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PHYSICAL QUALITY EVALUATION AND ANTIOXIDANT ACTIVITY OF RED WATERMELON (*Citrullus lanatus* Thunb.) RIND EXTRACT LOTION

Physical Quality Evaluation And Antioxidant Activity of Red Watermelon* (*Citrullus lanatus* Thunb.) *Rind Extract Lotion

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ABSTRACT

Skin is an organ that covers the entire surface of a living creatures's body. The topical preparations such as lotions is widely used to protect the skin from free radicals because the antioxidant content. One of plant that can be used is watermelon. Red watermelon rind contains lycopene, vitamin C, niacin, citrulline, beta-carotene, and vitamin E, which function as antioxidants. The aim of this study was to determine the physical quality and antioxidant activity of red watermelon rind extract lotion (*Citrullus lanatus* Thunb.). This methods of research was a quantitative descriptive. The lotion was made in four formula with various concentration of extract including F0(0%), F1(5%), F2(10%), and F3(20%). The lotion was evaluated for physical quality and antioxidant activity using a UV-Vis spectrophotometer. Physical quality assay for lotions include organoleptic, homogeneity, spreadability, stickiness, pH, and viscosity assay. The result of organoleptic F0 was a white in color, semi-solid, and has a distinctive base smell. The F1-F3 lotion was brownish-white, semi-solid, and has a characteristic smell of watermelon rind. The lotions were homogeneous, with spreadibility of 5.23-6.35 cm, stickiness of 1.55-3.50 seconds, pH of 5.50-6.81, and viscosity of 2755-4351 cps. The lotion F0 was classified as very weak antioxidant activity with an IC_{50} of 577.59 ppm, F1-F2 were classified as the moderate antioxidant activity with IC_{50} of 141.91 ppm and 100.31 ppm, and F3 was a strong antioxidant activity with IC_{50} of 59.93 ppm. All lotion formulas have complied with the topical preparation reference and SNI-16-4399-1996.

Keywords: watermelon rind, lotion, antioxidant activity

INTRODUCTION

Skin is an organ that covers the entire surface of the body of living creatures. The skin has a mechanism to defend against the toxic effects of exposure to UV rays, such as sweating and the formation of melanin, but with excessive exposure, the skin is unable to provide sufficient protection because there are many external environmental influences. This can cause damage to skin tissue and even cancer (Putri et al., 2019; Salasa, 2019). The topical preparation is widely used to protect the skin from free radicals because the antioxidant content. Free radicals in the form of ultraviolet rays are one of the causes of skin damage. In excessive conditions, UV rays can cause several skin problems, ranging from redness, and pigmentation, and even in the long term, causing the risk of cancer (Sari, 2012). One way to protect the skin from exposure to harmful free radicals is by using lotion (Tranggono & Latifah, 2014).

The lotion is a cosmetic preparation that is easy to spread evenly and provides comfort when used on the skin surface (Latifah et al., 2016). Lotion is usually in the form of an emulsion made from a mixture of oil phase, water phase, and emulsifier as the emulsion base as well as active ingredients derived from plant extracts (Sayuti, 2015). The active ingredients that can be used in lotion preparations are active ingredients that have antioxidant properties. It is important to look for alternative natural antioxidants that can ward off free radicals and can be used safely (Ren et al., 2003).

One plant that contains high antioxidants is watermelon. Watermelons are generally only consumed by the flesh, while the white layer on the rind is less desirable and only thrown away as waste. The white rind of red watermelon is not used optimally, meanwhile it contains that are so many beneficial substances for health, such as vitamin C and citrulline. Vitamin C and citrulline are antioxidants that are beneficial for the immune system and skin health (Rochmatika et al., 2012).

Red watermelon rind contains vitamins, minerals, chlorophyll, and enzymes. Red watermelon rind contains lots of vitamin C, vitamin A, lycopene, vitamin B2, citrulline, vitamin E, and vitamin B6. The high content of vitamin E, vitamin C, and protein in watermelon rind is used to smooth skin, and hair, and make hair look shiny. Vitamin C can be used to increase the body's endurance and as an antioxidant. Beta-carotene and lycopene found in watermelon rind are used as antioxidants for the body's immune system, tighten facial skin, and prevent wrinkles on the skin (Prahasta, 2009). Based on research, the ethanol extract of the white layer of red watermelon rind has a very strong antioxidant activity with an IC_{50} value of 14.796 ppm (Mariani et al., 2018).Therefore, researchers are interested in making innovations from the white layer of rind of red watermelon into an active ingredient in lotion preparations and testing its physical quality and antioxidant activity.

METHOD

The materials used in this research were red watermelon rind, methanol (*Merck*), cetyl alcohol (*Sigma Aldrich*), stearic acid (*Sigma Aldrich*), paraffin (*Sigma Aldrich*), buffer pH 7, 1,1-diphenyl-2-picrylhydrazyl (DPPH) Sigma Aldrich.

The equipment used is analytical scales (*Labex*), porcelain cups, object glass, water bath, thermometer, mortar and stamper, round bottom glass, stopwatch, calipers, pH meter (*Hanna HI 8010*), viscometer (*NDJ-82*), glass plate, adhesion test equipment, weights, and UV-Vis spectrophotometer (Raptor).

The research method used is a descriptive quantitative, whereas the analysis of research data is presented in the form of tables and narratives. The research was carried out at the integrated campus laboratory of campus 3 of the Health Polytechnic, Ministry of Health, Surakarta. The research stages include raw material preparation, extract making, lotion formulation, physical quality assay, and antioxidant activity.

Raw Material Preparation

The raw material for red watermelon rind was obtained from one of the fruit shops in Wedi. The selection of raw materials is done by looking at fruit that looks fresh, and does not appear wilted or rotten. For red watermelon, choose round fruit, the rind of the fruit is dark green with dark green stripes

Making Extracts

Extraction is carried out using the squeezing method. Preparation of modified extract according to Artika (2019), Start by preparing 1 kg of the white layer of red watermelon rind which is first washed, sorted, and separated between the fruit and the rind and then cut into pieces. The samples were squeezed using a juicer. The juice is concentrated in a water bath at a temperature of 60 °C to obtain a thick extract. The extract obtained from the extraction method is calculated as % yield.

Making Lotion

The formula for the red watermelon rind extract lotion can be shown in Table 1.

Table 1. Composition Lotion

Material	Function	Formula (%)			
		F0	FI	F2	F2
Red watermelon rind extract	Active substance	0	5	10	20
Cetyl alcohol	Thickener	2	2	2	2
Liquid paraffin	Emollient	5	5	5	5
Stearic acid	Emulsifier	2.5	2.5	2.5	2.5
Glycerin	Humectant	5	5	5	5
Triethanolamine	Emulsifier	1	1	1	1
Nipagin	Preservative	0.1	0.1	0.1	0.1
Nipasol	Preservative	0.1	0.1	0.1	0.1
Aquadest	Solvent	Add 100	Add 100	Add 100	Add 100

Source :(Putri et al., 2019)

Lotion formulations are divided into the oil phase and the water phase. The oil phase consisting of paraffin, nipasol, stearic acid and cetyl alcohol was put into an evaporating dish porcelain and heated at a temperature of 70 °C on water bath. Nipagin was dissolved in a little hot distilled water. Glycerin and triethanolamine were added to a water bath at a temperature of 70 °C. The oil phase was mixed into the water phase in a hot mortar and stirred quickly until a lotion base is formed. Aquadest is added to the desired volume in each formula. The extract that has been dissolved with some of the water phases is added and stirred until it is homogeneously mixed. Put the lotion into the prepared place (Putri et al., 2019).

Physical Quality Test

The organoleptic test was carried out by observing the physical appearance of the lotion. Tests carried out include color, shape, and odor (Kadang et al., 2019).

Homogeneity test was carried out by placing the 0.5 g of lotion on an object glass, leveling it, and observing it visually. Homogeneous lotion is characterized by the absence of coarse granules or agglomerate in the preparation (Sandi & Musfirah, 2018).

Spreadability test was carried out by placing the 0.5 g of lotion in the middle of a glass plate and leaving it for 1 minute, measuring the diameter of the lotion. An additional load of 200 g was added and left for 1 minute, and then the diameter was measured. A good lotion has a spreading capacity of between 5-7 cm (Dominica & Handayani, 2019).

Stickiness strength test was carried out by smearing the 0.5 g of lotion on an object glass. Another object glass was placed on top of the lotion, given a weight of 1 kg, and left for 1 minute. The object glass was placed on the test equipment, and then a load weighing 80 g was released. The time of release of the two object glasses was recorded. The good adhesion is < 4 seconds (Amalia & Sukmawati, 2022).

The pH measurements were carried out by preparing 0.1 g of lotion dissolved in 10 mL of distilled water. The lotion solution is measured with a pH meter. A good pH value range is 4.5-6.5 (Kadang et al., 2019).

Viscosity test was carried out by pouring the 250 ml of lotion into beaker glass. Spindle number 3 is installed on the tool and immersed in the sample so that the surface of the test substance is above the limit mark. The rotor is turned on at a speed of 30 rpm, then the Brookfield viscometer waits until the viscosity value is stable and the viscosity is recorded (Laksana et al., 2017).

Antioxidant Activity Test

Test of antioxidant activity begins with making a 40 ppm of DPPH solution in methanol and making a dick solution containing DPPH solution and methanol with ratio 1:1. The antioxidant activity of the samples was determined by making solutions with concentrations of 30, 60, 90, 120, and 150 ppm. 2 mL of each solution was taken and reacted with 2 mL of 40 ppm of DPPH solution then homogenized and left for 30 minutes in a dark place. The absorbance of the solution is measured at the maximum wavelength (Modification of Hartati et al., 2020).

RESULTS AND DISCUSSION

Making red watermelon rind extract resulted in the yield as in Table 2.

Table 2. Extract % Yield Results

Material	Material weight (g)	Extract weight (g)	Yield (%)
Red watermelon rind	1000	25.28	2.528

Based on Table 2, the yield of red watermelon rind extract was 2.528%. The results obtained are greater than research Princess (2022) which stated that the % yield was 1.44%. This can be caused by the influence of different raw materials, and different locations of plants which will affect the yield. The results of this research are also greater than Okzelia (2022) amounting to 1.4%. This is because the extraction method used is different, namely maceration using 70% ethanol solvent. Different extraction methods produce different yields. The yield is influenced by several factors, including the size of the simplicia, the solvent type, solvent concentration, and length of extraction time. Apart from that, something that can be a factor in the small yield of extracts is the place where the sample was taken. Different samples will produce different secondary metabolite compounds (Sineke et al., 2016).

The organoleptic test was carried out by observingat the physical appearance which includes color, shape or texture, and smell of the lotion. The organoleptic of the lotion preparation are shown in Table 3.

Table 3. Lotion Organoleptic Results

Formulas	Organoleptic		
	Color	Form	Smell
F0	White	Semisolid	Base
F1	Brownish-white	Semisolid	Distinctive watermelon rind
F2	Brownish-white>>	Semisolid	Distinctive watermelon rind
F3	Brownish-white >>>	Semisolid	Distinctive watermelon rind

Information :
F0 = Formula containing 0% red watermelon rind extract
FI = Formula containing 5% red watermelon rind extract

F2 = Formula containing 10% red watermelon rind extract
F3 = Formula containing 20% red watermelon rind extract

Based on Table 3, the organoleptic test results of watermelon white rind extract lotion F0 are white, while F1-F3 are brownish-white which becomes more intense as the concentration of the added extract increases, while for F0 it is white because it only comes from the base without the addition of extract. From F1-F3 it has a distinctive smell of red watermelon rind because it comes from the added extract. The organoleptic results obtained are similar to Safitri & Safitri (2020), who stated that a good lotion is suitable as a lotion preparation in semisolid and has a color and odor according to the sample used.

Homogeneity test on watermelon rind extract lotion was carried out to determine whether a preparation was completely mixed or not, as shown in Table 4.

Table 4. Lotion Homogeneity Results

Formulas	**SNI-16-4399-1996 requirements**	**Homogeneity**	**Interpretation**
F0	Homogeneous	Homogeneous, no lumps	Fulfill
F1		Homogeneous, no lumps	Fulfill
F2		Homogeneous, no lumps	Fulfill
F3		Homogeneous, no lumps	Fulfill

The four lotions had homogeneous results as indicated by the absence of lumps in the samples. The homogeneity of lotion was obtained meet the requirements of SNI -16-4399 concerning lotion quality requirements (BSN, 1996). The results obtained are similar to Damayanti et al. (2017) who stated that a good lotion preparation is the absence of lumps or coarse grains between the ingredients and the lotion base when applied to transparent glass.

Spreadability test was carried out to determine the lotion's ability to spread when applied to the skin surface. The spread ability results obtained can be seen in Table 5.

Table 5. Lotion Spreadability Results

Formulas	**Referenceof Dominica & Handayani (2019) (cm)**	**Spreadability Mean ± SD (cm)**	**Interpretation**
F0	5-7	6.35 ± 0.01	Fulfill
F1		5.73 ± 0.04	Fulfill
F2		5.62 ± 0.02	Fulfill
F3		5.23 ± 0.01	Fulfill

Based on Table 5, the spreadability of red watermelon rind extract lotion is similar to Dominica & Handayani, (2019) who stated that a good spreadability was 5-7 cm. From the four lotion formulas, the one with the greatest spreadability was F0 of 6.35 cm and the smallest was F3 of 5.23 cm. This is because the greater the concentration of the extract added, the smaller the spreadability, proportional to its viscosity. As similar Lumentut et al. (2020) stated that the greater the concentration of extract added to the preparation, the smaller its ability to spread.

The adhesion test aims was to determine the contact time for the lotion to stick to the skin. The adhesion test result can be seen in Table 6.

Table 6. Lotion Stickiness Results

Formulas	Reference of Amalia & Sukmawati (2022) (second)	Stickiness Mean±SD (seconds)	Interpretation
F0	≤4	1.55±0.02	Fulfill
F1		1.79±0.01	Fulfill
F2		2.61±0.03	Fulfill
F3		3.50±0.02	Fulfill

The stickiness of the four formulas is similar to Amalia & Sukmawati (2022) which stated good adhesion in less than 4 seconds. F0's adhesion was the fastest compared to F1, F2 and F3. The bonding time for F0 was the fastest, namely 1.55 seconds and F3 was the longest compared to the others was 3.50 seconds. This is because the higher the concentration of the extract added, the thicker it is and the longer the stickiness. The thicker the consistency of the preparation, the longer it takes for the two glass objects to separate. Apart from that, if the consistency of the lotion is thicker, the contact of the material on the skin surface will also be longer (Sawiji & Sukmadiani, 2021).

The pH testing is carried out to determine the acidity level of a preparation so that it does not irritate the skin. The pH of the four formulas can be seen in Table 7.

Table 7. pH Lotion Results

Formulas	SNI-16-4399-1996 requirements	pH Mean±SD	Interpretation
F0	4.5-8.0	6.81 ± 0.04	Fulfill
F1		6.27 ± 0.05	Fulfill
F2		5.98 ± 0.01	Fulfill
F3		5.50 ± 0.02	Fulfill

Based on Table 7, showed that the four formulas meet the requirements of SNI-16-4399-1996 regarding lotion quality requirements. From the four formulas, F0 has the highest pH because there are no added extracts in it. Meanwhile, the pH results for F1-F3 decreases, due to the increasing of the extract concentration in the lotion. The pH results obtained decreased along with increasing the concentration of watermelon white peel extract. This is similar to research Elmitra & Rikomah (2018). Thus, the formula is safe for use on the skin. A pH value that is too low causes skin irritation, the skin can become inflamed, while too high of pH can cause the skin to become dry, scaly, and sensitive (Utami, 2019).

Viscosity test aims to determine whether the preparation is easy to pour or not. The viscosity can be seen in Table 8.

Table 8. Lotion Viscosity Results

Formulas	SNI-16-4399-1996 (cps) requirements	Viscosity Mean±SD (cps)	Interpretation
F0	2,000-50,000	2,755 ± 26.85	Fulfill
F1		3,258±26.17	Fulfill
F2		3,896±14.18	Fulfill
F3		4,351±26.52	Fulfill

Based on Table 8, it can be seen that the four lotion formulas meet the requirements of SNI-16-4399-1996 regarding lotion quality requirements. F0 has the lowest viscosity, namely

2,756 cps, and the highest was F3, namely 4,350 cps. F0 has the most dilute form compared to F1, F2 and F3. The higher the concentration of the added extract, the viscosity of the lotion will increase. This proves that the greater the concentration of the extract added, the greater the viscosity produced from a preparation (Damayanti et al., 2017)

The antioxidant activity test of lotion preparations was carried out to determine the ability of these preparations to inhibit free radicals. Antioxidant activity testing was carried out at a wavelength of 516 nm. The results of antioxidant activity testing can be seen in Table 9.

Table 9.Antioxidant Activity

Sample	**IC_{50} (mg/L)± SD**	**Category**
Vitamin C Standard	3.022±0.278	Very strong
F0	577.585±57.394	Very weak
F1	141.914±0.878	Moderate
F2	100.309±0.656	Moderate
F3	59.932 ± 3.385	Strong

All formulations have different antioxidant activities. F0 has very weak category with an IC_{50} value of 577.583 ppm, F1 and F2 were classified as moderate antioxidant with IC_{50} were 141.914 ppm and 100.309 ppm. F3 is classified as strong antioxidant with IC_{50} was 59.932 ppm. This is similar to what was explained by Kurniawati & Sutoyo (2021) that an IC_{50} value of <50 ppm was categorized as very strong antioxidant activity, 50-100 ppm was categorized as strong, 100-150 ppm was categorized as moderate, 150-200 ppm was categorized as weak, and >200 ppm was categorized as very weak. F0 has very weak antioxidant activity because there is no added extract in it. F1 and F2 have moderate antioxidant activity with the addition of 5% and 10% extract due to the IC_{50} value in the range of 100-150 ppm. Meanwhile, F3 has the strongest antioxidant activity among F0, F1, and F3 because the adding concentration of the extract is the highest. This is similar with Miranti et al. (2016) stated that the higher concentration of the extract, the stronger the antioxidant activity produced. The ability of the active ingredients in the lotion to inhibit free radicals is getting stronger. However, when compared with the white rind extract of red watermelon, the antioxidant activity of lotion is relatively lower, whereas the antioxidant activity of the white rind extract of red watermelon was very strong with an IC_{50} value amounting to 14.796 ppm (Mariani et al., 2018). Apart from that, if we compare it with vitamin C standard, the antioxidant activity is much smaller. This is due to heating which causes a decrease in antioxidant activity, where the heating process will reduce the antioxidant activity potential due to the destruction of compounds in the sample (Anung et al., 2011).

CONCLUSION

The organoleptic test results of F0 lotion are white, semi-solid, and have a distinctive base smell. Lotion F1-F3 are brownish-white, semi-solid, and have a characteristic smell of watermelon rind. The lotion is homogeneous, with a spreadibility of 5.23-6.35 cm, an adhesion of 1.55-3.50 seconds, a pH of 5.50-6.81, and a viscosity of 2,755-4,351 cps. The antioxidant activity of F0 lotion was classified as very weak category with an IC_{50} value of 577.59 ppm, F1-F2 was classified as moderate in IC_{50} value of 141.91 ppm and 100.31 ppm and F3 was classified as strong with IC_{50} amounted to 59.93 ppm. All lotion formulas meet topical preparation references and SNI-16-4399-1996

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