Jurnal Farmasi Galenika (Galenika Journal of Pharmacy) (e-Journal) 2021; 7 (1): 77 - 90
ISSN: 2442-8744 (electronic); 2442-7284 (printed)
Journal Homepage: https://bestjournal.untad.ac.id/index.php/Galenika
DOI: 10.22487/j24428744.2021.v7.i1.15462

Formulation and Antioxidant Activity of Clay Mask of Tomato (*Solanum lycopersicum* L.) Lycopene Extract with Variation of Concentration of Kaoline and Bentonite Bases)

(Formulasi dan Aktivitas Antioksidan Masker Clay Ekstrak Likopen Tomat (*Solanum lycopersicum* L.) dengan Variasi Konsentrasi Basis Kaolin dan Bentonit)

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Article Info:
Received: 12 February 2021
in revised form: 26 February 2021
Accepted: 31 March 2021
Available Online: 31 March 2021

Keywords:
Tomato Fruit
Solanum lycopersicum L.
Clay Mask Antioxidant
Kaoline
Bentonite

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ABSTRACT

Free radicals can cause damage to human skin, so antioxidants are needed to counteract the negative effects of these free radicals, for example preparations in the form of face masks. Tomatoes (*Solanum lycopersicum* L.) contains nutritious substances, namely lycopene which can be useful as an antioxidant for the skin. This study aims to determine the effect of variations in kaolin and bentonite bases on physical characteristics and antioxidant activity of tomato lycopene extract *clay* mask, and to determine the best formula. Tomato lycopene extract was modified into a microemulsion preparation to maintain the stability of antioxidant activity. Kaolin and bentonite used as bases had various concentrations in each formula, namely F1: 15% and 2%, F2: 20% and 1.5%, F3: 25% and 1%, F4: 30% and 0.5%. The results showed that the four *clay* mask preparations were homogeneous and no change in color, shape and aroma. The pH test on the four formulas was F1: 4.33 ± 0.35, F2: 5.58 ± 0.24, F3: 6.48 ± 0.22, and F4: 7.34 ± 0.08. The viscosity test on the four formulas was F1 : 20213.3 ± 140.4, F2: 24133.3 ± 83.26, F3 29080 ± 105.83, F4 33293.3 ± 378.06. The spreadability test was F1 6.59 ± 0.24, F2 5.59 ± 0.16, F3 4.85 ± 0.11, F4 7.84 ± 0.05. The test time for the preparation to dry was F1 19.02 ± 0.36, F2 15.33 ± 0.54, F3 11.27 ± 0.42, F4 8.24 ± 0.50. F1 and F2 are very easy to clean. Meanwhile, F3 and F4 are easy to clean. The best formula for *clay* masks is the F3 preparation where the concentration of kaolin is 25% and bentonite is 1%. It also showed the lower antioxidant activity (741.34 µg/mL) than other formulas.

How to cite (APA 6th Style):
Syamsidi, A., Syamsuddin, A. M., Sulastri, E. (2021). *Formulation and Antioxidant Activity Test of Tomato Lycopene Extract (Solanum lycopersicum L.) Clay Mask with Variation of Kaolin and Bentonite Base Concentrations. Jurnal Farmasi Galenika: Galenika Journal of Pharmacy (e-Journal)*, *7*(1), 77-90. doi: 10.22487/j24428744.2021.v7.i1.15462

ABSTRAK

Radikal bebas dapat menyebabkan kerusakan pada kulit manusia, sehingga dibutuhkan antioksidan untuk menangkal efek negatif dari radikal bebas tersebut misalnya sediaan dalam bentuk masker wajah. Buat tomat (*Solanum lycopersicum* L.) memiliki kandungan zat berkhasiat yaitu likopen yang dapat bermanfaat sebagai antioksidan pada kulit. Penelitian ini bertujuan untuk mengetahui pengaruh variasi basis kaolin dan bentonit terhadap karakteristik fisik dan aktivitas antioksidan sediaan masker clay ekstrak likopen tomat, serta mengetahui formula terbaik. Ekstrak likopen tomat (*Solanum lycopersicum* L.) dimodifikasi menjadi sediaan mikroemulsi untuk menjaga aktivitas antioksidan tetap stabil. Kaolin dan bentonit yang digunakan sebagai basis memiliki variasi konsentrasi pada setiap formula berturut-turut yaitu F1 15% dan 2%, F2 20% dan 1,5%, F3 25% dan 1%, F4 30% dan 0,5%. Hasil penelitian menunjukkan keempat sediaan masker clay homogen, tidak mengalami perubahan warna, bentuk, dan aroma. Uji pH pada keempat formula yaitu F1 4,33 ± 0,35, F2 5,58 ± 0,24, F3 6,48 ± 0,22, F4 7,34 ± 0,08. Uji viskositas pada keempat formula yaitu F1 20213,3 ± 140,4, F2 24133,3 ± 83,26, F3 29080 ± 105,83, F4 33293,3 ± 378,06. Uji daya sebar yaitu F1 6,59 ± 0,24, F2 5,59 ± 0,16, F3 4,85 ± 0,11, F4 7,84 ± 0,05. Uji waktu sediaan mengering yaitu F1 19,02 ± 0,36, F2 15,33 ± 0,54, F3 11,27 ± 0,42, F4 8,24 ± 0,50. Uji kemudahan dibersihkan yaitu, F1 dan F2 sangat mudah dibersihkan, F3 dan F4 mudah dibersihkan. Formula terbaik masker clay yaitu sediaan F3 dimana konsentrasi kaolin 25% dan bentonit 1%.

Kata kunci: Buah tomat (*Solanum lycopersicum* L.), Masker Clay, Antioksidan, Kaolin, Bentonit.

INTRODUCTION

Excessive sun exposure can harm human skin, one of which can trigger the formation of free radicals that can cause skin damage. Skin damage is characterized by the appearance of wrinkles, scaly, dry, and cracked skin. Not only does it look dull, but the skin ages are more quickly, and black spots appear (Purwaningsih et al, 2014).

To counteract the negative effects caused by free radicals, antioxidants are needed (Murti, 2016). Tomato fruit is one of Indonesia's native plants that have the potential to be developed as a natural antioxidant. The most chemical content found in tomatoes is lycopene, 100 grams of tomatoes contain an average of 2-5 mg of lycopene. Lycopene in the cosmetic industry is used as a deterrent to skin damage caused by the influence of oxygen and light which are toxic (Agarwal & Rao, 2000).

To keep the stability of antioxidant activity, lycopene extract is made in a microemulsion system first. Microemulsion is an oil and cosurfactant dispersion system with water stabilized by an interface layer of surfactant molecules. In topical use, the microemulsion is easier to penetrate the skin because it has a small particle size and has a water and oil phase, so that, it can affect the permeability of the drug into the skin (Chandra, 2008).

Facial cosmetics are available in various dosage forms, one of which is in the form of masks. These face mask preparations are divided into several types, including the popular one at this time is the wash off type (rinsed using water) with a clay base, which is often referred to as a clay face mask or by the name in the market is a mud mask preparation (Reiger, 2000).

Clay is a clay plate formed from the weathering of granite which can harden and form a solid mass along with the loss of water due to evaporation. Examples of clay minerals that are most widely known today are kaolin and bentonite (WHO, 2005).

These two mask bases have different absorbency, where kaolin is stronger in absorbing small particles such as bacteria, fatty compounds, and toxins (Carretero et al, 2006), while bentonite absorbs more water (WHO, 2005). The next difference is the plasticity index, where the plasticity index of bentonite is greater than the plasticity index of kaolin (Jembise et al, 2014)

There have been many studies on the combination of kaolin and bentonite bases in clay face mask preparations, including the research of Santoso (2017), showing the results that the interaction of kaolin and bentonite has an effect on increasing viscosity, decreasing spreadability, and accelerating dry time for clay mask preparations Then Fauziah's research (2018) states that the results of the evaluation of each formula can be concluded that from a kaolin base of 35% and a bentonite concentration of 0.5% is the best formulation. The concentration variation of kaolin and bentonite bases in the clay mask dosage formulation shows an effect on the physical properties of the preparation, in terms of color, pH, spreadability test, and the results of the preference assessment of the dosage form. Therefore, this research was carried out by formulating lycopene extract of tomato (*Solanum lycopersicum* L.) in the form of a clay mask using several concentrations of combination of kaolin and bentonite bases and evaluate their physical characteristic and antioxidant activity.

METHODS

Materials

Tomato fruit (*Solanum lycopersicum* L.) were collected from tradisonal market in Palu, N. hexane, Ethanol p.as (Merck®), DPPH (2,2 Diphenyl-1-picrylhydrazyl (Sigma-D9132), Tween 80 (Brataco®), Glycerin (Brataco®), VCO (virgin coconut oil) (Brataco®), Kaolin, Bentonite, Methyl Paraben (Brataco®), Xanthan Gum, Oleum rosae (Brataco®), Aquadest.

Preparation of Coarse Lycopene Extract

The production of crude lycopene powder from tomatoes follows the method of Mappiratu *et al* (2010), as follows: tomatoes are washed using running water to separate tomatoes from foreign substances such as sand and dust, then split, separated between the pulp and seeds, then cut into small pieces to facilitate the crushing process with a blender, then put into a stainless pan, add water to the ratio of water / flesh of tomatoes (1.5: 1) on the basis of volume / weight (v / w, L / Kg). Tomato pulp is heated at 70o C for 60 minutes, then filtered and the resulting pulp or residue is dried using a vacuum oven at 40o C for 2 days or under a solar dryer (sunlight). The resulting dry residue is crude lycopene. To produce lycopene powder, the coarse residue is crushed with a blender and then weighed. The yield is calculated using the formula:

$$\text{Crude lycopene yield (\%)} = \frac{Weight\ of\ lycopene\ crude\ powder}{Weight\ of\ Tomato} x\ 100\%$$

Purification of Crude Lycopene Extract

Crude lycopene was purified by extracting lycopene as a result of separation from the pulp of tomatoes. Little by little, crude lycopene was put into the Erlenmeyer tube and N-hexane solvent was added to taste. Then shake it for 30 minutes and then be decanted. The treatments were carried out repeatedly until the resulting extract was no longer colored, the collected solution was separated from the solvent by vacuum using a rotary vacuum evaporator (Mappiratu, et al., 2010). Then the rendamen is calculated using the formula:

$$\text{Lycopene Extract Yield (\%)} = \frac{Weight\ of\ lycopene\ extract}{Weight\ of\ Coarse\ powder} x\ 100\%$$

Preparation of Microemulsion

The microemulsion of tomato lycopene extract was done by preparing tools and ingredients, adding VCO into a beaker, then adding tomato lycopene extract, stirring until it was mixed. Then added surfactant (Tween 80) and cosurfactant (glycerin), stirred using a magnetic stirrer at medium speed for 30 minutes. The mixture formed was added with distilled water to form a microemulsion system. The results obtained are put into a container and closed tightly (Sulastri, 2015).

Formulation of Tomato Lycopene Extract Clay Mask

A clay mask preparation was made as much as 100 grams per formula. Each ingredient was weighed according to its respective formula. The method of preparation was firstly dissolving bentonite and methyl paraben with 25 ml and 20 ml hot water, respectively. Then let stand for 15 minutes. Bentonite and methyl paraben, were added to the mortar, added with xanthan gum, crushed until homogeneous. Then added glycerin, propylene glycol, and tomato lycopene extract microemulsion, grinded until homogeneous. Furthermore, the kaolin was inserted gradually into the mortar while continuing to be crushed until the preparation was homogeneous. Oleum rosae was added for flavoring. The procedure was repeated for other formulas with different amounts of kaolin base and bentonite. Then the evaluation was performed on the preparation in each formula.

Table 1. Formulation of tomato lycopene extract clay mask

Ingredients	Concentration (%)				Function
	F1	F2	F3	F4	
Tomato lycopene extract microemulsion	10	10	10	10	The main ingredient
Kaolin	15	20	25	30	Base
Bentonite	2	1.5	1	0.5	Base
Glycerin	8	8	8	8	Humectant
Nipagin	0.1	0.1	0.1	0.1	Preservative
Xanthan Gum	0.5	0.5	0.5	0.5	Thickener
Rose Oil	qs	qs	qs	qs	Flavor
Distilled water	Suffice up to 100				Solvent

Information: qs = to taste

Evaluation of availability

Organoleptic test

The organoleptic test was carried out by observing the characteristics of the smell, color, and consistency of the clay mask preparation (Fauziah, 2018).

Homogeneity test

The mask is spread evenly on the transparent glass, dab it carefully, then the glass is directed to the light (Fauziah, 2018). The clay mask formulation can be said to be homogeneous if there are no coarse grains on the transparent glass (Sianipar & Marulam, 2018)

pH test

As much as 1 g of mask preparation is put into the container and then dissolved using distilled water, then the electrodes that have been calibrated using a buffer solution of pH 4 and pH 7 are immersed in the container. The number shown on the pH meter is the pH of the clay mask preparation (Fauziah, 2018). The pH of the clay mask preparation can be said to be good and meet the requirements if it is in accordance with the pH value range of facial skin, namely 4.5-7.5 (Sianipar & Marulam, 2018).

Viscosity test

Viscosity measurement is done by placing a number of samples in a Brookfield DV-E viscometer. The spindle size and rotation speed to be used are adjusted, and then the tool is turned on, and the viscosity of the clay mask will be read (Septiani *et al*, 2011). The range of good viscosity values for semi-solid preparations is around 4000 cPs-40,000 cPs (Wasitaatmadja, 1997)

Spreadability test

1 gram of gel preparation is carefully placed on a glass measuring 20 x 20 cm. Then it is covered with another glass and a weight is used on it until the weight reaches 125 grams and the diameter is measured after 1 minute (Vieira *et al*., 2009).

Preparation of test drying time

Measurement of the drying time of the preparations was carried out by applying a clay mask as much as 0.7 gram and smeared on the replica silicone skin with an area of 5.0 x 2.5 cm to form a uniform thin layer about 1 mm thick, then observed the preparation time. dry up. The requirement for a good drying time is 10-20 minutes (Septiani *et al*, 2011).

Ease of cleaning test

Dry preparations on silicone skin are cleaned under running water, then the ease of cleaning for each preparation formula is determined (Santoso *et al*., 2018).

Measurement of antioxidant activity of preparations using the DPPH method

A total of 10 mg of sample from each formula were dissolved with ethanol pa until the volume became 10 ml, where the concentration obtained was 1000 µg/mL. Then the obtained sample solution was diluted to obtain the concentration series of samples (100, 250, 500, 750 and 1000 µg/mL). Mix 2 ml of each preparation solution with 2 ml of DPPH 100 µg/mL, incubated for 30 minutes, measured the absorption using a UV-Visible spectrophotometer at a wavelength of 516 nm. The IC_{50} determination of the antioxidant activity was carried out from the results of absorbance measurements of the five-concentration series to produce percent inhibition where the five percent inhibition was calculated based on the equation:

$$\%\,Inhibition = \frac{absorption\ control - absorption\ sample}{absorption\ control}\, x\ 100\%$$

Data analysis

The test data for pH, viscosity, dispersibility, drying time and antioxidant activity were analyzed using the oneway anova test. Meanwhile, the test data for the physical properties of homogeneity and organoleptics, and ease of cleaning were analyzed descriptively.

RESULTS AND DISCUSSION

The tomatoes (*Solanum lycopersicum* L.) used were obtained from Biromaru District, Sigi Regency, Central Sulawesi Province. The sample processing process to obtain crude lycopene from tomatoes was carried out using the Mappiratu method (2010), where the tomatoes went through the boiling process using aquadest at 70^{o}C for 60 minutes, then filtered and then dried using a solar dryer. The crude lycopene of tomato fruit (*Solanum lycopersicum* L.) was extracted using a shaker with 6 liters of *n*-hexane as a solvent. The yield of thick tomato lycopene extract was 13.8 grams with the yield obtained as much as 5.162%.

Tomato lycopene extract was made in a microemulsion system in advance to increase the solubility of tomato lycopene and to maintain the antioxidant activity in it. Research by Sulastri et al (2015) produced a microemulsion with an IC50 value of 27.90 µg/mL, where the IC50 value is classified as very strong. The microemulsion system also has several other advantages as a topical preparation, including small particles and good penetration so that it can easily penetrate the skin surface.

The clay mask was made by adding 10% tomato lycopene microemulsion to each formula by varying the base of the clay mask preparation. The bases used were kaolin and bentonite with different concentrations of each formula. This aimed to see the effect of variations in base concentration on the physical quality test of the preparation and to determine the antioxidant activity of the tomato lycopene extract clay mask preparation.

Organoleptic test

Organoleptic testing of tomato lycopene extract clay masks (*Solanum lycopersicum* L.) was carried out by direct observation of the color, odor and texture of the preparation. The results obtained were not significantly different in terms of texture and aroma in each clay mask formula. Each formula has a distinctive aromatic smell that comes from the addition of oleum rosae as an odor or scent, and has a semi-solid texture like mud. The difference in color of the preparation but not too significant, this color difference was obtained from the difference in the concentration of bentonite base in each formula, the description of the bentonite itself, which is a very fine powder and pale yellow to grayish cream in color (Rowe et al., 2009).

Table 2. Organoleptic Observations

Formula	Shape	Color	Aroma
F1	Semi Solid	Beige	Aromatic Typical
F2	Semi Solid	Beige	Aromatic Typical
F3	Semi Solid	Beige	Aromatic Typical
F4	Semi Solid	Beige	Aromatic Typical

Homogeneity Test

Homogeneity test of tomato lycopene extract (*Solanum lycopersicum* L.) clay mask preparation obtained homogeneous results. The preparation is said to be homogeneous because each formula shows a homogeneous structure and there are no coarse grains (Sianipar and Marulam, 2018).

Table 3. Homogeneity Test

Formula	Homogeneity
F1	Homogeneous
F2	Homogeneous
F3	Homogeneous
F4	Homogeneous

pH test

Testing the pH of the tomato lycopene extract clay mask preparation was carried out using a pH meter. The pH test results of the four preparations were F1 4.33, F2 5.6, F3 6.46, and F4 7.34. The pH measurement results for the clay mask preparation of tomato lycopene extract (*Solanum lycopersicum* L.) were analyzed using one-way analysis of variance (Anova one way). The homogeneity of variances test is used to determine the homogeneity of the compared treatment data or can be used as a feasibility test for the One Way Anova test. The results obtained have a significance value> 0.05 (0.135> 0.05), it can be said that the four formulas have the same variance (homogeneous) and can be continued using One Way Anova. From the One Way Anova test, it is obtained a probability value of 0.000 which indicates a probability of <0.05. This shows that the data obtained has a significant difference due to the different concentration of kaolin base variations, where the pH of the kaolin base tends to be alkaline (pH 6.0-8.0), so the greater the concentration of kaolin used in a formula, then The pH of the formula is increasing (Armadany, 2018). This corresponds to the increase in pH that occurs from F1 to F4, where F1 has the smallest pH, and F4 has the largest pH. However, this pH still meets the pH requirements for preparations used on facial skin, namely 4.5-7.5 (Sianipar and Marulam, 2018). The pH value should not be too acidic because it can cause skin irritation and also should not be too alkaline because it can cause scaly skin (Kuncari, 2014). where the pH of the kaolin base tends to be alkaline (pH 6.0-8.0), so the greater the concentration of kaolin used in a formula, the pH of the formula will increase (Armadany, 2018). This corresponds to the increase in pH that occurs from F1 to F4, where F1 has the smallest pH, and F4 has the largest pH. However, this pH still meets the pH requirements for preparations used on facial skin, namely 4.5-7.5 (Sianipar and Marulam, 2018). The pH value should not be too acidic because it can cause skin irritation and also should not be too alkaline because it can cause scaly skin (Kuncari, 2014). where the pH of the kaolin base tends to be alkaline (pH 6.0-8.0), so the greater the concentration of kaolin used in a formula, the pH of the formula will increase (Armadany, 2018). This corresponds to the increase in pH that occurs from F1 to F4, where F1 has the smallest pH, and F4 has the largest pH. However, this pH still meets the pH requirements for preparations used on facial skin, namely 4.5-7.5 (Sianipar and Marulam, 2018). The pH value should not be too acidic because it can cause skin irritation and also should not be too alkaline because it can cause scaly skin (Kuncari, 2014). This corresponds to the increase in pH that occurs from F1 to F4, where F1 has the smallest pH, and F4 has the largest pH. However, this pH still meets the pH requirements for preparations used on facial skin, namely 4.5-7.5 (Sianipar and Marulam, 2018). The pH value should not be too acidic because it can cause skin irritation and also should not be too alkaline because it can cause scaly skin (Kuncari, 2014). This corresponds to the increase in pH that occurs from F1 to F4, where F1 has the smallest pH, and F4 has the largest pH. However, this pH still meets the pH requirements for preparations used on facial skin, namely 4.5-7.5 (Sianipar and Marulam, 2018). The pH value should not be too acidic because it can cause skin irritation and also should not be too alkaline because it can cause scaly skin (Kuncari, 2014).

Table 4. pH test

Formula	pH Mean ± SD (n = 3)
F1	4.33 ± 0.35
F2	5.58 ± 0.24
F3	6.48 ± 0.22
F4	7.34 ± 0.08

Viscosity Test

The viscosity test of the preparations was carried out using the Brokfield Viscometer. The results of measuring the viscosity of each clay mask preparation formula have their respective viscosity values, namely F1 20213.3 cPs, F2 2413.3 cPs, F3 29080 cPs, and F4 33293.3 cPs, the viscosity values obtained include good viscosity values because they are suitable with a range of viscosity requirements for semi-solid preparations, namely 4000 cPs-40,000 cPs (Wasitaatmadja, 1997).

Table 5. Viscosity Test

Formula	Viscosity (cP) Mean ± SD (n = 3)
F1	20213.2 ± 140.4
F2	24133.3 ± 83.26
F3	29080 ± 105.8
F4	33293.3 ± 378.0

Spreadability test

The results of the viscosity test also affect the spreadability test. Based on the One Way Anova test, the significance value of the viscosity and spreadability test is 0.000 <0.05 which indicates that the data obtained has a significant difference where the average results obtained from F1, F2, F3, F4 and F5 are 6, 59 cm, 5.59 cm, 4.85 cm, and 4.33 cm. The range of specifications for the spreadability of a good clay mask is> 2 cm and <5 cm (Santoso et al., 2018).

Formulas (3) and (4) have high viscosity values so that the spreadability of the preparations is lower than formulas (1) and (2), this is because if the amount of kaolin concentration used is greater, the viscosity value is higher but the spreadability more narrow. Likewise, if the concentration of kaolin used is less, the viscosity value will be lower but the spreadability obtained is wider (Santoso et al., 2018).

Table 6. Spreadability Test

Formula	Spreadability (cm) Mean ± SD (n = 3)
F1	6.59 ± 0.24
F2	5.59 ± 0.16
F3	4.85 ± 0.11
F4	4.33 ± 0.05

Test drying time of preparations

In the fast drying time test of the preparations, the average results obtained from F1, F2, F3, F4 and F5 were 19.02 minutes, 15.33 minutes, 11.27 minutes, and 8.24 minutes. The specific range of dry time for a good clay mask is (t = 10-20 minutes) (Septiani et al., 2011). Based on the One Way Anova test, the dry time results of each formula have a significance value of 0.000 <0.05, which means that the dry time test of the clay mask preparation has a significant difference due to an increase in the concentration of kaolin and bentonite, this is because of kaolin. has the advantage that it dries easily so that it can speed up the dry time of the preparation, while the role of bentonite itself is to act as an adsorbent, especially water.

Table 7. Test Drying Time of Preparations

Formula	Drying Time (t) Mean ± SD (n = 3)
F1	19.02 ± 0.36
F2	15.33 ± 0.54
F3	11.27 ± 0.42
F4	8.24 ± 0.50

Ease of cleaning test

In the ease of cleaning test preparations, F1 and F2 were very easy to clean, F3 and F4 were easy to clean. This is because the variations in the concentration of kaolin and bentonite bases have an effect on the ease of cleaning the preparation. The less the base concentration used, the easier the preparation is to clean, and vice versa (Santoso et al, 2018), the four preparations in this study meet the parameters of ease of cleaning. This is determined by cleaning the mask that has dried on the silicone skin, the faster the silicone skin is clean, the easier it will be to clean the mask preparation.

Table 8. Ease of cleaning test

Formula	Ease of cleaning Mean ± SD (n = 3)
F1	Very easy cleaned
F2	Very easy cleaned
F3	Easy to clean
F4	Easy to clean

Antioxidant Activity Test

Antioxidant activity testing was carried out on tomato fruit extract (*Solanum lycopersicum* L.) which was formulated in a clay mask preparation using the DPPH (2,2-diphenyl-1- pikrilhidrazil) method. DPPH radical is an organic compound containing unstable nitrogen with a strong absorbance at λmax 517 nm and dark purple in color. After reacting with antioxidant compounds, the DPPH will be reduced and the color will turn yellow (Erlidawati, 2018). The results obtained were that the extract of tomato lycopene (*Solanum lycopersicum* L.) had antioxidant activity with an IC50 value of 84.23 µg/mL. The antioxidant activity of tomato lycopene microemulsion had an IC50 value of 125.37 µg/mL. The antioxidant activity of the four clay mask preparations has an IC50 value of each preparation, namely F1 871.46 µg/mL, F2 947, 37 µg/mL, F3 741.34 µg/mL, and F4 815.27 µg/mL. The decrease in antioxidant activity from the extract to the microemulsion system and then to the clay mask preparation may occur possibly due to the instability of the compound where during the manufacturing process it is exposed to varying light and room temperature. This is in accordance with Desmiaty (2008), which states that lycopene degradation can be caused through isomeration and oxidation processes caused by light, oxygen, high temperatures, drying techniques, and storage. In accordance with the research of Giuliana et al (2015), antioxidants are very sensitive, if the preparation is exposed to a lot of light it will affect its antioxidant activity. The technique of testing for antioxidant activity itself must also be carried out quickly and carried out in a special room (Mappiratu et al.

Agustina's research (2017) also experienced lycopene degradation where a decrease in the antioxidant activity of the preparation as a result of the manufacturing process. The smaller the IC50 value produced, the stronger the antioxidant activity of a compound. Vice versa, the greater the IC50 value of a compound, the lower the antioxidant activity.

Table 9. Antioxidant Activity Test

Sample	IC_{50} (µg/mL)
Tomato Lycopene Extract	84.23
Tomato Lycopene Microemulsion	125.37
Clay Mask Preparations (F1)	871.46
Clay Mask Preparations (F2)	947, 37
Clay Mask Preparations (F3)	741.34
Clay Mask Preparations (F4)	815.27

The best preparation chosen is formula 3 because it has physical characteristics in the form of a pH value of 6.48 ± 0.22, where the pH value is closest to the normal pH for facial cosmetic preparations, namely pH 4.5-7.5 (Sianipar and Marulam, 2018), the good spreadability is 4.85 ± 0.11 cm, the viscosity of the preparation that meets the requirements range is 29080 ± 105.83 cPs, and the best drying time is 11.27 ± 0.42 minutes, the F3 preparation is also easy to clean and has the best value of antioxidant activity among the four formulas, namely the IC50 value 741.34 µg/mL.

CONCLUSION

The concentration variation of the combination of kaolin and bentonite bases in the clay mask formulation showed an effect on the physical properties of the preparation, in terms of color, pH, viscosity, dispersibility, and rapid drying of the preparation. The antioxidant activity of clay mask preparations is F1 871.46 µg/mL, F2 947.37 µg/mL, F3 741.34 µg/mL, and F4 815.27 µg/mL. The best formula for clay masks is the F3 preparation where the concentration of kaolin is 25% and bentonite is 1%.

REFERENCES

Agarwal, S., & Rao, AV (2000). *Tomato lycopene and its role in human health and chronic diseases*. Cmaj, 163 (6), 739–744.

Agustina, L., Yulianti, M., Shoviantari, F., & Sabban, IF (2017). *Formulation and Evaluation of Liquid Bath Soap with Extracts Tomato (Solanum lycopersicum L.) as an Antioxidant.* Wiyata Journal of Science and Health Research, 4 (2), p. 104-110.

Carretero, MI & Pozo, M. (2010). *Clay and Non-Clay Minerals In The Pharmaceutical and Cosmetic Industries.* Part II. Active Ingredients. 47 171-181

Desmiaty, Y., Alatas, F., & Sugianti, I. (2008). *MANUFACTURE OF LICOPE CRUDE FROM TOMATO FRUIT (Solanum lycopersicum L.) and DETERMINATION OF ITS ANTIOXIDE POWER* Yesi Desmiaty *, Fikri Alatas, Iis Sugianti. 11–12.

Fauziah, DW (2018). *Effect of Kaolin and Bentonite Base on Physical Properties of Combination Mud Mask of Olive Oil (Olive Oil) and Green Tea (Camelia sinensis).* Journal of Pharmacy Science and Health, 3 (2), 9–13.

Giuliana, FE, Ardanam M., Rusli, R. (2015). *Effect of pH on Antioxidant Activity of Miana (Coleus atrropurpureus L. Benth) Leaf Extract.* Kyushu Plant Protection Research, 3, 19–20. https://doi.org/10.4241/kyubyoch u.3.19

Jembise, RA, Oktavian BA Sompie, Freddy Jensen. (2014). *Addition of Bentonite and Kaolin Mixtures to Sand Soil Against Permeability Coefficients with Different Plasticity Conditions at Maximum Density Levels.* Media Engineering Scientific Journal Vol.4 N0.2. (127-134. ISSN: 2087-9334. Sam Ratulangi University. Manado. Page 131

Mappiratu, Nurhaeni, & Israwaty, I. (2010). *Utilization of rejected tomatoes for lycopene production.* (1), 64–69. Department of Chemistry, Faculty of Mathematics and Natural Sciences, Tadulako University, Palu

Molyneux, P. (2004). *The Use of the Stable Free Radical Diphenylpicryl- hydrazyl (DPPH) for Estimating Antioxidant Activity.* Songklanakarin Journal of Science and Technology, 26 (December 2003), 211–219.https://doi.org/10.1287/isre.6.2.144

Murti, Reni Widaya, *et al* (2016). *Antioxidant Activity and Irritation Test for Gell Peel-Off Mask Preparation of Methanol Extract of Rambutan Fruit Skin (Nephelium Lappaceum L.).* Journal of Pharmaceutical and Clinical Pharmacy, 13 (2), 32–38. https://doi.org/10.1007/BF02286428

Purwaningsih, S., Salamah, E., & Budiarti, TA (2014). *Skin Lotion Formulation with Addition of Natural Carrageenan and Antioxidants from Rhizophora mucronata Lamk.* V (1), 55–62.

Reiger, MM (2000). *Harry's Cosmetology 8th ed.* Chemical Publishing Co. Inc. New York 523-572