FORMULATION AND STABILITY TESTS OF CREAM FROM JUICE OF BELIMBING WULUH (*Averrhoa bilimbi* L.)

Annysa Ellycornia Silvyana[1*], Feronika Evma Rahayu [1], Lia Warti [1], Dentri Asih[2]

[1]Program Studi Farmasi, Sekolah Tinggi Ilmu Kesehatan Medistra Indonesia, Bekasi, Jawa Barat
[2]Program Studi Farmasi, UHAMKA Jakarta Timur, Jakarta, Indonesia

*Correspondence: Annysaellycornia@gmail.com

ABSTRACT

Research on cream formulations using starfruit (Averrhoa bilimbi L.) juice has been carried out to determine the effect of sodium lauryl sulfate on the physical stability of cream from starfruit juice. Carambola wealth as an active substance is made in cream with varying concentrations of sodium lauryl sulfate of 1%, 1.5%, 2%, and 2.5%. The evaluation was carried out in the form of organoleptic tests, homogeneity, cream type, pH, viscosity, centrifugation, and freeze-thaw. Data analysis was carried out using statistical tests using ANOVA which has a 95% confidence level (α = 0.05), the test is continued with the Tukey HSD test, and the analysis results show significant differences in each formula. The research results concluded that the higher the concentration of sodium lauryl sulfate as an emulsifying agent, the physical stability of the viscosity of the cream from starfruit juice increased.

Keywords: Averrhoa bilimbi, Sodium lauryl sulfate, cream, physical stability

Received: October 2022 *Accepted: December 2022* *Published: December 2022*

INTRODUCTION

Indonesian people have a habit of using natural ingredients as traditional medicine (Andi, 2000). Traditional medicine is considered to have relatively small side effects compared to treatment using chemicals. Belimbing wuluh (Averrhoa bilimbi L.) or also known as belimbing tamarind contains secondary metabolites of flavonoids that have antibacterial activity (Hembing, 2008). As a traditional treatment, star fruit is used as an acne remedy by mashing it until smooth and rubbing it on the part of the face with acne (Dalimartha, 2008).

One of the preparations that can be developed is to make topical preparations in the form of creams. The consideration is that it is more comfortable to use, easy to clean, the packaging is practical and safe, the dosage is correct, and it is stable when stored for a long time.

The dosage base components used to support cream formulation include the oil phase, the water phase, and the emulsifying agent. Sodium lauryl sulfate is an emulsifier in the anionic surfactant class which has the highest HLB value compared to other emulsifiers so that the activity of the interfacial boundary is stronger (Martin, 1993).

In this research, cream preparations have been made using 10% of star fruit juice as an active ingredient. The experiment was carried out by varying the sodium lauryl sulfate concentration to see the cream formulation's physical stability from bilimbi fruit juice.

MATERIALS AND METHODS

a. Materials

Analytical balance (Ohaus), pH meter (Hanna Instrument), viscometer *brookfield* type DV-E, thermometer (Pyrex), oven,

blender (National), centrifuge (Bio Lion XC-HR20), *rotary evaporator* (Buchi), refrigerator. Belimbing wuluh (*Averrhoa bilimbi* L.) (BALITRO), cetyl alcohol (BASF), stearyl alcohol (BASF), stearic acid (Wilfarin), glycerin (P&G), sodium metabisulfite (Aditya Birla), sodium lauryl sulfate (BASF), methylparaben (Oxoid), and distilled water.

b. Methods

1. Determination

Samples were obtained at BALITRO and then determined at BRIN Cibinong. The sample selection standard was selected fruits that were harvested less than 30 days after the flowers grew.

2. Preparation of Materials

The star fruit is picked and then cleaned by washing it in running water, chopped into small pieces, and then mashed using a blender. The star fruit that has been refined is then concentrated by reducing the water content using a rotary evaporator

3. Formulation

Table 1. Formulation of Cream

Materials	F 1	F2	F3	F4
Belimbing wuluh Juice	10	10	10	10
Na lauryl sulfate	1	1,5	2	2,5
Stearic acid	14	14	14	14
Cetyl alkohol	5	5	5	5
Stearic alcohol	5	5	5	5
Glycerin	10	10	10	10
Sodium metabisulfite	0,01	0,01	0,01	0,01
Metyl paraben	0,18	0,18	0,18	0,18
Aquadest ad	100	100	100	100

4. Preparation of Cream

1) Prepare and separate the ingredients into two groups: the oil and water phases.
2) Melt stearic acid, stearyl alcohol, and cetyl alcohol at 70^o – 75^oC (M1).
3) Dissolve glycerin, sodium metabisulfite, methylparaben, and sodium lauryl sulfate in hot water at 70^o – 75^oC (M2).
4) Enter the oil phase into the water phase and stir until homogeneous (M3).
5) Then the starfruit juice is added to the cream base and stirred until homogeneous.
6) Put in a clean container.
7) Then evaluate the cream.

5. Evaluation of Cream

1) Organoleptic
   The cream is stored in dry vials. This was done by observing the color, shape, smell, growth of fungi, and the formation of layers on the surface of the preparation which was seen visually at room temperature.
2) Homogeneity Test
   The cream sample is placed between two transparent glasses, then observed visually or eyesight. The cream preparation is said to be homogeneous if there are no visible particles.
3) Examination of Cream Type
   A certain amount of methylene blue or brilliant blue FCF is dropped on the surface of the emulsion. Then observed under a microscope. If the color diffuses evenly, it means the cream is of the M/A type. If the color does not diffuse evenly, then the cream is of the A/M type.
4) pH Test
   The pH check was carried out to predict the acid-base level of the cream preparation. The pH meter is calibrated by washing and rinsing the electrode with distilled water then using a phosphate buffer pH 4.0 and pH 7.0. Cream testing is done by dipping the pH electrode until the tip of the electrode is immersed in the preparation. Record the pH listed.
5) Viscosity Test
   Viscosity is done to observe the ability of a preparation to flow. The greater the resistance of a preparation is affected the higher the viscosity. Brookfield

viscometer can be used as an instrument in the determination of viscosity. The cream preparation to be examined is put into a container in the form of a 500 ml glass cylinder tube, then spindle number 5 is installed, and the device is turned on at a speed of 10 rpm. Then record the results of the constant viscosity values obtained.

6. Stability Test

1) Freeze-thaw
   Freeze-thaw is a method used to see the physical stability of a preparation with two temperature conditions, namely storage between 4^{o}C and 45^{o}C. A cream preparation must withstand at least six or eight heating/cooling cycles between 4oC and 45^{o}C in storage at a temperature of not less than 48 hours.
2) Centrifugation
   A centrifugation test was carried out to check the phase separation. 5 grams sample was put in a disposable centrifugation tube and centrifuged at 25^{o}C at 3750 RPM.
3) Data Analysis
   Data on the viscosity of the cream formulation were processed statistically using SPSS 20.

RESULT

From the results of the organoleptic examination, the four cream formulas obtained the same shape, smell, and color. This shows that there is no effect on shape, smell, and color with the addition of sodium lauryl sulfate in the cream formulation. From the organoleptic examination, no layer was formed on the cream due to differences in the concentration of the inner phase. In addition, there is no fungal growth so the cream is maintained during storage time.

The results of the examination of the homogeneity of the cream preparations for the four cream formulas showed a homogeneous composition, there were no layers that separated one ingredient from another. This shows that the emulsifying agent works well in occupying the space between the oil phase and the water phase so that the cream is dispersed evenly and forms a monomolecular layer. The four cream formulas of belimbing wuluh fruit juice can be said to be homogeneous during storage time.

In the four formulas after testing the type of cream, the formulation included the type of oil in water because after dropping methylene blue and observing it under a microscope, the cream preparation dissolved and diffused evenly throughout the water.

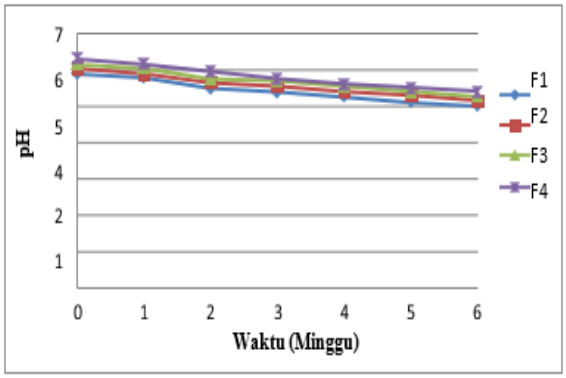

Figure 1. Results of pH Test

The results of the pH examination in Figure 1, the cream preparations of the four formulas showed significant changes due to the interaction between the ingredients and the length of time they were stored so the results obtained changed every week. Testing the pH is important for topical preparations because too high or low pH can irritate the skin. Based on these data it can be concluded that cream preparations are still in the pH range of the skin.

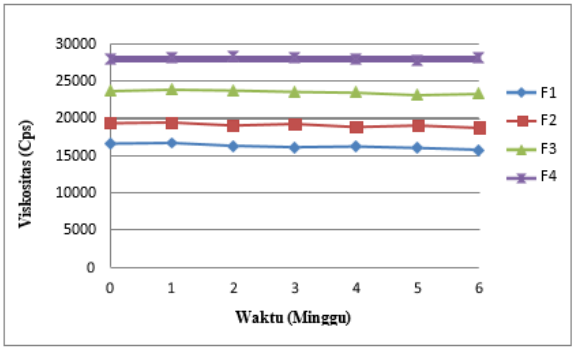

Figure 2. Results of the Viscosity Test

The results of the viscosity examination in Figure 2, the cream preparation can be seen that the higher the concentration of sodium

lauryl sulfate, the greater the viscosity of the cream. Sodium lauryl sulfate is an emulsifying agent for the anionic surfactant class which has a CMC value of 2.365 g/L. This means that the sodium lauryl sulfate used acts on the CMC so that an increase in surfactant concentration will form more micelles. Micelles are a collection of surfactants that form something and consist of hydrophilic and lipophilic groups. The greater the number of micelles formed, the greater the viscosity value because the bond between the oil phase and the water phase is getting stronger. Therefore, the stability of the cream can be related to Stokes' law where the higher the viscosity value the slower the sedimentation rate.

Table 2. Centrifugation Observation Results In Hours

Formula	1	2	3	4	5
1	-	-	-	+	+
2	-	-	-	-	-
3	-	-	-	-	-
4	-	-	-	-	-

Description: (-) No separation occurs
(+) Separation occurs

The centrifugation examination aims to observe the separation of the dispersed phase from the formation of cream or the presence of clumping cream after centrifugation. From the results of centrifugation observations in Table 2, there was a phase separation in Formula 1 with a concentration of 1% sodium lauryl sulfate. In centrifugation, there is a centrifugal force that causes the unstable cream to separate.

The test was continued by conducting a physical stability test in the form of freeze-thaw where in this test the samples were treated at 4^{o}C and thawed at 45^{o}C for 6 cycles. The results of freeze-thaw can be seen in Table 3 where in formulas 1 and 2 there is separation while in formulas 3 and 4 there is no separation. This is because the SLS concentration in formulas 1 and 2 is lower than in formulas 3 and 4. This is shown in formula 1 experiencing separation in cycles five and six, formula 2 experiencing separation in cycle six, while formulas 3 and 4 do not experience separation until the sixth cycle. This happens because the higher the concentration of sodium lauryl sulfate, the stronger the ability to bind water.

Table 3. Observation Results of Per-Cycle Freeze-Thaw

F	1		2		3		4		5		6	
	4	40	4	40	4	40	4	40	4	40	4	40
1	-	-	-	-	-	-	-	-	+	+	+	+
2	-	-	-	-	-	-	-	-	-	-	+	+
3	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-

DISCUSSION

Research has been carried out by developing formulations using natural ingredients in the form of belimbing wuluh juice and variations in the addition of sodium laurels sulfate on the physical stability and viscosity of the cream formulation.

CONCLUSION

Based on the research that has been done, it can be concluded that the cream formulation in starfruit juice with the addition of sodium lauryl sulfate concentration can affect the physical stability and viscosity of the formulation.

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