



Research Article

The Effect Of Variation In Stearic Acid Concentration On The Physical Properties Of Cream Preparations from Papaya Leaf Extract (Carica Papaya L.)

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ABSTRACT

Papaya leaf extract contains karpain alkaloids which can inhibit bacterial growth. The purpose of this study is to ascertain the concentration of stearic acid that satisfies the requirements of cream and the impact that variations in stearic acid concentration have on the physical characteristics of papaya leaf extract (*Carica papaya* L.) anti-acne cream preparations. The formulation of stearic acid in cream is divided into 3 formulations 5% (F1), 10% (F2), and 15% (F3). The cream preparations were tested for physical properties including organoleptic test, homogeneity test, pH test, spreadability test, adhesion test, emulsion type test, and viscosity test. From the results of the study, it can be concluded that stearic acid concentration affect organoleptic physical properties (smell and shape), viscosity, and spreadability, but has no effect on organoleptic color, homogeneity, pH, adhesion and emulsion type. F2 produces cream preparations that meet the physical properties.

1. Introduction

The outermost layer that envelops the entire body and protects the internal organs called skin. The image of healthy, fresh, smooth, clean, and supple skin is the dream of everyone, especially women. Because, no matter how small the blemish, spot, blackhead, or pimple, it will not escape the watchful eyes of every woman when looking in the mirror. The largest and outermost organ in the body, the skin shields us from a variety of external factors and microbes. The skin is a reflection of a person's health (Sulastomo, 2013).

Acne vulgaris, also known as acne, is a skin disorder caused by continuous inflammation and has a complex etiology that includes sebaceous glands, follicular hyperkeratinization, excessive bacterial

colonization, immunological responses, and inflammation (Madelina and Sulistyaningsih, 2018). It is common for everyone to have *Propionibacterium acnes* germs on their skin and to experience some degree of follicular obstruction. This disease can be found at any age (Sibero et al., 2019). Acne can be brought on by a number of factors, including genetics, hormonal activity throughout the menstrual cycle, stress, overactive sebaceous gland activity, cleanliness, diet, and cosmetic use. According to Muliyan and Suriana (2013), acne is brought on by clogged pores that prevent oil from being secreted, which causes the skin to swell and dry up into pimples. The appearance of acne can lead to a decrease in a person's self-confidence, especially in teenagers (Alfiya et al., 2025).

Indonesia is an agrarian country with many fruit plants, including papaya (*Carica papaya* L.) (Suprihatin and Titi, 2023). Papaya is a tree that grows in tropical regions, which is native to South America (Hidayati et al., 2020). This tropical plants has numerous advantages. Over the past few years, significant insights have been gained regarding the biological activity and medicinal applications of papaya, and it is now considered a valuable nutraceutical fruit plant (Lestari et al., 2018). Papaya fruit is rich in nutrients, such as provitamin A, provitamin C, B vitamins, lycopene, dietary minerals, and dietary fiber (Hidayati & Ruhayani, 2021). Additionally, papaya leaves contain alkaloids, flavonoids, saponins, phenols, steroids, and tannins, which act as anti-fatigue agents (Candra et al., 2024; Santi, et al., 2023).

Empirically, it has been proven that papaya leaves can be used to treat acne, by directly applying a solution made from crushed papaya leaves to the acne-affected areas of the skin. In the extract of papaya leaves, there are alkaloids such as carpain that can inhibit bacterial growth and give papaya leaves a rather bitter taste (Syarifah et al., 2015).

Papaya leaves have the potential to treat acne with easy use by turning them into a cream preparation. Cream is a semi-solid dosage form containing one or more dissolved or dispersed medicinal substances in a suitable solvent or base (Rahayu et al., 2023). Creams are chosen because this formulation has advantages such as being easy to apply on the skin, easy to wash off after application, can be used on skin with wet wounds, and distributes evenly (Anisa, 2013). The ingredient that significantly influences the formulation of the cream is the emulsifier or emulgator. An emulgator is an excipient that bridges the two phases of oil-in-water (O/W) and water-in-oil (W/O). Without an emulgator, separation between the oil and water phases will occur in the emulsion mixture, with the oil mixing on top of the liquid and the water at the bottom (Ermawati, 2017). One example of an emulsifier that is often used is stearic acid. The correct concentration of stearic acid will affect the physical properties of the cream.

This study aims to determine the effect of varying concentrations of stearic acid on the physical properties of papaya leaf extract anti-acne cream. The concentrations of stearic acid used were 5% (F1), 10% (F2), and 15% (F3). The cream formula was put through a number of tests to make sure it met the necessary standards for good physical attributes, including homogeneity, pH, spreadability, adhesion, emulsion type, viscosity, and organoleptic testing. The examination of the cream formulation's physical characteristics seeks to ascertain the impact of different stearic acid ratios on the formulation's physical characteristics as well as the concentration of stearic acid that satisfies these requirements.

2. Materials and Methods

Material

Papaya leaf, stearic acid (PT. Brataco), propilen glycol (PT. Brataco), methyl paraben (PT. Brataco), propyl paraben (PT. Brataco), TEA (CV. Inalab), cetyl alcohol (CV. Inalab), oleum citri (CV. Inalab), aquadest (PT. Aneka Kimia).

Method

Preparation of Papaya Leaf Extract

Papaya leaves were extracted using the maceration method with etanol 96% for 3x24 hours, then the macerate was concentrated using a rotary evaporator (Himaniarwati et al., 2019).

Cream Formulation

The water and oil phases are melted separately until the temperature 70°C. The oil phase is added to a warm mortar, then the water phase is added and stirred until a homogeneous cream mass is formed. Papaya leaf extract is added gradually until homogeneous, and finally, oleum citri is dripped into the cream preparation. The complete formulation is presented in Table 1.

Table 1. Cream Formulation

Material	F1 (%)	F2 (%)	F3 (%)
Papaya leaf extract	5	5	5
Stearic acid	5	10	15
Propilen glycol	10	10	10
Methyl paraben	0.3	0.3	0.3
Propyl paraben	0.2	0.2	0.2
TEA	3	3	3
Cetyl alcohol	3	3	3
Oleum citri	0.5	0.5	0.5
Aquadest	73	68	63

Homogeneity Test

To assess homogeneity, 0.5 grams of the gel formulation was applied to a transparent glass surface and examined for the presence of coarse particles. A formulation is deemed homogeneous if no coarse granules are observed upon visual inspection (Alfianti and Murrukmiyadi, 2015).

pH Measurement

One gram of the product was diluted with 100 milliliters of distilled water to test the cream's pH. The resulting solution was then transferred into a beaker glass. A pH meter was used to measure the pH value. This test was conducted in triplicate to ensure accuracy (Himaniarwati et al., 2019).

Spreadability Test

One transparent glass is filled with 0.5 g of cream, and another transparent glass is placed over it. Let it sit for 1 minute to obtain several spread diameters. Then continue by adding weights on top of it: 50, 100, 150 g, and observe the spread diameters that form. This spreading power test is conducted with 3 replications for each formula (Sariyanti et al., 2019).

Adhesion Test

0.25 g of cream is placed on two predetermined object glasses, then pressed with a 1 kg weight for 5 minutes. On the testing apparatus, an object glass is installed, and an 80 g weight is placed on it, recording the release time from the object glass. The adhesion test was conducted with 3 replicates for each formula (Himaniarwati et al., 2019).

Emulsion type

Put the cream into 30 ml of distilled water. O/W type cream is evenly distributed, whereas W/O type cream will not be evenly distributed. Conduct emulsion type tests with 3 replications for each formula (Himaniarwati et al., 2019).

Viscosity test

The cream is placed into a beaker, then the spindle is lowered until the limit is submerged in the cream preparation. The spindle is allowed to rotate and the red needle on the scale is observed. Repeat for 3 replicates of each formula Himaniarwati et al., 2019).

Data Analysis

The data was analyzed using the Statistical Product and Service Solutions (SPSS) program. The Kolmogorov-Smirnov method was used to test the normality of the data. One Way ANOVA (Analysis of Variance) was used for analysis when the p value was greater than 0.05, and the Kruskal Wallis test was used when the p value was greater than 0.05.

3. Results and Discussions

The goal of this study is to determine how stearic acid concentration influences the physical properties of anti-acne cream formulations based on papaya leaf extract (*Carica papaya* L.) and to identify the optimal stearic acid concentration for the physical properties of the cream.

The organoleptic testing of the anti-acne cream preparation with papaya leaf extract (*Carica papaya* L.) was conducted visually by three respondents. This test includes shape, smell, and color. The cream preparations meet the criteria if they have a thick consistency, a citrus scent, and green color. The differences among the three cream preparations are in their shape and smell. This is due to the difference in the concentration of stearic acid used. Because the more stearic acid is used, the thicker the resulting cream becomes (Sariyanti et al., 2019). While all of the formulas are homogen. The results of the test described in Table 2.

Table 2. Organoleptic and homogeneity result test of papaya leaf cream

Formula	Shape	Smell	Color	Homogeneity
F1	A bit thick	Strong citrus	Green	Homogen
F2	Thick	Citrus	Green	Homogen
F3	Very thick	Weak citrus	Green	Homogen

The next tests are pH test, spreadability test, *Adhesion test*, emulsion type, and cream viscosity. The results of the test described in Table 3.

Tabel 3. Result of pH, spreadability, adhesiveness, emulsion type and viscosity of papaya leaf cream

Physical property	F1	F2	F3
pH	6,13 ± 0,30	6,26 ± 0,08	6,38 ± 0,10
Spreadability (cm ± SD)	8,66 ± 0,57	6,70 ± 0,10	6,53 ± 0,15
Adhesion (seconds ± SD)	83 ± 2,51	84 ± 7,93	88 ± 6,65
Emulsion type	O/W	O/W	O/W
Viscosity (dPas ± SD)	20 ± 0,00	45 ± 8,66	63 ± 5,77

pH testing is conducted to determine the chemical properties of the cream formulation, where the pH requirement for a good cream is in accordance with the skin's pH, which is 4.5 – 6.5 (Edy et al, 2017). The result of a formulation when used must meet the existing parameters/requirements to avoid skin irritation, specifically a pH value of < 3 , and if it is too alkaline, it becomes scaly or dry, which is a pH value of > 10 (Budianor et al, 2022). Table 3 shows that the preparation's pH will be more acidic the higher the stearic acid concentration in the formula. Because stearic acid has an acidic pH, the preparation will have a lower pH the more of it is used (Saryanti et al, 2019). Statistical analysis using One Way ANOVA resulted in a significance value of 0.344 ($p > 0.05$), indicating that variations in the concentration of stearic acid didn't have impact on the cream's pH.

The next physical property test is the spreadability test. To find out how well the cream spreads on the skin, the spreadability test is used (Lucyani, 2014). From the spreadability test results in Table 3, it is known that higher concentrations of stearic acid lead to a decrease in the cream's spreadability. This is because the use of stearic acid can increase the cream's viscosity, thereby reducing its spreadability (Saryanti et al, 2019). Statistical analysis using Kruskal Wallis test resulted in a significance value of 0.043 ($p < 0.05$), indicating that variations in the concentration of stearic acid have impact on the cream's spreadability.

The *adhesion* test is the next physical property test. A cream is considered good if it has an adhesion time of more than 4 seconds. The purpose of this adhesion test is to determine the cream's ability to adhere when applied to the skin. The higher the adhesion value of the cream, the stronger it will stick and the more optimal the absorption is expected to be (Suprasetya et al., 2024). Based on the results in Table 3, it is known that all formulas have met the adhesion requirements. Variations in the stearic acid concentration had no effect on the adhesiveness of the cream, according to statistical analysis using One Way ANOVA, which produced a significance value of 0.509 ($p > 0.05$).

The emulsion type test aims to determine whether the cream preparation is an O/W or W/O emulsion. The tests were conducted using the dilution method. If the cream preparation cannot be diluted with water, the emulsion type is water in oil (W/O); if it can, the emulsion type is oil in water (O/W). According to Table 3, the final cream is an oil-in-water (O/W) emulsion. O/W type creams have advantages, including not being sticky when used (Zulkarya and Ema, 2018).

The final physical property test is the viscosity test to determine the resistance produced by the cream. Good cream viscosity is indicated by cream that is neither too thin nor too thick (Saryanti et al., 2019). The viscosity of a good cream preparation range from 30 – 70 dPa.s (Kurniati, 2011). Based on the results obtained, increasing the concentration of stearic acid leads to an increase in the viscosity of the cream. Stearic acid is a free fatty acid used as an emulsifier, which is a component that forms the mass, increases the consistency of the cream, and has emollient properties (Rowe et al., 2009). The Kruskal Wallis test yielded a significant value of 0.023 ($p > 0.05$), indicating that variations in the content of stearic acid had an impact on the cream's viscosity.

4. Conclusions

Stearic acid concentration affect organoleptic physical properties (smell and shape), viscosity, and spreadability, but has no effect on organoleptic color, homogeneity, pH, adhesion and emulsion type.

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