Formulation of *Moringa oleifera* Leaf Extract in Lotion and Gel as Sunscreen

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Abstract: *Moringa oleifera* leaf extract has an antioxidant activity so it can be used to protect the skin. The aim of this study is to determine the extract specification and formulation in lotion and gel as sunscreen agent. *Moringa oleifera* leaf extract was obtained by maceration method using ethanol 70%. The extracts were identified for chemical content and specification test of extract. After that, extract was formulated into gel and lotion. The evaluation of gel and lotion includes physical characteristics (spreadability and adhesivity) and the value of Sun Protection Factor. The result showed that *Moringa oleifera* leaf extract contained alcaloids, flavonoids and poliphenols. The value of moisture content, ash content, acid soluble ash, and β-caroten were 5.75%, 0.19%, 0.16%, and 0.46%, respectively. The IC_{50} of antioxidant activity was 516.28. The value of Sun Protection Factor of the 5% octyl metoxycinnamate solution, gel (contain 5% extract), and lotion (contain 5% extract) were 33.25, 34.75, 24.98, and 25.89, respectively. The lotion and the gels have a strong sunscreen activity and meet the requirements of physical properties for preparations.

1 INTRODUCTION

Moringa oleifera contains ß-carotene, protein, vitamin C, calcium and potassium that can be used as natural antioxidant (Krisnadi, 2013). In addition, other studies have also shown that moringa leaves contain phenolic compounds, flavonoids and carotenoids (Vongsak *et al*., 2013 and Jayawardana *et al*., 2015). Based on the content of active ingredients, moringa leaves have various properties such as antioxidants, antimicrobials, natural food preservatives, and anti-inflammatory (Jayawardhana *et al*., 2015; Singh *et al*., 2009).

Indonesia as a tropical country has a high intensity of sunlight, so one part of the body that was affected by the condition is the skin. The skin, as one of the body's protective organs, can undergo an excessive dryness (Rawlings *et al*., 2000). Therefore, it needs a certain dosage form that can be used to protect and to maintain the moisture of skin. Antioxidant and anti-inflammatory properties of moringa leaves are expected to protect the skin from free radicals that are caused by sunlight or other factors.

A previous study have shown that moringa leaf extract can be applied in topical form for the prevention and treatment of oxidative and anti-aging stress diseases (Atif *et al*., 2013). A research by Sugihartini *et al*. (2016) showed that a 3% concentration of extract in cream was able to improve skin smoothness. The increasing concentration of extract in cream will increase SPF value. This study will focus on the formulation of extract in the form of lotion and gel preparation with an extract concentration of 3%. The evaluations of dosage form will consist of physical properties of the preparation and the SPF value.

2 MATERIALS AND METHOD

2.1 Materials

Moringa oleifera leaves was obtained at Yogyakarta, Indonesia. The ingredients for lotion and gel were

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vaseline album (Brataco, Indonesia), stearic acid (Brataco, Indonesia), cetyl alcohol (Brataco, Indonesia), thrietanolamin (Brataco, Indonesia), dimeticon (Brataco, Indonesia), methyl paraben (Brataco, Indonesia), propylene glycol (Brataco, Indonesia), ethanol 0% (pharmaceutical grade), ethanol 35% (pharmaceutical grade), etanol 70% (pharmaceutical grade), and aquadest. The instruments that was used were oven (Binder, ED 115/Esv 00-17289), *rotary evaporator* (Heidolph, Germany), analitical balance (Wiggen Hauser), waterbath (Memert, Germany), pH meter (WTW 82362 Weilheim, Germany), termometer, sentrifugator (PLC-series), vacuum pump (Rotary Vane), viskometer Rheosys Merlin VR, freeze dryer (Virtis, United States), the equipment of adhesivity, the equioment of spreadability and glassware (Pyrex, United States).

2.2 Methods

2.2.1 Extraction of *Moringa oleifera* Leaf

Extract of leaves *Moringa oleifera* leaves was obtained by using maceration method. The maceration method was performed with a ratio of 1:40. The 10 grams of dried sample powder was extracted by using of 400 mL ethanol 70% pharmaceutical grade for 72 hours at room temperature. After that, it was filtered with filter paper and vacuum pump. The extract was evaporated by using rotary evaporator and was continued by using waterbath until dry (Vongsak *et al*., 2013).

The extract of moringa leaf was obtained by maceration method with ethanol 70%. This is based on research results of Vongsak *et al*. (2013) which indicates that the nutritious compounds of phenolic and flavonoids as antioxidants can be maximized by using the methods. This study will be identify the specific and non-specific parameters of moringa leaf extract.

2.2.2 Specification of Extract

The levels of β-carotene in moringa leaf extract was determined by using High Performance Liquid Chromatography. The extracts were also identified for their chemical content, the extract specification test included water content, total ash content, acid soluble ash content.

2.2.3 Formulation of *Moringa oleifera* Extract in Lotion and Gel

The composition of lotion and gel that was used in this study are presented in Table 1 and 2.

The preparations of lotion and gel were performed by using fusion principle. The water-soluble and oil-soluble parts was were soluted in water and then heated at a temperature of 70°C. Then, the second mixture (water phase) was gradually added into the first mixture (oil phase) at 70°C and was homogenized. The extract of moringa was added when it was cold (Munson, 1991).

2.2.4 Evaluation of Physical Characteristic

- Adhesivity test

The gel or lotion was weighed 0.25 g and then was placed between two glass objects. One kilogram of load was put on the upper side of glass objects to give a tension for 5 minutes. After that, the glass object were put on the tool that had 80 grams of load. The time was needed for two glass objects separated after the load of 80 grams release was noted (Putra and Setyawan, 2014).

- Spreadability test

The gel or lotion was weighed 0.5 g and then was placed in the middle of a circular glass. The other glass was placed on the upper side of it for 1 minute. The diameter of lotion or gel was measured. One hundred grams of load was placed on the glass for 1

Table 1: The Formulation of *Moringa oleifera* leaf extract in lotion.

Composition	Weight (g)
Stearic acid	4,00
Cetyl alcohol	4,00
Triethanolamine	2,00
Glycerin	2,00
Methylparaben	0,20
Propylparaben	0,03
Extract of moringa	3%
Aquadest	Add 100

Table 2: The Formulation of *Moringa oleifera* leaf extract in gel.

Composition	Weight (g)
Carbopol	1
Triethanolamine	0,05
Glycerin	2
Propylene glycol	1
Methylparaben	0,03
Extract of moringa	3%, 6%
Aquadest	100

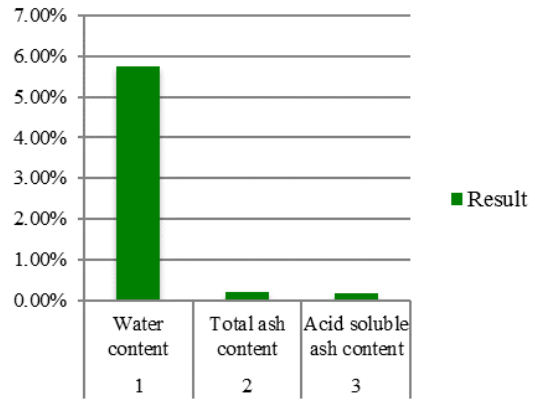


Figure 1: Result of water content, total ash content and acid soluble ash content in the extract of

minute and then the diameter of gel or lotion was measured until getting a constant one (Astuti *et al*., 2010).

- The measurement of pH

The pH values of lotion and gel were determined by using pH meter after 500 mg of gel or lotion was soluted in 5 ml of distilled water (Naibaho *et al*., 2013).

- The measurement of Viscosity

The viscosity of lotion or gel was measured by using Viscosimeter Rheosys Merlin VR.

2.2.5 The Measurement of Sun Protection Factor Value

The values of Sun Protection Factor (SPF) of the gel and the lotion were determined based on a set method by Bambal *et al*. (2011). A total of 1 gram of sample was added to Erlenmeyer and then was added with ethanol up to 100 ml. The solution was sonicated for 5 minutes and then the mixture was filtered. A total of 10 ml of first filtrate was discarded. Furthermore, filtrate was taken as much as 5 ml and then was added ethanol up to 50 ml. Five ml of the solution was taken and was added with ethanol to 25 ml. The spectral absorbance was read by using spectrophotometer at 290-320 nm with a wavelength interval of 5 nm. The SPF value was calculated based on the equation (1):

$$SPF_{spectrophotometric} = CFx \sum_{290}^{320} EE(\lambda)xI(\lambda)xAbs(\lambda) \quad (1)$$

2.2.6 Data Analysis

The data were analysed by ANOVA test to find the level of differences between the formulas.

3 RESULT AND DISCUSSION

The extract obtained in this study was evaluated for water content, total ash and acid soluble ash content as presented in Figure 1. The total ash content and acid soluble ash content of moringa leaf extract fullfilled the requirement (≤0.20%) based on Herbal Pharmacopoeia (year). The extracts were also evaluated for their chemical content including alkaloids, flavonoids and polyphenols as presented in Table 3.

The extract was also analysed for the level of β carotene as active substance in the extract. The extract potency was evaluated based on antioxidant activity by calculating IC_{50} and SPF values. The result of the assay of β-carotene, IC50 and SPF values was presented in table 4.

The test results show that IC_{50} was 516.28. This means that the antioxidant activity of moringa leaf extract was weak. However, the extract has a high SPF value of 33.25 which means it has a strong sunscreen activity. The step after the extract specification was formulation of extracts for the preparation of lotions and gels. The preparations were then evaluated for physical properties as presented in Figure 2 and table 5. The test results show that all the preparations also met the requirements of pH, viscosity, adhesivity and spreadability.

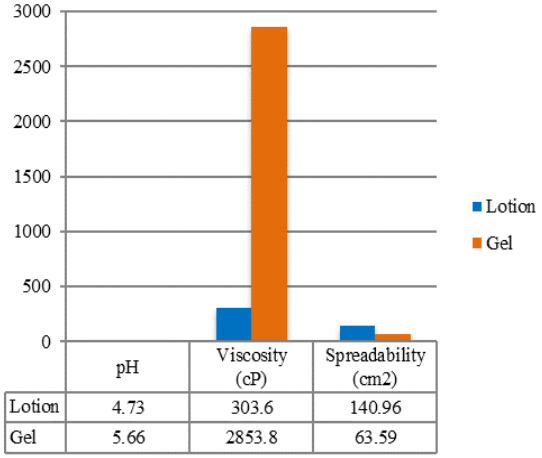
The test results show that the pH values of the lotion (4.75) and the gel (5.66) met the requirements of pH of the skin preparation that are between 4.5 to

Table 3: Result of identification of chemical content on moringa extract.

Test	Reagen	Result	Evidence
Alkaloid	HCL 2N, Dragendorf and mayer	+	There was sediment
Flavanoid	Ethanol 70%, amonia	+	Yellow
Polyphenol	$FeCL_3$	+	Green dark

Table 4: The number of β carotene, IC_{50} and SPF value of extract moringa.

No	Test	Result
1.	The number of β karoten	0,024 mg/ml
2.	The value of IC_{50}	516,28
3.	The value of SPF	33.25±0.98

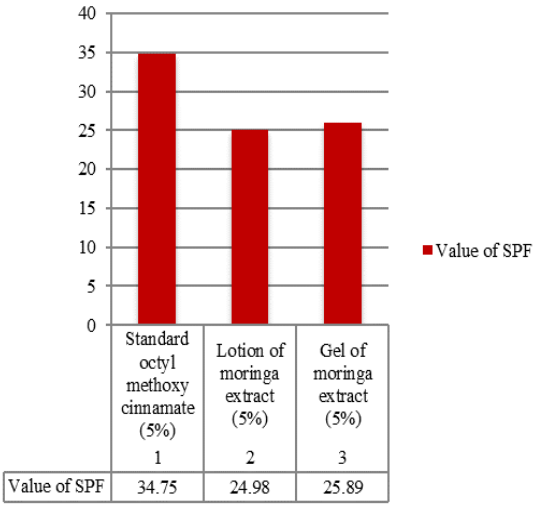


	pH	Viscosity (cP)	Spreadability (cm2)
Lotion	4.73	303.6	140.96
Gel	5.66	2853.8	63.59

Figure 2: The result of evaluation of physical characteristic of gel and lotion.

6.5 (Swastika *et al*., 2013). Otherwise, it will cause irritation. The viscosity of the lotion (303.6 cP) was lower than gel (2,853.8 cP) which resulted in a thinner consistency. It also increased the lotion's spreadability and decreased its adhesivity (Vicky *et al*., 2016; Latifah *et al*., 2016). The lotion and the gel met the requirements of adhesivity, that is at least 4 seconds, spreadability, that is between 5-7 cm^2 (Ulaen *et al*., 2012; Garg *et al*., 2002).

The potencies of lotion and gel of moringa leaf extract as a sunscreen agent were evaluated based on SPF values as presented in Figure 3. The results show that, at concentration of 5%, both gel and lotion have a strong activity as sunscreen although the values were lower than the standard octyl



	Standard octyl methoxy cinnamate (5%)	Lotion of moringa extract (5%)	Gel of moringa extract (5%)
	1	2	3
Value of SPF	34.75	24.98	25.89

Figure 3: The values of SPF of standard, lotion, and gel.

Table 5: The result of evaluation of physical characteristic of gel and lotion.

Test	Lotion	Gel
Adhesivity (minute)	>10	>10

methoxycinnamate. The existing sunscreen activity may be due to the presence of active ingredients such as alkaloids, flavonoids and polyphenols that are able to absorb the sunlight.

4 CONCLUSION

Moringa leaf extract contains alkaloids, flavonoids and polyphenols and meets the requirements of moisture content, ash content and acid soluble ash content. The extract has a weak antioxidant activity but a strong activity as a sunscreen. Similarly, when it has been formulated in the preparation forms, of lotion and the gel have a strong sunscreen activity and meet the requirements of physical properties of preparations.

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