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Gel Formulation from Ethanol Extract of the Leaf of White Guava (*Psidium guajava* L.)

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ABSTRACT

White guava is a plant that can grow easily in Indonesia. As a source of vitamin C, white guava leaves have been used as antidiarrheal drugs. Some studies state that white guava leaves contain antioxidants. Aside from having a selling value, white guava leaves are also used as raw materials for facial cosmetics, namely as raw materials for gel. Flavonoids are a large family of plant secondary metabolites that have various and amazing biological functions, including as antioxidants. The study aims to determine the gel preparation formulation of the white guava leaf extract (*Psidium guajava L.*) as a good antioxidant and the characteristics of the preparation. To extract the active substance in simplicia, maceration is used by using ethanol extract processes. The gel making uses a CMC-Na base. Formulation I uses a concentration of CMC-Na 0.1 gram. Formulation II uses a concentration of CMC-Na 0.3 grams. Formulation III uses a concentration CMC-Na 0.6 gram. The main raw material is 0.2 grams of white guava leaf ethanol extract for each formulation. The maceration process uses 70% ethanol. 250 grams of white guava leaves are used. The yield obtained was 13.92%. The gel product was analyzed organoleptic test, pH test, dispersion test, homogeneity test, and adhesion test. The results showed that the CMC-Na 0.1-grams, 0.3 grams CMC-Na, and 0.6-grams CMC-Na had a distinctive odor of white guava leaves, brownish color, and thick concentration. The gelling product is homogeneous and pH of 6. The formulations under CMC-Na 0.6 grams have good dispersibility. All formulations have good adhesion. The adhesion is more than 4 seconds. The conclusions are the formulation with CMC-Na 0.6 grams fulfills the requirements for topical gel preparation.
Keywords: antioxidants; ethanol extract; gel dosage formulations; vitamin C; white guava leaves.

INTRODUCTION

White guava is a plant that can grow easily in Indonesia. In addition to using the fruit as a source of vitamin C, white guava leaves have been used as antidiarrheal drugs (Kurnia *et al*., 2020). Some studies say that white guava leaves contain antioxidants. So white guava leaves have to sell values if the leaves are used as raw materials for facial cosmetics, namely as raw materials for gel. Antioxidants inhibit the formation of free radicals in the body (Purwandari, 2018). Flavonoids are secondary metabolites. Flavonoids have various and different biological functions, among them, antioxidant activity. Flavonoids have two benzene that binds to the propane chain. Flavonoids types are flavonoids, isoflavonoids, and non-flavonoids (Alfaridz, 2018).

Guava leaves contain volatile flavonoids, tannins (17.4%), phenolics (575.3 mg/g). The usage of guava leaves is anti-inflammatory, anti-diarrheal, analgesic, anti-bacterial, anti-diabetic, antihypertensive, and platelet enhancer. The compounds of flavonoids in guava are quercetin, which has a melting point of 310ºC, so that quercetin is resistant to heating (Indriani, 2006) shows that guava leaf extract has the best antioxidant potential is white fleshy guava leaves extracted with 70% of ethanol by maceration.

The technique to obtain guava leaf extract by several methods. Maceration and continuous extraction are two types of extraction methods. Maceration is a process to immerse simplicia in water or organic solvents until it is absorbed which will soften the cell structure so that the substances contained in it will dissolve (Ansel, 1989).

The use of guava leaf extract directly on the skin is very ineffective. Therefore, the white guava leaves are used as raw materials for gelling products. A gel is a semisolid preparation consisting of a suspension made of small inorganic particles or large organic molecules penetrated by a liquid. Gel products have excess dry easily, form a film layer that is easy to wash and, give a cold feeling to the skin (Sayuti, 2015). In this study, the maceration method is used to extract white guava leaves.

Gelling agents that are often used in gel formulas are carbopol and carboxymethylcellulose (CMC). Carbopol polymer is a hydrophilic polymer with a polyacrylic acid structure. Concentration of 0.5% carbopol 941 or 981 at room temperature

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Table I. Gel formulation of white guava leaf extract

No	Materials (units)	Formulation			Function
		I	II	III	
1	White guava leaf extract (g)	0.2	0.2	0.2	Active substance
2	CMC-Na (g)	0.1	0.3	0.6	Gelling Agent
3	Glycerine (g)	1	1	1	Humectant
4	Propylene Glycol (g)	0.5	0.5	0.5	Humectant
5	Methyl paraben	0.025	0.025	0.025	Preservative
6	Aquadest ad (ml)	10	10	10	Carrier

produces a viscosity of 4,000 – 11,000 cP. Meanwhile, Na-CMC is included in the cellulose-derived gelling agent. Cellulose derivatives are often used in gel formulas because of their neutral nature and good viscosity increase. Na-CMC functions as a gelling agent at a concentration of 3 – 6% (Kusuma *et al*., 2018).

Based on the description above, it is necessary to conduct this research on the gel formulation of white guava leaf extract (*Psidium guajava L.*) under Na-CMC base and the physical test of characteristics of gel preparation.

METHODOLOGY

Materials

The tools used in this study were blenders, measuring cups, porcelain plates, analytical scales, glass objects, wooden tongs, spatels, spatula, aluminum foil, mortar and stamper, stopwatch, stirring rod, and water bath. The materials used in this study were white guava leaf extract as much as 250 grams, 70% ethanol, Na-CMC, glycerin, propylene glycol, methylparaben, and distilled water. The white guava leaf was taken from Bakulan Regency RT 04 RW 02 Kecamatan Kemangkon Kabupaten Purbalingga, Central Java, Indonesia.

Methods

Before the maceration process is carried out, the plant is determined first. Plant determination is intended to determine the correct identity of white guava leaves (*Psidium guajava L.*) which will be used in this study. The determination was carried out at the Biology Laboratory, Faculty of Mathematics and Natural Sciences, Jenderal Sudirman University, Purwokerto.

To extract white guava leaves is used the maceration methods. The maceration method uses 70% ethanol as solvent. A total of 250 grams of white guava leaf simplicia powder is put into a maceration container, after that soaked in 70% ethanol until the guava leaf simplicia is completely submerged. The maceration container for dissolving the simplicia powder of white guava leaves is covered with black cloth or with aluminum foil. The container is stored at room temperature protected from direct sunlight for 3 x 24 hours. Maceration is done by stirring every day. Every day for 3 x 24 hours the solvent is replaced and filtered with filter paper then the results of the filtrate are stored in a different place, the dregs of the filtered results are added with 70% ethanol, do the same thing for 3 x 24 hours. The resulting filtrate is then evaporated on a water bath until it reaches a fixed weight.

Prepare all the ingredients used in the process of making gel formulation. The ingredients are weighed beforehand, each according to the formulation that has been determined. First, make formulation I, which is to take white guava leaf extract, dissolve it with ± 2 ml hot water, stir until homogeneous, and then set aside. Take Na-CMC and sprinkle it on top of the mortar that already contains ± 5ml of hot water, let stand until it expands. When it has expanded, stir until homogeneous and then add glycerine little by little, stirring until homogeneous. Second, propylene glycol was added and stirred until homogeneous. Methylparaben is added little by little and stirred until homogeneous. The last white guava leaf extract is added gradually and stirred until homogeneous. The remaining is added hot water in the preparation and stirring until homogeneous. After completing the input of the preparation to the place where the preparation is then stored, do the same thing in formulation II with a concentration of CMC-Na 0.3 grams and formulation III with a concentration of CMC-Na 0.6 grams. The gel product is then stored at room temperature overnight (Hamzah, 2006). The table of gel formulation can be seen in Table I.

Testing of gel preparation

Organoleptic Test

Organoleptic tests are the odor, color, and texture of the preparation (Handayani, 2012).

Table II. Organoleptic test result

Extract	Type of testing	Result
White guava leaf extract *(Psidium guajava L.)*	Odor	Specific of leaf
	Color	Brown
	Concentration	Thick

Homogeneity Test

Homogeneity test was carried out by means gel sample smeared on a piece of glass or other suitable transparent material, the preparation must indicate the order homogeneous and no visible granules rough (Astuti *et al*., 2017).

pH test

The test was carried out by using a universal pH that was dipped in a diluted gel sample after being completely immersed, the universal pH changes color and matches it with the universal pH standard. The pH of the preparation must match the pH of the skin, namely 4.5 - 6.5 (Voigh, 1995).

Spreadability Test

The spreadability test is carried out by placing a certain amount of substance on a glass scale. Then the top is given the same glass, and the load is increased, and given a 1-2 minute interval. Then the dispersion diameter is measured at each additional load when the preparation stops spreading. Increasingly spread shows its ability to distribute evenly. A good spreadability area is 5-7cm^2 (Garg *et al*, 2002). The gel is weighed as much as 0.5 grams placed in the middle of a glass scale tool. Then at the top, it is given the same glass and the load is increased with a period of 1-2 minutes. Furthermore, the dispersion diameter is measured at each additional load, when the preparation stops spreading within a certain time regularly (Suryani, 2015).

Adhesion Test

The purpose of this adhesion test is to determine how much the ability to adhere to the skin in a certain time so that it can function optimally, while the adhesion time requirement for topical preparations is not less than 4 seconds (Ulean *et al*, 2012). Weigh the gel as much as 0.5 grams and place it on a glass object on the sticky power tester, and given a load of 500 grams, let it sit for 1 minute, after 1 minute the load is lowered, and then record the time (Nurlaela *et al.*, 2012).

RESULT AND DISCUSSION

Determination Plant

The result of determination plant is code : 2008187, Family : *Myrtaceae,* Speciemen : *Psidium guajava L.,* Local Name : Guava, References : Sp. Pl. 470 1753. It can be concluded that the plant used is *Psidium guava L.*

Yield extract

The yield of the extract was 13.92%. While a good standard for the yield of white guava leaf extract is 12.3% (MOH, 2008). There may still be ethanol content in the extract at the time of evaporation, so the final result does not meet good yield standards. The amount of yield in the extract according to Afif (2006) was caused by factors of extraction method, amount of solvent, extraction time, powder size, and temperature.

Evaluation of Gel Preparations

Organoleptic Test

Organoleptic observations of gel preparations included the color, odor, and texture of the preparation (Handayani, 2012). Table II shows the result of the organoleptic test.

Based on the organoleptic test results table can be concluded that the formulation with a concentration of CMC-Na of 0.1 gram has a distinctive odor of white guava leaves, has a dark greenish-brown color, and a thick dosage concentration. The formulation with a concentration of CMC-Na of 0.3 grams has a distinctive smell of white guava leaves and a dark greenish-brown color and a thicker concentration than the CMC-Na of 0.1 gram. The formulation with a CMC-Na concentration of 0.6 grams has a greenish-brown color, a distinctive odor of white guava leaves, and the thickest concentration of the three formulations. According to Kusuma *et al* (2018), the use of Na-CMC produces cloudy preparations because of the formation of a colloidal solution in water. In addition, the use of Na-CMC as a gel base will produce a higher viscosity than carbopol.

Homogeneity test

This test is carried out by placing a 0.5 gram dosage on a glass with a scale. Then observed whether there are particles or not. If there are no separate particles, the preparation is declared homogeneous (Astuti *et al*., 2017). The homogeneity test can be seen in Figure 1.

Table III. Homogeneity test result

Formulation	FI	FII	FIII
Condition of preparation	Homogeneous	Homogeneous	Homogeneous

Table IV. The result of pH test

Formulation	Replication	pH
1	I	6
	II	6
	III	6
2	I	6
	II	6
	III	6
3	I	6
	II	6
	III	6

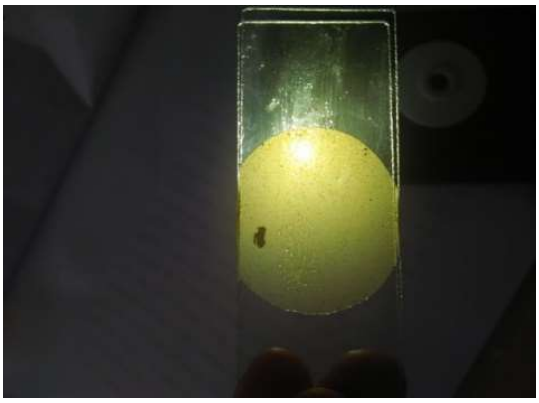

Figure 1. Homogeneity test result

The test results showed that the three formulations showed a homogeneous arrangement. The formulation of guava leaf extract gel that has been tested shows homogeneous results. It can be seen from the glass for the homogeneity test that there is no coarse grain which indicates the preparation is not homogeneous. The color of the formulation is homogeneous (Figure 1). According to Kusuma *et al.* (2018), Na-CMC contains cellulose which is neutral and can easily combine with ethanol extract of white guava leaves.

pH test

The test was carried out using a universal pH that was dipped in a diluted gel sample. After being completely immersed, the universal pH changes its color and matches it with the universal pH standard. The pH of the preparation must match the pH of the skin, namely 4.5 - 6.5 (Voigh, 1995). Table IV shows pH test.

The pH test in this test is carried out using a universal indicator. The best pH of topical preparations is 4.5-6.5 (Suryani, 2013). The results of the pH test for white guava leaf gel preparation showed a pH of 6 so that it meets the skin pH standard requirements. The ideal preparation is that it does not irritate the skin. If the preparation is too acidic or too alkaline it can irritate the skin (Voigh, 1995). The pH test can be seen in the image below. According to Kusuma et al (2018), Na-CMC is included in the derived gelling agent cellulose. Cellulose derivatives are often used in gel formulas due to their properties which are neutral and increase viscosity which is quite good.

Spreadability Test

The spreadability test is carried out by placing a certain amount of substance on a glass scale. Then the top is given the same glass, and the load is increased, and given a 1-2 minute interval. Then the dispersion diameter is measured at each additional load when the preparation stops spreading. Increasingly spread shows its ability to distribute evenly. A good spreadability area is 5-7cm^2 (Greg *et al*, 2001). The gel is weighed as much as 0.5 grams placed in the middle of a glass scale tool. Then at the top, it is given the same glass and the load is increased with a period of 1-2 minutes. Furthermore, the dispersion diameter is measured at each additional load, when the preparation stops spreading within a certain time regularly (Suryani, 2013).

Of the three gel formulations of white guava leaf extract, each of them showed a different spreading power area. The table shows that the white guava leaf gel preparation formulation III has the criteria following the provisions of the good

Table V. Spreadability Test Result

Formulation	Replication	Without Load		Load of 50 gram		Load of 100 gram	
		r	L	r	L	R	L
I	I	1.8	10.17	1.9	11.33	1.9	10.33
	II	1.9	11.33	1.9	11.33	1.8	10.17
	III	1.9	11.33	1.8	10.17	1.8	10.17
	Average	1.9	10.94	1.86	10.94	1.833	10.22
II	I	1.7	9.07	1.7	9.07	1.7	9.07
	II	1.7	9.07	1.7	9.07	1.7	9.07
	III	1,7	9.07	1.7	9.07	1.7	9.07
	Average	1.7	9.67	1.7	9.67	1.7	9.67
III	I	1.5	7.06	1.4	6.15	1.4	6.15
	II	1.4	6.15	1.4	6.15	1.4	6.15
	III	1.4	6.15	1.4	6.15	1.4	6.15
	Average	1.43	6.45	1.4	6.15	1.4	6.15

Table 6. Adhesion Test Result

Formulation	Replication	Time (second)
I	I	10.35
	II	11.25
	III	9.27
	Average	10.29
II	I	14.6
	II	14.30
	III	15.65
	Average	14.85
III	I	17.40
	II	18.25
	III	17.85
	Average	17.83

topical dispersion test. Formulation III has an area with an average of 5-7 cm^2 (Greg *et al*, 2001). Formulation III uses CMC-Na 0.6 grams. The journal reference formulation and physical stability test of Chinese ketepeng leaf extract gel (Sayuti, 2015) show the good spreadability test was 0.3 grams of CMC-Na formulations. It shows the opposite with the spreadability of gel under white guava leave extract.

Adhesion test

The purpose of this adhesion test is to determine how much the ability to adhere to the skin in a certain time so that it can function optimally. The adhesion time requirement for topical preparations is not less than 4 seconds (Ulean *et al*, 2012). Weigh the gel material as much as 0.5 grams and place it on a glass object on the sticky power tester, and given a load of 500 grams, let it sit for 1 minute, after 1 minute the load is lowered, and then record the time (Nurlaela, 2012). Table VI shows the result of the adhesion test.

Based on the adhesion test table on gel preparations, formulation I had the fastest time, while formulation III had the longest time. In making this gel preparation, the number of bases of each formulation is distinguished. The adhesion power test of the gel preparation was conducted to determine the ability of the gel preparation to adhere to the skin. Adhesiveness is related to the length of contact between the base and the skin.

The results were obtained, gel formulation I had an average time of 10.29 seconds, gel formulation II had an average time of 14.85 seconds, while gel formulation III had an average time the longest is 17.83 seconds. According to Kusuma *et al* (2018), Na-CMC is a gelling agent from cellulose derivatives. Na-CMC is often used because it produces a gel that is neutral and has a stable viscosity. However, the disadvantage of using cellulose derivatives is that they are

susceptible to enzymatic degradation resulting from organisms that can result in a decrease in viscosity. So in this study, the gel formula needs to be added with a preservative in the form of methylparaben.

CONCLUSION

Based on the research and discussion results, it can be concluded that White Guava Leaf Extract (*Psidium guajava L.*) can be made gel preparations using CMC-Na as much as 0.6 grams (FIII). The white guava leaf extract under 0.6 grams CMC-Na gel preparation (*Psidium guajava L.*) is a good topical gel according to the physical characteristics test.

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