FORMULATION OF EXTRACT MOISTURIZING CREAM WATERMELON (*Citrullus lanatus* (Thunb.) Matsum. & Nakai) AS ANTIOXIDANT

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Abstract

Dry skin is one of the most common problems, where dry skin looks dull and rough. Therefore, it is necessary to prepare a moisturizing cream that can be obtained from watermelon (*Citrullus lanatus* (Thunb.) Matsum. & Nakai) which has antioxidant activity in the form of flavonoids. *This studi aims to formulate the watermelon extract* (*Citrullus lanatus* (Thunb.) Matsum. & Nakai) *into fresh cream preparations of watermelon extract* (*Citrullus lanatus* (Thunb.) Matsum. & Nakai) *as antioxidants with varying concentrations of F1* (*base*), *F2* (*5%*), *and F4* (*15%*). *This type of research is experimental with a post test design with control with group design. The sample is Watermelon purchased at the Jepara Mayong Market. This research process uses water extract, namely fresh fruit juice thickened with a water bath thermostat at a temperature of 80°C. Determination of antioxidant activity was carried out using UV-Vis spectrophotometry using the DPPH (1,1-diphenyl-2-picrylhidrazil) method using quercetin as a comparison solution. Phytochemical screening of watermelon extract* (*Citrullus lanatus* (Thunb.) Matsum. & Nakai) *was positive for flavonoids, saponons and sucrose. The content of watermelon extract used for the antioxidant activity test was flavonoids. Watermelon* (*Citrullus lanatus* (Thunb.) Matsum. & Nakai) *fruit extract has moderate antioxidant activity with an IC50 of 143,93 µg/ml. formulated into a moisturizing cream has weak antioxidant activity IC50 at F1, F2, F3, and F4 respectively 552,09 µg/ml, 451,50 µg/ml and 387,26 µg/ml. The study shows that watermelon extract* (*Citrullus lanatus* (Thunb.) Matsum. & Nakai) *has moderate antioxidant activity and can be formulated into a moisturizing cream for watermelon extrac.*

Keywords*: Watermelon* (*Citrullus lanatus* (Thunb.) Matsum. & Nakai), *Antioxidant, Moisturizing Cream.*

INTRODUCTION

Beautiful, clean, and healthy skin, one of which is maintaining healthy skin. Skin is the outermost layer of the body that protects internal organs and important organs in the human body, skin can also be used as an indicator that can indicate a disease, such as hepatitis which is indicated by changes in skin color to yellow (Pratiwi *et al.*, 2017). The skin is divided into several parts, one of which is the facial skin. Facial skin is classified into several types including normal skin, combination skin, oily skin, dry skin, and sensitive skin (Susanti, 2015).

Cosmetic preparations that act as moisturizers can be used ti prevent the evaporation of water and can cause the skin to become moist, smooth, and healthy by forming a thin layer of fat on the surface of the skin. Moisturizers are preparations used to improve dry skin. Dry skin is one of the most common skin problems, where dry skin will look dull, scaly surface, and rough and dry white areas evenly (Voegeli, 2007). Skin moisturizing preparations can reduce Trans Epidermal Water Loss (TEWL) by forming a thin layer of fat on the skin surface as a barrier, calming dermal nerve endings, and restoring skin softness (Simion *et al.,* 2005).

One of the things that can cause disease and cause premature aging is free radicals. Because free radicals are compounds or molecules that have one or more unpaired electrons. These electrons act as materials that combine several atoms to form molecules in chemical reactions. These free radicals tend to attract electrons and have the ability to convert a molecule into a new free radical. So that new reactions occur that can stop if these free radicals are quenched with antioxidants (Yuslianti, 2018). One of the causes that can increase the number of free radicals caused by radiation, cigarette smoke, and stress. The number of free radicals and antioxidant that are not balanced can cause oxidative stress and can trigger the occurrence of lipid peroxidation (Suryadinata, 2018). Oxidative stress is a condition where damage to the

occurrence of fatty preoxides on cell membrans that is allowed to continue will cause an imbalance between free radicals and endogenous antioxidants (Parwata, 2016).
Antioxidants are substances at significantly small concentrations that can inhibit oxidation reactions on substrates such as degenerative diseases, namely cardiovascular, carcinogenic, and other diseases (Parwata, 2016). Antioxidants can be grouped based on their source, namely natural antioxidants and synthetic antioxidants. Natural antioxidants are antioxidants obtained from plant parts such as wood, leaves, roots, fruit, flowers, and vegetables that contain vitamin A, vitamin C, vitamin E, and phenolic compounds (flavonoids). Synthetic antioxidants are antioxidants that are mostly used in food products in the form of Butyl Hydroxy Anisol (BHA), Butyl Hydroxy Toluene (BHT), Propyl gallate, and Ter-Butyl Hydroxy Quinone (TBHQ) (Parwata, 2016).
To obtain antioxidant properties, there are now many foods that contain antioxidants. One of them that is often recommended is fruit. Some fruits can be used as moisturizing products, one of which is watermelon (*Citrullus lanatus* (Thunb.) Matsum. & Nakai). Fruit (*Citrullus lanatus* (Thunb.) Matsum. & Nakai) is a good source of pure water. Where in the content of watermelon (*Citrullus lanatus* (Thunb.) Matsum. & Nakai) one of them contains flavonoid carotene pigments that can give a yellow or red color. This color pigment protects against free radical attack. This flavonoid content can also act as an antiallergic and has the ability as a high antioxidant and prevent anticancer disease (Bangun, 2005).
Red watermelon (*Citrullus lanatus* (Thunb.) Matsum. & Nakai) contains 92.1% water, 0.5 grams protein, 0.2 grams fat, 6.9 grams carbohydrates, vitamin A 590 SI, vitamin C 6 mg, niacin 0.2 mg, riboflavin 0.05 mg, thiamin 0.05 mg, calcium 7 mg, iron 0.2 mg, phosphorus 12 mg (Kalie, 2008). In addition, watermelon (*Citrullus lanatus* (Thunb.) Matsum. & Nakai) also contains citrulline acid, alanine, glutamic acid, arginine, phosphoric acid, malic acid, ethylene acid, glucose, fructose, sucrose, vitamin B4, etc. All the content contained in watermelon fruit (*Citrullus lanatus* (Thunb.) Matsum. & Nakai) can be used as a good antioxidant because it can neutralize free radicals contained in ultraviolet light and pollutants (Surtiningsih, 2005).
Watermelon contains alkaloids, phenolic compounds, and flavonoids. Where the results of the antioxidant activity test showed a very strong antioxidant activity with an IC50 value of 31.42 g/mL using 70% ethanol as solvent. Based on these results, it shows that the watermelon (*Citrullus lanatus* (Thunb.) Matsum. & Nakai) mesocarp has very strong antioxidant activity against free radicals using the ABTS method (2,2-azinobis-(3-ethyl benzothiazoline-6-sulfonic acid) (Astuti *et al.,* 2021).

METHOD

Types of research

This type of research was conducted using an experimental method which was carried out to see the effect of the independent variable of the study, namely the formulation of a moisturizing cream preparation from watermelon extract (*Citrullus lanatus* (Thunb.) Matsum. & Nakai).

Research design

The research design in this study was to make watermelon extract formulated into a moisturizing cream preparation of watermelon extract (*Citrullus lanatus* (Thunb.) Matsum. & Nakai) as an antioxidant.

Population

The population used in this study was watermelon plants obtained from Mayong Jepara.

Sample

The sample is part of the number and characteristics possessed by the population that can be studied and conclusions are drawn.
The characteristics of the sample in this study are:

1. 8 months old red watermelon
2. Watermelon with green skin with yellowish stripes
3. Fruit is fresh and undamaged (still intact)
4. Watermelon weighing 5-6 kilograms

Research sites

Plant determination was carried out at the Pharmacy Biology Laboratory, Ahmad Dahlan University, Yogyakarta. The formulation and test of antioxidant activity of the moisturizing cream preparations of watermelon (*Citrullus lanatus* (Thunb.) Matsum. & Nakai) extracts were

carried out at the Laboratory of the Kudus Main Cendekia Utama Institute of Health Technology.

Research time

The time to carry out the research is from February to April 2022.

Research instrument

The equipment used in this study included: a measuring cup (Herma), measuring flask (Herma), blender, filter paper, funnel glass (Herma), micropipette, dropper pipette, flacon, beaker glass (Herma), stirring rod, mortar, stamper, horn spoon, analytical balance (Ohaus), rotary evaporator (Eyela N-1000), spatula, UV-Vis spectrophotometer (Biobest), and Eyela SB-1000 water bath, ointment pot, spatula.

The sample used was watermelon extract, the materials used in the antioxidant activity test were quercetin solution (Bratacem), pro-analytical ethanol (Bratacem), and DPPH (1,1-diphenyl-2-picrylhydrazil) (Bratacem). The materials used in this study included watermelon extract (Citrullus lanatus Thunb.) Matsum. & Nakai, sodium lauryl sulfate (Bratacem), stearic acid (Bratacem), cetyl alcohol (Bratacem), propylene glycol (Bratacem), methylparaben (Bratacem), propylparaben (Bratacem), oleum rosae (Bratacem), aquadest, Mg, HCl concentrated, $FeCl_3$, Molisch reagent (solution of -naphthol in ethanol).

Data Collection Technique

1. Plant Determination

Determination is done by comparing samples of plants that are not yet known with plants whose identity is known so that there are no errors when taking plants. The determination test was carried out at the Pharmacy Biology Laboratory, Faculty of Pharmacy, Ahmad Dahlan University, Yogyakarta.

2. Sampling

The sample taken was watermelon with a fruit weight of 3300 grams, the fruit taken was fruit that was still fresh and wet, and free from contamination.

3. Sample Processing

Fresh red watermelons are washed, then separated from the red flesh from the skin and seeds. The flesh of the fruit is then cut into smaller pieces and weighed to obtain its weight. The fresh Simplicia was mashed using a blender, then filtered. The watermelon juice was then evaporated using a water bath at 80^{o}C to obtain a thick extract (Ekayanti *et al.,* 2019).

4. Extract Standardization
   a) Non-specific Standardization
      1) Determination of Water Content

Determination of water content is done using a moisture balance tool. As much as 2 grams of watermelon extract was put into an aluminum cup. Wait until it gives a sign that appears on the moisture balance device which indicates that the drying process with the tool has been completed, then reads and record the moisture content (Rustam *et al.,* 2018).

   b) Specific Standardization
      1) Organoleptic Examination

Organoleptic tests can be carried out using the human senses to determine the shape, color, and smell of watermelon extract (Juwita *et al.,* 2013).

      2) pH check

The pH test is a test carried out to determine the pH of watermelon extract by weighing 1 gram of the sample diluted with 10 mL of distilled water (Juwita *et al.,* 2013).

5. Phytochemical Screening Test
   a) Flavonoid test, put 1 gram of extract into a test tube, add magnesium and concentrated HCL, heated for 15 minutes. The formation of red or yellow color indicates the presence of flavonoids (Muthmainnah, 2017).
   b) Saponin examination, put 1 gram of extract into a test tube, added 10 mL of hot water, cool, and shake for 10 seconds. If a stable foam is formed, it means that it contains saponins (Muthmainnah, 2017).
   c) Sucrose Test, the test is carried out by inserting a 2 mL sample into a test tube, adding 2 drops of Molisch reagent and 5 mL of concentrated HCL through the wall, a positive result is indicated by the formation of purple color in the solution (Milgia, 2020).

d) Tannin test, put 1 gram of extract into a test tube, add 10 mL of hot water, boil for 5 minutes and add 3-4 drops of $FeCl_3$. The formation of a green-blue color (green-black) means that it indicates the presence of tannins (Muthmainnah, 2017).

6. How to Make Moisturizing Cream

From the research results, the formulation of avocado flesh extract cream was taken with a good concentration of emulsifier selection, namely sodium lauryl sulfate with a concentration of 2% (Stevani *et al.,* 2019), as shown in table 1 below:

Table 1 Watermelon Extract Moisturizing Cream Formulation

Material name	Function	F1 (%)	F2 (%)	F3 (%)	F4 (%)	Range
Watermelon extract	Active ingridients	0	5	10	15	-
Sodium Lauryl Sulfate	Emulsifier	2	2	2	2	0,5-2,5
Stearic Acid	Fat base	15	15	15	15	1-20
Cetyl Alcohol	Emolient	3	3	3	3	2-5
Propileneglycol	Humectant	10	10	10	10	5-80
Methylparaben	Preservative	0,18	0,18	0,18	0,18	12-0,18
Prophylparaben	Preservative	0,2	0,2	0,2	0,2	0,01-0,6
Oleum Rosae	Fragrance	0,3	0,3	0,3	0,3	0,3
Aquadest	Solvent	Ad 100	Ad 100	Ad 100	Ad 100	-

Weighed all the ingredients to be used including watermelon extract, stearic acid, sodium lauryl sulfate, cetyl alcohol, propylene glycol, methyl paraben, propyl paraben, oleum rosae. The first step is to make the oil phase by melting each cetyl alcohol, stearic acid, and propylparaben into a porcelain dish and then heating at a temperature of 70°C and the temperature is kept stable or constant.

The second step is to make the aqueous phase by melting sodium lauryl sulfate, methylparaben, propylene glycol, aquadest into a porcelain dish and then melting it at 70°C and keeping the temperature constant. The watermelon extract was mixed with the oil phase and the water phase into a hot mortar simultaneously while stirring until a preparation was formed. Added oleum rosae into the cream mixture until it gives off an aroma. Then the cream is put into a container and tightly closed. Preparations are labelled (Stevani *et al.,* 2019).

7. Physical Properties Test of Cream

a) Organoleptic Test

The organoleptic test of cream preparations was carried out by observing the color, odor, and dosage form of the cream (Safitri *et al.,* 2014).

b) Homogeneity Test

A total of 1 gram of cream preparation is applied to the slide, then flattened. The results of the preparation must show that it is free from particles that are still clumping and there are no visible coarse grains (Suartha *et al.,* 2021).

c) pH Test

The cream was weighed as much as 1 gram and then diluted with 10 mL of distilled water. Then tested using a pH indicator. The pH of the preparation is good according to the pH of the skin, namely 4.5-6.5 (Juwita *et al.,* 2013).

d) Spreadavility Test

A total of 1 gram of cream was weighed and placed in the middle of a slide then left for 1 minute and given a load of 50 grams (Riski *et al.*, 2017). This test was conducted to determine the speed of spread and even distribution of the cream when applied to the skin (Mappa *et al.,* 2013).

e) Adhesion Test

A total of 0.5 grams of cream was smeared on a slide that had been given a load of 1 gram for 5 minutes. A load weighing 80 grams is released at the bottom of the glass object and then the time of cream release is recorded (Saryanti *et al.,* 2019).

8. Antioxidant Activity Test

a) Preparation of DPPH Solution

A solution of 0.1 mM DPPH concentration was prepared by weighing 9.8 mg of DPPH into a measuring flask and adding 250 mL of ethanol p.a (Molyneux, 2004).

b) Preparation of Quercetin Comparison Solution

50 mg of quercetin was weighed into a volumetric flask and 50 mL of ethanol p.a was added to obtain a concentration of 1000 ppm. Furthermore, a solution with a concentration of 1000 ppm was pipetted as much as 1 mL into a measuring flask with 10 mL of ethanol p.a added to obtain a stock solution of quercetin with a concentration of 100 ppm. Then tested at various concentrations that have been made (Rahmawan & Dwiatmaka, 2016).

c) Determination of Maximum Wavelength (λ)

500 l of 2 ppm quercetin stock solution was taken, put in a flacon, added with 4 mL of DPPH, then the flacon was covered with aluminum foil. Next, scanning was carried out using a UV-Vis spectrophotometer at a wavelength of 400-600nm (Molyneux, 2004).

d) Determination of OT *(Operating Time)*

Determination of operating time was carried out by taking 500 l of 2 ppm quercetin stock solution and adding 4 mL of 0.1 mM DPPH into a flacon that had been covered with aluminum foil. Then read the absorbance for 1 hour at a wavelength of 513nm.

e) Measurement of absorbance of DPPH Solution (control)

Measurement of absorbance of DPPH solution for antioxidant activity using control solution from comparison solution and the test solution. 4 mL of DPPH solution was taken and put into a flacon that had been covered with aluminum foil. Furthermore, absorbance readings are carried out at a maximum wavelength of 513nm.

f) Quercetin Raw Curve Creation

25 mg of quercetin was weighed into a measuring flask and 25 mL of p.a ethanol was added to obtain a concentration of 1000 ppm, from a concentration of 1000 ppm, 1 mL was pipetted with ethanol p.a up to 10 ml to obtain a stock solution of quercetin with a concentration of 100 ppm. Several serial solutions were made with concentrations of 2 ppm, 4 ppm, 6 ppm, 8 ppm, and 10 ppm.

g) Measurement of the absorbance of the comparison solution

Take 500 l of each concentration series that has been made and then put it into the flacon and add 2 mL of 0.1 mM DPPH. then incubated for 31 minutes and the absorbance was measured at a maximum wavelength of 513nm.

h) Antioxidant Activity Testing of Moisturizing Extract and Creams

This test was carried out using the DPPH method and using a UV-Vis spectrophotometer. This test solution was prepared by weighing 50 mg of watermelon extract and 25 mg of cream, adding 50 mL and 25 mL of ethanol p.a. Concentration series of 50 ppm, 75 ppm, 100 ppm, 125 ppm, and 150 ppm were made. From each concentration, 500 l was taken, added with 2 mL of DPPH stock solution, and then homogenized. Incubated for 31 minutes and measured absorbance at a maximum wavelength of 513nm. The absorbance obtained at each concentration was recorded.

$$(\%)\ IC50 = \frac{\text{Control abs.} - \text{Sample abs.}}{\text{Control abs.}} \times 100\%$$

Information :
Abs. control = absorbance DPPH
Abs. sample = absorbance of watermelon extract and cream

Data analysis

The data from the dispersion test, adhesion test, and IC50 were analyzed using SPSS (Statical Product and Service Solution) version 22.0 program. The first step is to analyze the data using the Shapiro Wilk method to determine its homogeneity and normality.

1. If the data is normal ($p>0.05$) and homogeneous ($p>0.05$) it is analyzed using the One Way Anova ($p<0.05$) method to determine the average difference between groups. If there is a difference, it is continued with the Post Hoc Tukey HSD test to see the real difference between treatments.
2. If the data is not normal, and not homogeneous or the data is not normal and homogeneous, it is analyzed using the Kruskal Wallis method to determine the average difference between groups. If there is a difference ($p < 0.05$), followed by the Post Hoct Mann-Whitney test to see the real difference between treatments

RESULT AND DISCUSSION

1. Plan Determination

The determination of red watermelons taken from watermelon gardens in Mayong Jepara was determined at the Biology Laboratory of Ahmad Dahlan University, Yogyakarta. Based on the results of the determination using the Flora of Java book, it shows that the plant used is red watermelon (*Citrullus lanatus* (Thunb.) Matsum. & Nakai) with Number: 067/Lab.Bio/B/II/2022. The following are the results of the determination of watermelon plants used in this study as follows:

1b – 2b – 3b – 4b – 12b – 13b – 14b – 17b – 18b – 19b – 20b – 21b – 22b – 23b – 24b – 25b – 26b – 27a – 28b – 29b – 30b – 31a – 32a – 33c – 631a – 632a – 633a – 634b – 635b – 636b – 637b – 638a – 639b – 640b – 652d – 653a – 654b Cucurbitaceae

1b – 2b – 4b – 6b – 7b – 9b – 11b – 12a – 13a – 14a – 15b – 16a – 17b – 19b Citrullus

1 *Citrullus lanatus* (Thunb.) Matsum. & Nakai.

2. Sample Processing

Processing of watermelons can be done by selecting red watermelons with light green skin with a shiny line pattern, weighing the total weight, washing them thoroughly, and separating the red flesh of the watermelon from the skin and seeds. The watermelon flesh is then cut into smaller pieces and weighed to get the weight. Then the watermelon flesh that has been weighed is mashed using a blender and filtered. Watermelon juice obtained was weighed to determine the weight of the juice.

Watermelon juice is then thickened in a water bath with a temperature of 80^{o}C until a thick watermelon extract is obtained. In line with the research of Ekayanti *et al.,* (2019), the heating temperature of 80^{o}C is stable in obtaining a thick watermelon extract without destroying the contents of the watermelon fruit. The thick watermelon extract obtained was weighed to determine the weight and the thick watermelon extract was used in the manufacture of cream preparations.

3. Standardization of Wtermelon Fruit Extract

Watermelon fruit extract was standardized which included non-specific and specific parameters. Watermelon fruit extract was carried out by non-specific standardization in the form of determining water content.

The results of determining the water content of the red watermelon extract resulted in an average of 11.78%. These results indicate that the thick extract of watermelon fulfills the requirements for water content, which is in the range of 5-30%. Specific standardization of red watermelon extract includes organoleptic examination and pH examination.

The organoleptic examination aims to determine the color, smell, and texture of the red watermelon extract. The watermelon fruit extract is dark red, has a characteristic watermelon smell, and has a thick texture.

The results of the pH examination of red watermelon extract produced an average of 5.6. These results indicate that the pH of the red watermelon extract meets the requirements, namely in the range of 4.5-6.5.

4. Phytochemical Screening

Phytochemical screening of watermelon extracts praised the tests for flavonoids, saponins, sucrose, and tannins. The following are the results of phytochemical screening of red watermelon extract, which can be seen in Table 2

Table 2 Data on Phytochemical Screening Results of Watermelon Fruit Extract

Phytochemical Screening	Test Result	Description
Flavonoid Test	(+)	Contains Flavonoids
Saponin Test	(+)	Contains Saponins
Sucrose Test	(+)	Contains Sucrose
Tannin Test	(-)	Does not contain Tannins

Source: Processed primary data (2024)

The results of the phytochemical screening of red watermelon extract were known to contain flavonoid compounds, saponins, and sucrose and did not contain tannin compounds. Following research by Oseni & Okoye, (2013) dan Govindaraj & Vivek, (2015) that watermelon extract contains sucrose, flavonoids, saponins, and no tannin content in watermelon extract.

5. Phsical Properties of Moisturizing Cream Preparation

a. Organoleptic Test

Based on the data table of organoleptic test results, cream preparations produced in all formulations have a semi-solid texture. F1 has a characteristic odor of a base, while F2, F3, and F4 have a characteristic odor of extract. F1 has white color, and F2, F3, and F4 have pink color according to research (Ekayanti *et al.,* 2019).

b. Homogeneity Test

The homogeneity examination of all cream formulations showed homogeneous results, indicated by all the particles observed on the slide that was evenly dispersed and there was no agglomeration on one side. Following the research of Suartha *et al.,*(2021) that homogeneous cream preparations are characterized by being free from particles that are still clumping.

c. pH Test

The pH test aims to determine the preparation of the cream that is made will not irritate the skin. According to Tranggono & Latifah, (2013) the quality requirements for the physiological pH of the skin are between 4.5-6.5. The results of the pH test showed that the pH in all formulas was 5. The results of the pH test met the range of good pH values for skin pH, namely 4.5-6.5.

d. Spreadability Test

The spreadability test aims to determine how well the semi-solid preparation spreads on the skin surface. The ability to spread cream is an important requirement of cream preparations. High dispersion can provide a wide area of distribution on the skin so that the active substance can be spread evenly and effectively. The dispersion test has good requirements, namely between 5-7 cm (Genatrika *et al.,* 2016).

The results obtained for F1, F2, F3, and F4 were 5.1; 6; 5.4; 5.3 where all formulas meet the requirements for semi-solid preparations because the results of the dispersion test are in the range of good dispersibility of semi-solid preparations, which is between 5-7 cm. The difference in the spreadability of the cream in F1, F2, F3, and F4 is because F1 is a base without the addition of red watermelon extract, so the texture of the cream is thicker and difficult to spread. In F2, F3, and F4 the addition of watermelon extract so that the spreadability is higher.

The results of the statistical test of the dispersion test showed that the data were not normal and homogeneous, then continued with the Kruskal Wallis test to determine the difference. The Kruskal Wallis test shows that the P value <0.05 is significant data, which means that there is a significant difference. Then proceed with the Mann-Whitney test to determine the differences between each formula.

From the results of statistical tests, it can be concluded that it has a significantly different dispersion. This significant difference is because F1 is the base without the addition of watermelon extract while F2, F3, and F4 are without the addition of watermelon extract. This can be interpreted that the variation of extract concentration with the higher the amount of extract, the dispersion will increase.

e. Adhesion Test Result

The stickiness test aims to determine how much the cream adheres to the skin. Good adhesion of the cream that can coat or adhere to the skin thoroughly, does not clog pores and does not interfere with the physiological functions of the skin. The adhesion test has a good condition, which is more than 4 seconds.

The results obtained by all the formulas met the requirements for semi-solid preparations because the results of the adhesion test were in the range of good adhesion for semi-solid preparations, which was more than 4 seconds, which meant that the preparations met the requirements for good adhesion.

The difference in the stickiness of the cream preparations on F1, F2, F3, and F4 was because F1 was a base without the addition of red watermelon extract. So, the resulting adhesion time is

longer. In F2, F3 and F4 there was a decrease in the adhesion time of the preparation sequentially because the three formulas contained variations in the concentration of the added extract. This is related to the spreadability test where when the dispersion produced is greater then the ability of the cream to stick to the skin is getting smaller.
The results of the statistical test of the adhesion test showed normal and homogeneous data, then continued with the One Way Anova test to find out the difference. The One Way Anova test shows that the P value <0.05 is significant data, which means that there is a significant difference. Then proceed with the Post Hoc Tukey test to find out the differences between each formula.
From the results of statistical tests, it can be concluded that there is a significant difference between the formulas, which is known with a P value <0.05. This means that the addition of variations in the concentration of the addition of watermelon extract affects the stickiness of the cream preparation, where the higher the concentration of the extract, the lower the stickiness.

f. Antioxidant Activity Test of Watermelon Fruit Extract and Moisturizing Cream
Testing the antioxidant activity of the extract and moisturizing cream of watermelon extract using the DPPH (1,1-diphenyl-2-picrylhydrazyl) method because this method is the most commonly used.
Hydrogen atoms of antioxidant compounds bonded to free electrons are indicated by a purple to yellow color change measured at a wavelength of 513nm. Determination of antioxidant activity in this study using the parameter concentration % inhibition (IC50). The IC50 value is a value that shows the effectiveness of antioxidants that can inhibit free radical activity by 50% (Haeria *et al.,* 2016).

Table 3 IC50 Quercetin and Watermelon Extract

IC50	Average Result
Quercetin	17,18 µg/mL
Watermelon Extract	143,93 µg/mL
5% Cream Formula	508,22 µg/mL
10% Cream Formula	451,50 µg/mL
15% Cream Formula	387,26 µg/mL

Source: Processed primery data (2024)

The result of antioxidant activity obtained that has a strong antioxidant is quercetin because quercetin is a flavonoid of the flavonol group which has a keto group on the C-3 or C-5 atom which is neighboring to flavones and flavonoids (Desmiaty *et al.,* 2009).
Compared to the IC50 of watermelon extract, an average of 143.93 g/mL was obtained, and compared to the IC50 value of the 5% cream formula, an average of 508.22 g/mL was obtained, the 10% cream formula obtained an average of 451 .50 g/mL, and 15% cream formula obtained an average of 387.26 g/mL, which means that it is classified as having a weak antioxidant activity value. antioxidant activity is said to be strong if the IC50 value is between 50-100, the antioxidant activity is said to be moderate if the IC50 value is between 100-150, and antioxidant activity is said to be weak if the IC50 value is between 151-200. The smaller the IC50 value obtained, the higher the antioxidant activity it has (Molyneux, 2004).
Statistical test results show that there is a significant difference between the formulas P value <0.05. This means that the addition of watermelon extract can affect antioxidant activity. The difference in antioxidant value in each formula is due to the amount concentration of watermelon extract added. The greater the amount of extract added to the moisturizing cream preparation, the ability to inhibit free radicals will increase

CONCLUSION

Conclusions

Based on the results of the study it can be concluded that:

1. Watermelon (*Citrullus lanatus* (Thunb.) Matsum. & Nakai) extract can be formulated into a skin moisturizing cream preparation that meets the parameters of good physical properties.
2. Watermelon fruit extract (*Citrullus lanatus* (Thunb.) Matsum. & Nakai) has secondary metabolite compounds that contain flavonoid compounds, saponins, and sucrose.
3. Watermelon fruit extract (*Citrullus lanatus* (Thunb.) Matsum. & Nakai) and watermelon fruit extract cream have antioxidant activity through the free radical

scavenging test using the DPPH method. The antioxidant activity of watermelon extract has an IC50 value of 143.93 g/mL which is in the moderate category. Antioxidant activity in the Moisturizing Cream preparation of watermelon extract (Citrullus lanatus (Thunb.) Matsum. & Nakai) has an IC50 value of F1, F2, F3 and F4 respectively, namely 552.09 g/mL; 508.22 g/mL; 451.50 g/mL and 387.26 g/mL.

Suggestion

From the research that has been done, further research can be done related to:

1. It is necessary to identify the compound using KLT.
2. It is necessary to conduct research using different extraction methods and solvents to maximize the antioxidant activity of the watermelon used in the formulation.
3. It is necessary to test antioxidant activity using different methods such as ABTS and FRAP.

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