, such as redness, swelling, and itching, in 5 volunteers when the gel was applied to the affected area. The surface skin with a diameter of 3 cm on the elbow fold of the volunteer's hand was left for 2 hours to observe the changes. The results of the irritation test on 5 volunteers can be seen in Figure 4.

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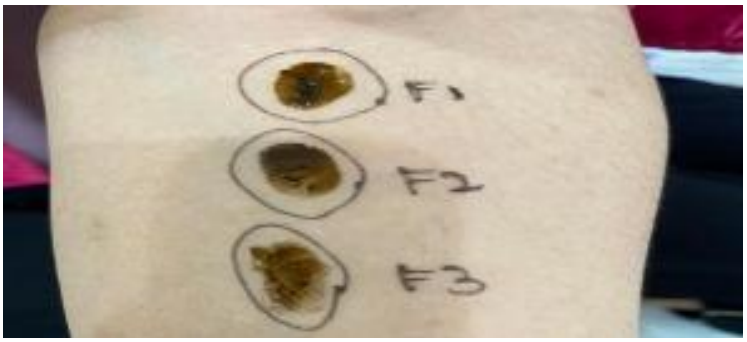

Figure 4. Irritation Test Results

According to Praptiwi et al. (2014), the most appropriate locations for irritation tests are the back of the hand, the elbow fold, and the skin behind the ear [31]. According to Sari et al. (2017), irritation reactions are characterized by redness, swelling, or itching of the skin in the Volunteer's elbow crease [32].

g. Cycling Test Stability Results

Table 8 shows the results of the stability test of the Jackfruit Leaf gel preparation can be seen in Table 8. Based on Table 8, the cycling test results on the facial wash gel preparation were 6 cycles for 18 days using 3 temperatures: cold temperature 2 - 4°C, oven temperature 40°C, and room temperature 25°C. In the preparations F0, F1, F2, and F3, there were no changes in color, shape, or odor until the preparation's texture.

According to research by Yuniarsih et al. (2020), changes in color and aroma that occur in a product preparation during stability testing indicate that the product is heading towards instability, which suggests an oxidation reaction [14].

Table 8. *Cycling test* observation results

Inspection	**Formula**	**Cycle Observation**						
Cycle		**0**	**1**	**2**	**3**	**4**	**5**	**6**
Form	F0	Hc	Hc	Hc	Hc	Hc	Hc	Hc
	F1 6%	Hc	Hc	Hc	Hc	Hc	Hc	Hc
	F2 9%	Hc	Hc	Hc	Hc	Hc	Hc	Hc
	F3 12%	Hc	Hc	Hc	Hc	Hc	Hc	Hc
Smell	F0	Ns	Ns	Ns	Ns	Ns	Ns	Ns
	F1 6%	Ds	Ds	Ds	Ds	Ds	Ds	Ds
	F2 9%	Ds	Ds	Ds	Ds	Ds	Ds	Ds
	F3 12%	Ds	Ds	Ds	Ds	Ds	Ds	Ds
Color	F0	Cw	Cw	Cw	Cw	Cw	Cw	Cw
	F1 6%	Dg	Dg	Dg	Dg	Dg	Dg	Dg
	F2 9%	Dg	Dg	Dg	Dg	Dg	Dg	Dg
	F3 12%	Dg	Dg	Dg	Dg	Dg	Dg	Dg

Information : Hc = Half congested; Ns = No smelly; Ds = Distinctive smell; Dg = Deep Green; Cw = Clear white

Test Results for *Staphylococcus aureus* Bacteria

a. Results of Extract Tests Against *Staphylococcus aureus* Bacteria

Staphylococcus aureus bacteria with various concentrations of 6%, 9%, and 12% are in Table 9. As shown in Table 9, the antibacterial inhibition test results indicated that there is inhibition formed by jackfruit leaf extract with concentrations of 6%, 9%, 12% and K (+) which is indicated by the formation of a clear zone in the area around the well, this is because the jackfruit leaf extract will diffuse out to inhibit the growth of *Staphylococcus aureus bacteria* in the medium around the well. The higher the concentration of the extract used, the higher the diameter of the inhibition zone. This is due to the increasing active substances in jackfruit leaf extract (*Artocarpus heterophyllus* Lamk.) that inhibit the growth of *Staphylococcus aureus bacteria,* which causes acne. This is due to the presence of bioactive compounds in jackfruit leaf extract, namely Flavonoid, tannin, and saponin compounds, in inhibit *Staphylococcus aureus bacteria.*

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Table 9. Results of Observations of Extract Tests on Bacteria

Extract	Inhibition (mm)	Category
F1 6%	13.3	Strong
F2 9%	14.7	Strong
F3 12%	15.8	Strong
Control (+)	17.1	Strong
Control (-)	0	-

Information : Control (+) = Himalaya; Control (-) = DMSO

Davis et al. (1971) stated that if the diameter of the inhibition zone formed is 0-5 mm, then the antibacterial power is weak. If the inhibition zone formed is 5-10 mm, then the antibacterial power is moderate. If the inhibition zone formed is 10-20 mm, then the antibacterial power is strong; if it is>20 mm, then the antibacterial power is extreme [33].

Table 10. Results of the Calculation of the Effectiveness of Jackfruit Leaf Extract

Extract concentration	Average (mm)	Percentage of effectiveness (%)	Effectiveness Category
F1 6%	13.3	77.7	Effective
F2 9%	14.7	85.9	Effective
F3 12%	15.8	92.3	Effective
Control (+)	17.1	100	Effective
Control (-)	0	0	Ineffective

Based on table 10, the results of the calculation of the percentage of antibacterial effectiveness against *Staphylococcus aureus bacteria* can be seen at concentrations of 6%, 9% and 12% which are included in the effective category, as well as in the positive control, namely facial wash gel preparations available on the market, which are included in the effective category, therefore this study can help and provide information to the public that jackfruit leaf extract (*Artocarpus heterophyllus* Lamk) can be used as an alternative medicine for infectious diseases caused by *Staphylococcusaure bacteria.*

b. Formulation Test Results Against *Staphylococcus aureus Bacteria*

The results of the observation of the inhibition test of the jackfruit leaf extract formulation against *Staphylococcus aureus bacteria* with various concentrations of 6%, 9%, and 12% are in Table 11.

Table 11. Results of Observations of Formulation Tests on Bacteria

Extract	Inhibition (mm)	Category
F1 6%	9.7	Currently
F2 9%	12.2	Strong
F3 12%	14.2	Strong
Control (+)	17.2	Strong
Control (-)	0	-

Information : Control (+) = Himalaya; Control (-) = Aquadest

Based on Table 11, the results of the antibacterial test of the *facial wash preparation formula* from jackfruit leaf extract at a concentration of 6% had moderate inhibitory power, and at concentrations of 9% and 12% it had strong inhibitory power.

Based on table 12, the results of the calculation of the percentage of antibacterial effectiveness against *Staphylococcus aureus bacteria* can be seen at concentrations of 6%, 9% and 12% which are included in the effective category, as well as in the positive control, namely facial wash gel preparations available on the market, which are included in the effective category, therefore this study can help and provide information to the public that jackfruit leaf extract (*Artocarpus heterophyllus* Lamk.) can be used as an alternative medicine for infectious diseases caused by *Staphylococcus aureus bacteria.*

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Table 12. Results of Calculating the Percentage of Effectiveness of the Formula

Extract concentration	Average (mm)	Percentage of effectiveness (%)	Effectiveness Category
F1 6%	9.7	56.3	Effective
F2 9%	12.2	70.9	Effective
F3 12%	14.2	82.5	Effective
Control (+)	17.2	100	Effective
Control (-)	0	0	Ineffective

Conclusions

Based on the research, jackfruit leaf extract has been successfully formulated into a facial wash gel that meets the evaluation requirements for organoleptic properties, homogeneity, pH, spreadability, irritation, foam height, and cycling tests. Additionally, the facial wash gel containing ethanol extract of jackfruit leaves (*Artocarpus heterophyllus* Lamk.) exhibited antibacterial effectiveness at concentrations of 6% (m/v), 9% (m/v), and 12% (m/v). These findings suggest that jackfruit leaf extract has potential as an active ingredient in antibacterial facial wash gel preparations.

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