Formulation and Assessment Of Antibacterial Activity Of Hand Spray Antiseptic Extract of Manggost Fruit (*Garcinia Mangostana* L.) With Variations Of Carbopol 940 Concentration Against *Staphylococcus aureus* ATCC 25923

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Abstract

Antiseptic hand spray is a liquid preparation that is used by spraying on the palms of the hands. Staphylococcus aureus is one of the bacteria that is part of the normal flora of the skin. Mangosteen rind has activity in inhibiting the growth of Staphylococcus aureus caused because it contains chemical compounds namely, flavonoids, tannins, and saponins. Carbopol 940 is one of the gelling agents that is widely used because it can produce high viscosity with a small concentration, carbopol is also not toxic so it can be well received in the skin. The purpose of this study was to determine the ability of hand spray of mangosteen rind ethanol extract with variations in the concentration of carbopol 940 in inhibiting the antibacterial activity of Staphylococcus aureus ATCC 25923. Mangosteen rind was extracted by maceration with 95% ethanol as solvent. Mangosteen rind extract was made in a formula with variations in the concentration of carbopol 940, namely 0.1%, 0.15%, and 0.2%. Evaluation of the physical properties of thepreparation included organoleptic, homogeneity, viscosity, pH, spraying pattern, adhesion, stability, and activity test against Staphylococcus aureus ATCC 25923 by disc diffusion method. The results of testing the antibacterial activity of hand spray preparations showed an inhibition zone which was marked by a clear zone around the disc. The results showed the preparation of hand spray extract ethanol mangosteen fruit skin form a diameter of tasteless power between 14.66 mm - 16.53 mm against Staphylococcus aureus. The largest bland diameter with an average of 16.53 mm in formula I with a concentration of carbopol 940 of 0.1%.

Keywords: mangosteen skin, antiseptic hand spray, antibacterial, Staphylococcus aureus, carbopol 940.

Preliminary

Some infectious diseases such as ulcers, pneumonia, meningitis, and also diarrhea, mostly occur due to laziness in maintaining hand hygiene. One way to prevent infection through hands is to use an antiseptic hand spray that is practically used as a substitute for washing hands with soap and water (Anindhita et al. 2020). Some hand antiseptic products use alcohol as an active antibacterial agent. The use of chemicals in topical preparations can cause harmful side effects and irritate the skin (Wibawati, 2012).

Indonesia has many biological natural resources around 30,000 species of plants, approximately 9,600 species of which are known as medicinal plants. Mangosteen rind (Garcinia mangostana L.) has many

benefits to be developed as medicine. Some of the active compounds that can be used as antibacterials are xanthones, flavonoids, tannins, and saponins. Xanthones which are abundant in mangosteen rind act as antioxidants, antiproliferation, anti-inflammatory, and antimicrobial (Iswari et al. 2007). Flavonoids, tannins, and saponins are compounds found in plants that have antibacterial activity (Vincken et al. 2007).

Several studies have proven the activity of mangosteen rind extract as an antibacterial. According to Aziz's research (2015) mangosteen rind extract has activity in inhibiting the growth of Staphylococcus aureus. Staphylococcus aureus is a gram-positive bacterium that is part of the normal flora of the skin, mucous membranes, respiratory tract, and gastrointestinal tract (Jawetz et al. 2007). Staphylococcus aureus bacteria can cause various diseases ranging from mild skin inflammation, food poisoning to systemic infections (Radiji, 2011).

Carbopol 940 is one of the gelling agents that is often used because it can produce high viscosity with a small concentration, where at a concentration of 0.5% carbopol 940 has a viscosity of 40,000-60,000 mPas. Carbopol 940 is also non-toxic so it is well received in the skin (Rowe et al. 2006). The purpose of this study was to determine the quality of physical quality and good stability as well as the ability to inhibit the antibacterial activity of Staphylococcus aureus ATCC 25923 from hand spray preparations of mangosteen rind ethanol extract with various concentrations of carbopol 940.

Research Methods

1. Tools and Materials

The tools used in this research are maceration vessel, rotary evaporator, petri dish, incubator, pH meter, and viscometer. The material used is mangosteen rind (Garcinia mangostana L.) obtained from Tawangmangu, Karanganyar, Central Java.

2. Ways of working

Material collection

The mangosteen rind obtained was washed with running water and then dried in an oven at a temperature of 60ºC and then sorted dry. Furthermore, the mangosteen rind is made into powder and sieved with a 40 mesh sieve (Depkes RI, 2000).

Making of mangosteen rind extract

Put 800 grams of mangosteen peel powder into the maserator and add 8,000 ml of 95% ethanol. Soak for 6 hours, stirring occasionally, then let stand for 18 hours. Separate the maserate by filtration. Repeat the filtering process at least once with the same type of solvent, the total volume of solvent is half of the volume of the first extracted solvent. Collect all the maserate and vaporize with a vacuum evaporator or rotavapor until a thick extract is obtained (Depkes RI, 2017).

Determination of extract water content

Determination of the water content of the powder using the distillation method using the Sterling-Bidwell apparatus. The material is weighed as much as 5 grams, put into a dry flask. Toluene saturated with water is put into a flask of approximately 200 ml, then install a series of tools. The volume of water in the reservoir is read after the toluene and water are completely separated and the percent water content is calculated (Depkes RI, 2000).

Identification of the chemical content of the extract

It was carried out on the chemical content of flavonoids using the Shibata reaction, saponins with the foam formation method, tannins with FeCl3 reagent, alkaloids with Dragendoorff/Mayer reagent, sterols/triterpenoids with LB reagent.

Antiseptic hand spray formulation

The formulation was made with variation of carbopol 940 as Viscosity increasing. The design of the hand spray formula for mangosteen rind ethanol extract can be seen in the following table.

Table 1. Antiseptic hand spray formulation

Ingredients	Function	Materian concentration (%)			
		F0	FI	FII	FIII
Mangosteen rind extract	Active substance	-	20	20	20
Glycerin	Emollient	0,2	0,2	0,2	0,2
Propylene glycol	Solvent	30	30	30	30
Methyl paraben	Preservative	0,18	0,18	0,18	0,18
Prophyl paraben	Preservative	0,2	0,2	0,2	0,2
Carbopol 940	*Viscosity increasing*	0,1	0,1	0,15	0,2
Trietanolamin	Stabilizer	0,05	0,05	0,05	0,05
Aquadest	Solvent	ad 100	ad 100	ad 100	ad 100

Preparation of hand spray preparations

Carbopol 940 was dispersed in some cold water then added TEA and homogenized to form a transparent gel mass (mixture A). In a separate container, the ethanol extract of the mangosteen rind was dissolved sufficiently into propylene glycol, after dissolving add glycerin and then homogenized until mixed (mixture B). In a separate container, methyl paraben and propyl paraben are dissolved with sufficient propylene glycol then stir until dissolved (mixture C). Mix B was added to Mix A, both were homogenized until completely mixed, then Mix C was added and distilled water was added to the limit of 100 ml.

Physical quality test of hand spray

1. **Organoleptic examination**

Uji organoleptik dilakukan dengan melihat tampilan fisik sediaan dengan cara mengamati warna, aroma, dan tekstur dari sediaan (Anindhita *et al*. 2020).

2. **Homogenity examination**

The homogeneity test was carried out by spraying the preparation on a piece of transparent glass preparation. Observe the presence or absence of particles or substances that have not been mixed evenly. The preparation is said to be homogeneous if there are no solid particles and the tides agglomerate (Anindhita et al. 2020).

3. **pH test**

The pH test was carried out using a pH meter. Before carrying out the test, calibration was carried out with standard buffers of pH 4 and pH 7. Furthermore, the electrode was dipped into the preparation. The pH value that appears on the screen is recorded. Measurements were carried out at room temperature. Ideally, topical preparations have the same pH value as the skin pH, which is 5-7 to prevent irritation on the skin surface (Anindhita et al. 2020).

4. **Viscocity test**

Put the preparation into a tube-shaped container, then installed rotor no. 3 and ensure that the rotor is submerged in the test preparation. Turn on the tool and make sure that the rotor can rotate. The needle of

the viscosimeter is observed pointing towards the number on the viscosity scale for rotor no. 3 available. When the needle points in a steady direction then that number is the measured viscosity, recorded in dPaS units. A good viscosity value is less than 150 cP (1.5 dPaS) (Anindhita et al. 2020).

5. Spray pattern testing

The preparation is sprayed on a plastic sheet that has been weighed and numbered at a distance of 3, 5, 10, 15, and 20 cm. Furthermore, the drying time was measured with a stopwatch and weighed after being sprayed. The test for each distance was carried out three times, in this test the observations made were the spray pattern formed, the diameter of the spray pattern formed, and the number of preparations that came out (grams) each spray at the same distance. An acceptable criterion in this test is that the preparation can be sprayed and the particles formed are small and evenly distributed (Anindhita et al. 2020).

6. Adhesion test

This test is carried out on the skin by spraying it on the upper arm from a distance of 3 cm. After spraying, it is counted for 10 seconds to see if the preparation sticks or droplets from the spray drip down (Anindhita et al. 2020).

7. Stability testing

The test was carried out using the freezethow method, namely by storing the preparation at 4ºC for 48 hours and then transferred to 40ºC for 48 hours (one cycle). The test was continued until 5 cycles. The preparation is said to be stable if during storage there is no change in pH, viscosity and organoleptic.

Antibacterial Activity Test

1. Preparation of Staphylococcus aureus ATCC bacterial suspension 25923

Pure cultures of approximately 2 oses of Staphylococcus aureus ATCC 25923 were taken. The suspension was made in a tube containing brain heart infusion (BHI) media and the turbidity was adjusted to the standard Mc Farland turbidity of 0.5, equivalent to the amount of 1.5x108cfu/mL (Jawetz et al. 2007).

2. Testing of antibacterial activity by disc diffusion

Antibacterial activity test was carried out by disc diffusion method. This method uses filter paper (paper disc) as a place that contains antimicrobial substances, namely antiseptic hand spray of mangosteen rind extract. Disc paper was dipped in formula I-III, negative control, and positive control. Then the disc paper was put into a petri dish that had been filled with MHA media and inoculated with the test bacteria, repeated 3 times. The negative control used was a preparation without the addition of mangosteen rind extract (F0). The positive control used the "AIKEN" brand hand spray formulation. The cup was then incubated at 37°C for 18-24 hours, then the zone of inhibition was observed and measured (Jawetz et al. 2007).

Data analysis

The research data obtained were organoleptic, homogeneity, viscosity, pH examination, pattern examination, adhesive dispersion, physical stability, and activity test. The research data were analyzed statistically. Data distribution was tested using Shapirow-wilk and one way ANOVA with SPSS for window program.

Results and Discussion

The results of the manufacture of mangosteen rind powder and extract

The sample used in this study was the mangosteen rind obtained from the Tawangmangu area, Karanganyar, Central Java, which was collected in March 2021. The mangosteen rind obtained was washed, dried in an oven, then sorted dry to remove the inappropriate parts. Mangosteen rind was made into powder

and sieved using a 40 mesh sieve. Determination of the moisture content of the powder was obtained as much as 5.3% v/w. This value meets the requirements for simplicia water content, which is less than 10%.

The manufacture of mangosteen rind extract (Garcinia mangostana L.) was carried out by the maceration method. The yield of mangosteen rind extract obtained was 24.25% w/v. According to the Indonesian Herbal Pharmacopoeia (2017), the yield value of mangosteen rind extract is not less than 8.2%. Determination of the water content of the extract was carried out using the distillation method using the Sterling-Bidwell apparatus. The water content of the extract was obtained as much as 8.49% v/w. According to the Indonesian Herbal Pharmacopoeia (2017), the water content of the thick mangosteen rind extract is not more than 10.8%.

The results of the identification of the chemical content of mangosteen rind extract

Identification of chemical content aims to determine the content of compounds contained in the extract qualitatively with a test tube. Based on the test results, it can be concluded that the mangosteen rind extract contains alkaloids, flavonoids, saponins, tannins, and triterpenoids. The results of the identification of mangosteen rind extract can be seen in table 2.

Table 2. The results of the identification of the chemical content of mangosteen rind extract

Contents	Test Results	Description	Reference
Alkaloids	An orange precipitate is formed in Dragendorff's reagent and a yellowish white precipitate is formed in Mayer's reagent	(+)	An orange precipitate is formed in Dragendorff's reagent and a yellowish white precipitate is formed in Mayer's reagent (Dewi *et al*., 2013)
Flavonoids	A red-orange color is formed on the amyl alcohol layer	(+)	A red-orange color is formed on the amyl alcohol layer (Depkes RI, 2008)
Saponins	Foam is formed as high as 1 cm	(+)	Foam is formed as high as 1 cm (Dewi *et al*., 2013)
Tannins	Formation of blackish blue or blackish green	(+)	Formation of blackish blue or blackish green (Dewi *et al*., 2013)
Triterpenoids	A brown ring is formed	(+)	A brown ring is formed (Dewi *et al*., 2013)

Hand spray formulation of mangosteen rind extract

The hand spray formulation produced 4 formulas where Formula 0 was a hand spray preparation without mangosteen rind extract as a negative control with a concentration of carbopol 940 0.1%. Formula I, II, and III used carbopol 940 with a concentration of 0.1%, respectively; 0.15% and 0.2%. The positive control was a hand spray preparation of the "AIKEN" brand which contained 70% alcohol as an active substance.

The results of testing the physical quality of hand spray preparations

Table 3. Organoleptic test results, homogeneity, pH, viscosity, hand spray adhesion

Formula	Time	Organoleptic	Homogenity	pH	Viscocity (dPaS)	adhesion (detik)
0	Day 1	clear color; odorless; a little watery	Homogeneous	6,25 ± 0,05	0,4 ± 0,05	16,05±0,72
	Day 21	clear color; odorless; a little watery	Homogeneous	6,24 ± 0,03	0,3 ± 0,05	14,07±0,46
I	Day 1	Yellowish brown; characteristic odor; a little watery	Homogeneous	5,56 ± 0,03	0,6 ± 0,05	19,54±0,59
	Day 21	Yellowish brown; characteristic odor; a little watery	Homogeneous	5,53 ± 0,03	0,5 ± 0,05	18,44±0,53
II	Day 1	Yellowish brown; characteristic	Homogeneous	5,39 ± 0,03	0,7 ± 0,05	26,35±0,37

		odor; a little watery				
	Day 21	Yellowish brown; characteristic odor; a little watery	Homogeneous	5,34 ± 0,04	0,7 ± 0,1	25,21±0,50
III	Day 1	Yellowish brown; characteristic odor; a little thick	Homogeneous	5,33 ± 0,06	0,9 ± 0,05	35,04±1,03
	Day 21	Yellowish brown; characteristic odor; a little thick	Homogeneous	5,32 ± 0,03	0,8 ± 0,05	34,49±0,54

i. Organoleptic test results

The results of the organoleptic hand spray test show that formula 0 has a clear color, no odor, and a slightly liquid form. Meanwhile, formulas I, II, and III have a yellowish-brown color and a characteristic smell of extract. Formula I and II have a slightly liquid form, while Formula III has a slightly viscous form. Color, odor, and dosage form of mangosteen rind extract hand spray did not change on the first day after manufacture nor during storage for 21 days, which means that the hand spray preparation of mangosteen rind extract was organoleptically stable. The test results can be seen in table 3.

ii. Homogenity test results

Homogeneity testing is carried out to see and find out the components of the ingredients in the hand spray preparation have been mixed well. The homogeneity test results showed that each hand spray formulation of mangosteen rind extract was homogeneous on the first day and during the storage period for 21 days. This can happen because the mangosteen rind extract mixed with other ingredients is done properly. The test results can be seen in table 3.

iii. pH test results

The pH test aims to determine the safety and suitability of the preparation to the skin so that irritation does not occur. Table 3 shows that formulas 0, I, II, and III are in the normal pH range of the skin (5-7) so that the four formulas are in the safe range for use on the skin. The use of different HPMC concentrations at FI, FII, and FIII had a significant effect on the pH of the preparation. The results of the ANOVA test showed a sig value of 0.000 <0.05, which means that there was a significant difference in pH for each formulation. The results of the pH analysis were continued with the paired t test and the results obtained sig value > 0.05 indicating there was no significant difference, which means that the hand spray preparation has a stable pH during 21 days of storage.

iv. Viscocity test results

The viscosity of the preparation will have an effect on whether or not the preparation can be delivered through a spray applicator and will affect the ability of the preparation to release its active substance. The results of the viscosity test in table 3 show that the difference in the concentration of carbopol 940 in the four formulas has a significant effect on the viscosity of each formula. This is indicated by a significance value of 0.000 <0.05 in the one-way ANOVA test. The results of the viscosity analysis continued with the paired t test and the results obtained sig value > 0.05 indicating there was no significant difference, which means that the hand spray preparation has a stable viscosity during 21 days of storage.

The test results show that the four formulas meet the viscosity criteria for hand spray preparations, which are less than 1.5 dPaS.

v. Adhesion test results

In table 3 it can be seen that the four formulas can be attached to the skin of the upper arm after being sprayed. The four formulas meet the criteria because they can stay attached for more than 10 seconds. The ability to adhere to the skin proves that hand spray preparations can retain the active substances on the skin thereby increasing its effectiveness. Formula 0, I, and II showed an even distribution, while Formula III showed that the preparation did not spread but only accumulates at one spray point, this happens because Formula III has a higher viscosity so it is not suitable for use as a sprayed preparation. The results of the ANOVA test showed a sig value of 0.000 <0.05, which means that there was a significant difference in the adhesive power of each formulation. The difference in the concentration of carbopol 940 in the preparation had a significant effect on the adhesion results. The results of the adhesion analysis were continued with the paired t test and the results obtained sig value > 0.05 indicating there was no significant difference, which means that the hand spray preparation has a stable viscosity during 21 days of storage.

vi. Spray pattern test result

Table 4. Spray pattern test results

Formula	Range (cm)	Spray pattern		
		Pattern	Diameter (cm)	Drop weight (g)
0	3	Spread	5,2±0,3	0,02±0,00
	5	Spread	7,83±0,2	0,03±0,00
	10	Spread	13,86±0,2	0,04±0,00
	15	Spread	16,43±0,2	0,06±0,00
	20	Spread	19,15±0,2	0,06±0,00
I	3	Spread	4,8±0,3	0,03±0,00
	5	Spread	7,46±0,3	0,04±0,00
	10	Spread	12,9±0,2	0,06±0,00
	15	Spread	15,03±0,2	0,07±0,00
	20	Spread	18,63±0,3	0,08±0,00
II	3	Spread	4,1±0,2	0,05±0,00
	5	Spread	5,8±0,2	0,06±0,00
	10	Spread	9,93±0,2	0,09±0,00
	15	Spread	14,36±0,4	0,09±0,00
	20	Spread	17,76±0,2	0,15±0,05
III	3	Clot	3,03±0,3	0,05±0,00
	5	Clot	5,13±0,3	0,07±0,00
	10	Clot	7,06±1,1	0,08±0,00
	15	Clot	9,7±0,9	0,10±0,00
	20	Clot	12,33±0,7	0,14±0,05

The spraying pattern is influenced by the viscosity of the preparation. Spraying results are also influenced by the spraying distance. The farther the spraying distance, the larger the diameter of the spray pattern formed. Formula 0, I, and II tend to produce an elongated and widening pattern compared to formula

III which seems to tend to clump and only stay at one straight point from the spray. This can happen because formula III has a higher viscosity than formula 0, I, and II. The difference in the concentration of carbopol in the preparation can affect the results of the spraying pattern, where the higher the concentration of carbopol, the larger the particles produced which makes the pattern of spraying not spread. The results of the spraying pattern test can be stated that Formula 0, I, and II meet the standard criteria for a good spraying pattern where the preparation can be sprayed well and the particles are evenly distributed. The results of the ANOVA test showed a sig value of 0.000 <0.05, which means that there was a significant difference in the spraying pattern of each dosage formula. The difference in the concentration of carbopol 940 in the preparation had a significant effect on the measurement results of the spraying pattern.

vii. Stability test result

Table 5. Stability test results

Formula	Time	Organoleptic	pH	Viscocity (dPaS)
0	Before freeze thaw	clear color; odorless; a little watery	6,25 ± 0,05	0,4 ± 0,05
	After freeze thaw	clear color; odorless; a little watery	6,24 ± 0,03	0,3 ± 0,05
I	Before freeze thaw	Yellowish brown; characteristic odor; a little watery	5,56 ± 0,03	0,6 ± 0,05
	After freeze thaw	Yellowish brown; characteristic odor; a little watery	5,53 ± 0,03	0,5 ± 0,05
II	Before freeze thaw	Yellowish brown; characteristic odor; a little watery	5,39 ± 0,03	0,7 ± 0,05
	After freeze thaw	Yellowish brown; characteristic odor; a little watery	5,34 ± 0,04	0,7 ± 0,1
III	Before freeze thaw	Yellowish brown; characteristic odor; a little thick	5,33 ± 0,06	0,9 ± 0,05
	After freeze thaw	Yellowish brown; characteristic odor; a little thick	5,32 ± 0,03	0,8 ± 0,05

The hand spray preparation which has been tested for stability for 6 cycles is then tested again for its physical quality to determine whether there are changes that occur. Based on table 4, in the organoleptic test, all preparations did not change before and after the stability test, which showed that the hand spray preparations remained homogeneously mixed and had no effect on the temperature treatment given. The test results also showed a decrease in pH and viscosity, but the decrease did not have a large difference.

b. The results of the identification of Staphylococcus aureus ATCC 25923

Morphological identification of Staphylococcus aureus ATCC 25923 was carried out using Vogel Johnson Agar (VJA) media. The results after being incubated for 18 hours were black colonies appeared

with yellow surrounding media. The black color in bacteria occurred because the colonies reduced potassium tellurite, while the yellow color in the media was caused by mannitol fermentation so that under acidic conditions the media produced pigments that varied from white to dark yellow. (Hayati et al. 2019). The results of the microscopic identification study with gram staining showed that the bacteria to be used were gram-positive as seen from the formation of a purple color, round in shape and clustered like grapes. The results obtained from the catalase test on Staphylococcus aureus ATCC 25923 showed bubbles and oxygen after 2 drops of 3% H202 were added. This happens because the bacterium Staphylococcus aureus ATCC 25923 produces the enzyme catalase (Radiji, 2011). The identification results showed positive where there was a change in blood plasma which was denatured by Staphylococcus aureus so that white clots were formed (Hayati et al. 2019).

c. Disc diffusion antibacterial activity test results

Tabel 6. Antibacterial activity test results

Sample	Inhibition zone diameter (mm)			Average ± SD
	Replication			
	I	II	III	
K(-)	6,3	9,3	7,6	7,73 ± 1,50
FI	15,3	16	18,3	16,53 ± 1,57
FII	14,3	16,3	17	15,87 ± 1,40
FIII	14	14	16	14,67 ± 1,15
K(+)	20,6	19	18,3	19,3 ± 1,18

Description :
Formula I : hand spray mangosteen rind extract with carbopol concentration of 940 0.1%.
Formula II : hand spray of mangosteen rind extract with carbopol concentration of 940 0.15%.
Formula III : hand spray of mangosteen rind extract with carbopol concentration of 940 0.2%.
K(+) : AIKEN brand hand spray
K (-) : hand spray without mangosteen rind extract as a negative control (F0).

The results of the antibacterial activity test for hand spray preparations of mangosteen rind extract with variations in the concentration of carbopol 940 0.1%; 0.15% ; and 0.2% of Staphylococcus aureus ATCC 25923 by disc diffusion showed the formation of inhibitory zones with diameters of 16.53 mm, 15.87 mm, and 14.66 mm, respectively. Formulas I and II had more active inhibition zones than formula III against Staphylococcus aureus ATCC 25923. In the test results for the formula without extract (F0) or negative control, an inhibition zone was also formed, but the inhibition zone produced by the negative control was smaller than the inhibition zone. produced by the formula containing mangosteen rind extract, this indicates that the hand spray preparation has better antibacterial activity if it is added to the mangosteen rind extract as the active substance. Variations in the concentration of carbopol 940 in this study resulted in significant differences between formulas where the higher the concentration of carbopol in the preparation, the higher the viscosity produced, resulting in a decrease in the diameter of antibacterial inhibition (Sinko, 2011). The ANOVA test results showed a sig value of 0.000 <0.05, which means that there is a significant difference. Then the Post Hoc Tukey test was carried out. The results show that formulas I and II have almost the same efficacy as positive controls, this can be seen with the same subset location.

The results of the identification of chemical constituents indicate that the mangosteen rind extract contains alkaloids, flavonoids, tannins, saponins, and triterpenes which have antibacterial activity. Flavonoid compounds have a mechanism of action in inhibiting bacterial growth by inactivating proteins (enzymes) in

cell membranes (Ngajow et al. 2013). The mechanism of action of tannins as antibacterial is to inhibit DNA topoisomerase so that bacterial cells cannot be formed. The mechanism of action of saponins as antibacterial is that they can cause leakage of proteins and enzymes from the cell. The mechanism of action of alkaloids as antibacterial is by interfering with the peptidoglycan constituent components in bacterial cells, so that the cell wall layer is not fully formed and causes cell death. The mechanism of triterpenoids as antibacterial is related to lipid membranes and sensitivity to triterpenoid components that cause leakage in liposomes (Titis et al. 2013).

2. Conclusion

The conclusion obtained from this study is that the first hand spray preparation of mangosteen rind ethanol extract with variations in the concentration of carbopol 940 has good physical quality and stability. Second, the hand spray preparation of mangosteen rind ethanol extract with variations in the concentration of carbopol 940 has antibacterial activity against Staphylococcus aureus ATCC 25923. Third, formula I meets the criteria for good physical quality and stability in the hand spray formula of mangosteen rind ethanol extract compared to formula II and III.

3. Thank-you note

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