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Formulation Of Aloe Vera (*Aloe Vera* L.) Extract Gel As A Skin Moisturizer With Variations Of Carbopol 934

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ABSTRACT

Aloe vera is a type of plant that can moisturize the skin to prevent premature aging. One type of cosmetic preparation that can be used for skin health is gel. This research aims to determine the optimal variation of Carbopol 934 for formulating the gel. The method used in this research is maceration, creating aloe vera extract gel preparations in three formulas with variations of Carbopol 934: F1 (1 g), F2 (1.5 g), and F3 (2 g). Subsequently, a physical evaluation was conducted, which included: Organoleptic test: The results showed a nearly yellowish-white color, a characteristic aloe vera plant aroma, and a semi-solid form. pH measurement: The pH values for F1, F2, and F3 were 6.1, 4.8, and 4.3, respectively.Homogeneity test: All formulas were homogeneous. Viscosity test: The viscosity results for F1, F2, and F3 were 285,290, 515,821, and 749,374 mPa.s, respectively, compared to the reference sample at 375,163 mPa.s. Spreadability test: The spreadability for F1, F2, and F3 were 6.5 cm, 5.5 cm, and 5 cm, respectively. Adhesion test: The adhesion times for F1, F2, and F3 were 7.02, 10.40, and 24.23 seconds, respectively. Based on the physical evaluation results, the gel preparations meet the requirements for a good gel preparation according to the specified SNI No.06-2588 standards.
Key words: *Gel, Aloe vera, Moisturizer, Carbopol 934,* Physical evaluation

INTRODUCTION

Dry skin often becomes an issue that causes discomfort and stress on the skin. The surface of the skin will feel tight, stiff, rough, dull, scaly, itchy, red, and may even cause pain. The main cause of dry skin is hot weather, which can lead to significant water loss, making the skin scaly. Additionally, exposure to chemicals, aging, and other skin conditions can lead to dry skin, which is characterized by the appearance of wrinkles (Butarbutar & Chaerunisaa, 2020; Sari & Diana, 2019).

Dry skin can occur due to dehydration of the skin. In this case, sufficient water intake can provide nutrients to skin cells and improve skin elasticity, making the skin healthy, supple, and well-moisturized. One solution for dry skin is the use of moisturizers in gel form. Gel is a topical preparation that is easy to apply to the skin because it contains water that can cool, soothe, moisturize, and easily penetrate the skin. Gel preparations can also include

natural ingredients that have benefits as skin moisturizers, one of which is aloe vera (*Aloe vera* L.). Aloe vera contains vitamins A, B1, B2, B3, B12, C, E, choline, inositol, as well as folic acid, magnesium (Mg), calcium (Ca), chromium (Cr), potassium (K), sodium (Na), iron (Fe), and zinc (Zn). Currently, aloe vera is widely cultivated in Indonesia because it is a natural ingredient used in the production of cosmetics, food, beverages, and medicines (Imani & Shoviantari, 2022; Mardiana & Ambarwati, 2021).

In the formulation of gel preparations, a gelling agent is also needed, one of which is carbopol. Carbopol is a commonly used gelling agent in cosmetics due to its high compatibility and stability, non-toxic nature, and ease of spreadability on the skin. Additionally, Carbopol has favorable properties for the release of active substances (Mohan et al., 2020). Based on that, it is necessary to conduct a study on the formulation of gel preparations from aloe vera extract using Carbopol 934 as the gelling agent at various concentrations. This aims to obtain preparations with good physical properties.

MATERIAL AND METHODS

Material

Aloe vera extract, carbopol 934, methylparaben, propylparaben, TEA, propylene glycol, distilled water and 96% ethanol.

Methods

Extraction

The aloe vera samples were obtained from Gunung Sulah, Bandar Lampung. The aloe vera samples were sorted and washed using running water, then the inner part was extracted. The samples were further subjected to maceration extraction method using 96% ethanol solvent for 3x24 hours. The maceration extract was filtered using filter paper and then evaporated to obtain a semi-solid extract.

Formula Gel

Tabel 1. Formula (F) Gel Ekstrak Lidah Buaya

Ingredients	Formula 1 (g)	Formula 2 (g)	Formula 3 (g)	Function
Aloe vera extract	1	1	1	Active Ingredient
Carbopol 934	1	1,5	2	Gelling Agent
TEA	0,5	0,5	0,5	Alkalizer
Methylparaben	0,18	0,18	0,18	Preservative
Propylparaben	0,02	0,02	0,02	Preservative
Propylene glycol	15	15	15	Moisturizer

Distilled water	Add 100 mL	Add 100 mL	Add 100 mL	Solvent

Preparation of Gel Formulation

Carbopol 934 1g; 1.2g; 2g, was dispersed in 40 mL hot distilled water (90-100°C), then stirred until it expanded at a temperature of 27-28°C. Methylparaben 0.18g and propylparaben 0.02g were dissolved in 20 mL boiling distilled water, then added to the Carbopol 934 gel base. 1g of aloe vera extract was added to 15g propylene glycol, then added to the Carbopol 934 base. Triethanolamine (TEA) 0.5g was added dropwise and stirred again until homogeneous. The gel preparation was then transferred into prepared containers.

Physical evaluation of Gel Preparation

Organoleptic

The test samples were visually examined for the gel preparation, which included its form, aroma, and color. Generally, gel preparations have a clear appearance with a semi-solid consistency (Astuti *et al*, 2018)

pH

The test samples were weighed at 10g of gel preparation, then dissolved in 50 mL of distilled water in a glass beaker. Distilled water was added to make it up to 100 mL and stirred until homogeneous. The solution was then measured with a pH meter that had been standardized. The pH measurement results were compared with the pH standards for skin according to SNI No. 06-2588, which are 4.5-6.5 *(Rohma, et al*, 2021).

Viscosity

The test samples were placed into a glass beaker. The rotor was then placed in the beaker containing the sample by lowering the viscometer's position with the lifting knob until it reached the designated boundary line. The viscometer was turned on by pressing the power button and then waited until the measurement was completed. The viscosity measurement results would be displayed on the screen

Homogeneity

The test samples were applied to a glass slide and then observed for the presence of any clumps or aggregates. Generally, gel preparations should be homogeneous and free of coarse particles (Hafid *et al*, 2019).

Spreadability

The test samples were weighed at 0.5g and then placed on a graduated round glass, followed by applying a load of 50g and 100g, and left for 1 minute. According to SNI No. 06-2588, good spreadability of the gel should be between 5-7 cm (Sayuti, 2015).

Adhesion Time

The test samples were weighed at 0.25g and then placed on a specified area of a glass slide. The glass slide containing the gel was attached to another glass slide and then loaded with a weight of 1 kg for 3 minutes. The determination of adhesion involved the time it took for the two glass slides to detach. Generally, the adhesion of the gel preparation should be more than 1 second (Sukartiningsih *et al*, 2019).

Data analysis

The data analysis method used in this study is descriptive analysis. This involves comparing the physical evaluation results of the gel preparations with the standards for good gel preparations, which include organoleptic evaluation, pH evaluation, viscosity evaluation, homogeneity evaluation, spreadability evaluation, and adhesion evaluation. In descriptive analysis, the obtained data from these physical evaluations will be detailed and then compared with the established standards to determine how well the gel preparations meet the desired quality criteria.

RESULT AND DISCUSSION

Tabel 2. Organoleptic of *Aloe vera* Extract

	Result	Rendement of Extract (%)
Organoleptic of Extract	Texture : Semi solid Color : Golden brown Aroma : Characteristic of *Aloe vera*	16,16

The extraction of aloe vera leaf (*Aloe vera* L.) was carried out using the maceration method. 300 g of aloe vera leaves were macerated with 96% ethanol solvent. Ethanol is an organic solvent that can extract most of the bioactive compounds found in the extract because it has high polarity, which allows it to dissolve both polar and non-polar compounds. Based on Table 2, the extract obtained is in the form of a semi-solid, thick extract with a golden brown color, semi solid texture, characteristic aroma of aloe vera, and has an extract yield of 16.16%. The obtained extract meets the standard for good extract, which is not less than 10%, because the higher the extract yield, the higher the content of the extracted substances (Senduk *et al*, 2020).

Tabel 3. Organoleptic Properties of Gel Preparation

Formula	Texture	Color	Aroma
F1	Semi solid	Pale yellow	Characteristic of *Aloe vera*
F2	Semi solid	Pale yellow	Characteristic of *Aloe vera*
F3	Semi solid	Pale yellow	Characteristic of *Aloe vera*

Based on the results of the organoleptic test of the aloe vera extract gel preparations in Table 3, F1, F2, and F3 are semi-solid in form, pale yellow in color, and have the characteristic aroma of aloe vera. The general organoleptic requirements for gel preparations are clear with a semi-solid consistency (Astuti *et al*, 2018). The gel preparations produced exhibit a pale yellow color, which is due to the presence of aloe vera extract added. Therefore, it can be concluded that all three gel formulation formulas have met the requirements.

Tabel 4. pH Properties of Gel Preparation

Formula	pH			
	Replication 1	Replication 2	Replication 3	Average of pH ±SD
F1	6,5	5,5	6,5	6,1±0,6
F2	5	4,5	5	4,8±0,3
F3	4,5	4	4,5	4,3±0,3

Based on Table 4, it shows that the pH of the aloe vera extract gel preparations has met the requirements according to SNI No. 06-2588, with a pH range of 4.5-6.5, namely F1 6.1; F2 4.8; and F3 4.3. The difference in pH values at each carbopol concentration is due to the chemical reaction of the carboxyl groups in carbopol with water, forming H_3O^+ which is acidic (Rowe *et al*, 2009). The condition of the preparation with a very low pH can cause skin irritation, while a very high pH can cause the skin to become scaly. (Titaley *et al,* 2014).

Tabel 5 Viscosity Properties of Gel Preparation

Formula of Gel Preparation	*Viscosity* (mPa.s)			Average of *Viscosity* ±SD
	Replication 1	Replication 2	Replication 3	
F1	288210	284884	282776	285290±2740
F2	543034	505480	495949	515821±24894
F3	782368	742540	723213	749374±30164
F Comparative	388818	369912	366759	375163±11930

Based on Table 5, the viscosity values for F1, F2, and F3 are 285,920; 515,821; and 749,374 mPa.s, respectively. In this study, a commercial comparator product was used to determine the viscosity value of Carbopol 934, which was found to be 375,163 mPa.s. The results obtained can be

concluded that F1 is the closest to the viscosity value of the comparator product, indicating its superiority. Carbopol is an effective gel-forming agent capable of increasing viscosity. Its use in gel preparations is safe for topical application and does not cause hypersensitivity reactions (Firdaus *et al*, 2023)

Formula of Gel Preparation	Spreadability (cm)

Tabel *6*. Homogeneity Properties of Gel Preparation

Formula of Gel Preparation	Homogeneity
F1	homogeneous
F2	homogeneous
F3	homogeneous

Based on Table 6, it is shown that all formulas do not contain coarse particles in the preparation, indicating that the preparation has good homogeneity. The homogeneity test aims to determine the mixing between the active ingredients and the additives in the preparation of the emulgel *(Mugita et al*, 2024).

Tabel 7. Spreadability Properties of Gel Preparation

Formula of Gel Preparation	pH
F1	6,5
F2	5,5
F3	5

Based on Table 7, it is shown that F1, F2, and F3 have spreadability of 6.5, 5.5, and 5 cm, respectively. This indicates that the spreadability meets the requirements of SNI No. 06-2588, which is 5-7 cm. Based on the spreadability test results, the higher the concentration of Carbopol, the smaller the spreadability value in the preparation (Forestryana *et al*, 2020).

Tabel 8 Adhesion Time Properties of Gel Preparation

Formula of Gel Preparation	Adhesion Time (Second)
F1	07,02
F2	10,40
F3	24,23

Based on Table 8, the adhesion time of the gel for F1, F2, and F3 is 7.02, 10.40, and 24.23 seconds, respectively. Therefore, it can be concluded that in this adhesion test, the requirements are met. The requirement for adhesion

is more than 1 second (Yusuf et al, 2017). The higher the concentration of Carbopol used, the longer the adhesion time produced (Atmaja *et al*, 2022).

CONCLUSION

1. The variation of carbopol concentration affects the physical properties of the gel. The higher the concentration in the preparation, the physical properties of the gel may not meet the parameters of SNI No.06-2588, including pH test, viscosity test, spreadability test, and adhesion test.
2. The physical evaluation results of the aloe vera extract gel formulation that showed the best performance and met the requirements of SNI No.06-2588 is F1 (1 g). It has the following characteristics: Organoleptic test: semi-solid texture, golden brown color, characteristic aroma of aloe vera, pH test: F1 (6.5); Viscosity test: F1 (282,776); Homogeneity test; Spreadability test: F1 (6.5); Adhesion test: F1 gel (7.02 seconds).

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