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Formulation and Physical Stability of Temulawak (*Curcuma xanthorhiza* Roxb.) Antiaging Lotion with Natural Colorant from Strawberry Extract (*Fragaria vesca* L)

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ABSTRACT

Skin protection is needed to reduce the unwanted effects of free radicals, such as antiaging lotions. Temulawak (*Curcuma xanthorhiza* Roxb.) contains curcumin which has antioxidant activity with the potential to antiaging. Strawberries (*Fragaria vesca* L) contain anthocyanins known used as natural dyes. This study aims to determine the antioxidant activity of temulawak extract then formulated as a lotion with the addition of natural colorant from strawberries and tested for physical stability. *Curcuma* extraction was carried out by maceration using 70% ethanol solvent to obtain a thick extract, infundation method was used to extract a strawberry. Determination of the antioxidant activity of temulawak extract using the DPPH method is expressed by the IC50 value. The antioxidant activity of temulawak extract is included in the moderate category with an IC50 value of 144.126 ppm. Evaluation of physical quality characteristics of temulawak lotion with natural colorant strawberry included organoleptic observations, spreadability, adhesion, pH test, viscosity, emulsion stability as well as stability to temperature and humidity. The results of the study after temperature and humidity treatment showed that the temulawak lotion was in the form of semi-solid, pink in color, the spreadability values were, respectively in centimeter 7.95 ; 7.35 ; 6.8 ; 7.05 ; 5.45 ; 5.85 ; 5.25 ; and 5.5 , the adhesive values are respectively in second 0.52 ; 0.56 ; 0.46 ; 0.51 ; 0.52 ; 0.50 ; 0.82 ; and 0.48, the pH value are 7; 6; 7; 7; 7; 7; 7; and 7, the viscosity values are in Pa.S 0.017; 0.031; 0.113; 0.055; 0.352; 0.263; 0.18; and 0.324. The conclusion of this study shows best formulation stability was formulas E, F, and H.

Keywords: Temulawak, Strawberries, Antioxidant, Lotion

ABSTRAK

Perlindungan kulit diperlukan untuk mengurangi efek yang tidak diinginkan dari radikal bebas, seperti lotion antiaging. Temulawak (*Curcuma xanthorhiza* Roxb.) mengandung kurkumin yang memiliki aktivitas antioksidan yang berpotensi sebagai antiaging. Stroberi (*Fragaria vesca* L) mengandung antosianin yang dikenal sebagai pewarna alami. Penelitian ini bertujuan untuk mengetahui aktivitas antioksidan dari ekstrak temulawak yang kemudian diformulasikan dalam bentuk lotion dengan penambahan pewarna alami dari buah stroberi dan diuji stabilitas fisiknya. Ekstraksi temulawak dilakukan dengan cara maserasi menggunakan pelarut etanol 70% untuk mendapatkan ekstrak kental, metode infundasi digunakan untuk mengekstrak buah stroberi. Penentuan aktivitas antioksidan ekstrak temulawak menggunakan metode DPPH yang dinyatakan dengan nilai IC50. Aktivitas antioksidan ekstrak temulawak termasuk dalam kategori sedang dengan nilai IC50 sebesar 144,126 ppm. Evaluasi karakteristik mutu fisik lotion temulawak dengan pewarna alami stroberi meliputi pengamatan organoleptis, daya sebar, daya lekat, uji pH, viskositas, stabilitas emulsi serta stabilitas terhadap suhu dan kelembaban. Hasil penelitian setelah perlakuan suhu dan kelembaban menunjukkan bahwa lotion temulawak berbentuk semi padat, berwarna merah muda, nilai daya sebar berturut-turut dalam centimeter 7,95; 7,35; 6,8; 7,05; 5,45; 5,85; 5 25; dan 5,5, nilai daya lekat berturut-turut dalam detik 0,52; 0,56; 0,46; 0,51; 0,52; 0,50; 0,82; dan 0,48, nilai pH berturut-turut 7; 6; 7; 7; 7; 7; 7; dan 7, nilai viskositas berturut-turut dalam Pa.S 0,017; 0,031; 0,113; 0,055; 0,352; 0,263; 0,18; dan 0,324. Kesimpulan dari penelitian ini menunjukkan stabilitas formulasi yang paling baik adalah formula E, F, dan H.

Kata Kunci: Temulawak, Stroberi, Antioksidan, Lotion

INTRODUCTION

Indonesia is one of the countries that the equator passes through so that it becomes a country with a tropical climate, this makes the sun's rays longer. Excessive exposure to sunlight for a long time can cause damage to the skin. This is because sunlight has UV waves which are a source of exposure to free radicals which can cause cell damage or disruption of cell function so that the skin ages faster due to this accumulation (Dewi, 2021).

Indonesia is also one of the countries with quite a lot of plant diversity, namely nearly 30,000 species of plants and around 7,000 of which can be used as medicinal plants. In a study related to the use of the temulawak plant as an antioxidant which was then made into temulawak extract, it was found that there was a curcumin compound content of 27.19%. The curcumin results obtained were then tested for antioxidant activity using the DPPH method resulting in an IC50 value of 87.01 ppm, these results provide information that the curcumin contained in temulawak extract is an active antioxidant (Rosidi et al., 2014).

Another type of plant found in Indonesia is the strawberry, this plant contains several secondary metabolites, including anthocyanins. Anthocyanins include organic chemical compounds that can produce red, orange, blue, purple colors in higher plants that have fruit and flowers, or tubers (Priska et al., 2018).

Temulawak which contains antioxidants combined with strawberries can be processed into a cosmetic preparation that is used topically on the skin, namely antiaging lotion to treat premature aging caused by free radicals from UV exposure..

Based on the above, a research was conducted on the formulation and physical stability of antiaging lotion with temulawak extract with natural dyes from strawberry extract.

METHOD

Tools dan Materials

The tools used in this study were a water bath, blender, analytical balance, filter paper, sealed glass container for maceration, test tube, funnel, beaker glass, measuring glass, spatula, watch glass, glass stirrer, porcelain cup, pH meter, aluminum foil, dropper pipette, UV-Vis spectrophotometer spreadability test equipment, adhesion test equipment.

The materials needed in this research were ginger powder simplicia, strawberry, Aqudest, Glycerin, Propylene glycol, Olive oil, Triethanolamine, Glyceryl monostearate, Phenoxyethanol, Cetyl alcohol, EDTA, DMDM Hydantoin, Novemer ec, Paraffin, Hidroethylcellulose, Euxyl PE, Carbopol, DPPH and methanol p.a.

Temulawak Extraction

The extraction process was carried out by the maceration method, 1000 grams of ginger simplicia powder was weighed, 10 liters of 70% ethanol solvent was added so that the ratio between the sample and the solvent was 1:10 parts. The maceration process was carried out at room temperature for 3 x 24 hours and occasional stirring was carried out. Then the filtering process was carried out using Whatman paper no. 1. The filtrate results are then concentrated at a temperature of 40ºC and a pressure of 100 mBar using a rotary evaporator for 1 hour. Then the results of the rotary evaporator were thickened with an oven and set at 40ºC until a thick extract was obtained. The results of the condensed extract were then stored for further testing of antioxidant activity (Rosidi et al., 2014).

Strawberry Extraction

2 kg of strawberries are washed with running water until clean, then in a blender to get the juice. The extract is heated in a waterbath to obtain a thick essence which is then used in making lotion (Sianipar et al., 2020).

Antioxidant Activity Test of Temulawak Extract

50 mg of temulawak extract was weighed and 50 ml of methanol p.a solvent was added so that the concentration was 1000 ppm, then series of concentrations were made of 100 ppm, 200 ppm, 300 ppm, 400 ppm and 500 ppm. Then a 40 ppm DPPH solution was made and the maximum wavelength was determined and the absorbance of the 40 ppm DPPH solution was measured at the maximum wavelength that was previously obtained. Furthermore, temulawak extract samples that had been made into a series of concentrations of 100 ppm, 200 ppm, 300 ppm, 400 ppm, and 500 ppm were taken 2 ml each and homogenized with 2 ml of DPPH 40 ppm and incubated at 37°C for 30 minutes and then the absorbance was measured with a spectrophotometer. uv vis with the maximum wavelength of DPPH previously obtained (Sholikhah et al., 2023).

Formulation of Temulawak Ekstract Lotion

The lotion is made by mixing the oil and water phases, the components of the oil phase (cetyl alcohol, glyceryl monostearate, propylene glycol, olive oil, and paraffin). The oil phase is heated to 50°C in a water bath, until all the ingredients melt. The water phase (aquades, Glycerin, TEA, DMDM hydantoin, EDTA, phenoxyethanol, Novemer ec, Euxyl PE, Hidroethylcellulose, Carbopol) was put into a beaker glass and stirred until homogeneous. Gradually add the water phase and other additives into the beaker glass containing the oil phase and stir quickly using a mixer until a homogeneous preparation is obtained and a good lotion is formed. The next stage is adding temulawak extract, strawberry extract, fragrance and remaining distilled water up to 100 grams into the lotion beaker and stirring again until homogenus which can be seen in Table 1.

Table 1. Formulation of Lotion

No.	Material	A	B	C	D	E	F	G	H
1	Aqua	83,93	83,85	83,67	83,64	83,67	83,58	81,65	81,61
2	Glycerin	3,87	3,87	3,86	3,86	3,86	3,86	5,05	5,05
3	Propylene glycol	0,96	0,96	0,96	0,96	0,96	0,95	1,25	1,25
4	Olive oil	0,96	0,96	0,96	0,96	0,96	0,95	1,25	1,25
5	Triethanolamine	0,06	0,06	0,06	0,06	0,06	0,06	0,08	0,08
6	Glyceryl monosterate	3,35	3,35	3,34	3,34	3,34	3,34	1,56	2,08
7	Phenoxyethanol	0,16	0,16	0,16	0,16	0,16	0,16	0,21	0,21
8	Cetyl alcohol	0,2	0,2	0,48	0,2	0,4	0,2	0,57	0,52
9	EDTA	0,04	0,04	0,04	0,04	0,04	0,04	0,05	0,05
10	Dmdm hydantoin	0,16	0,16	0,16	0,16	0,16	0,16	0,21	0,21
11	Novemer ec	0,62	0,62	0,62	0,62	0,62	0,62	1,04	1,04
12	Paraffin	2,99	2,99	2,99	2,98	2,99	2,98	3,91	3,9
13	Hydroethylcelulose	0	0,08	0	0	0	0	0	0
14	Euxyl PE	0	0	0	0,32	0	0,32	0,42	0
15	Carbopol	0	0	0	0	0,08	0,08	0,05	0,05
16	Ekstrak temulawak	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5
17	Ekstrak strawbery	2	2	2	2	2	2	2	2
18	Fragrance strawberry	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
19		100	100	100	100	100	100	100	100

Evaluation of Lotion

The physical stability test of the lotion was carried out using the accelerated stability method for 7 days. Lotion is stored in the Climatic chamber with a temperature of 40 ˚C and 70% humidity with several parameters observed in the test before and after the stability test including:

Organoleptic Test

Testing is done by visually observing the shape, aroma, and color of the lotion (Cahyani & Erwiyani, 2022).

pH Test

A total of 1 gram of lotion from each formula was taken and tested with a pH meter (Alfian et al., 2022).

Spreadability Test

Lotion in the amount of 0.5 grams is placed on the spreadability testing tool, which is between 2 glass objects and at the top is given a load of 50 grams which is then allowed to stand for 1 minute, after which the diameter of the spread is measured (Alfian et al., 2022).

Adhesivity Test

A 0.5 gram amount of lotion is taken, then placed on a glass object contained in the stickiness test tool. Then cover the object glass with the other glass object, add 500 g of weight on the object glass and let it stand for 1 minute. Then lift the weight and pull the lever and record how long it takes for the lotion to separate between the two glass objects (Alfian et al., 2022).

Viscosity Test

Viscosity test using a Lamy Rheology viscometer with spindle L-1, rpm 30, some lotion is placed in a glass beaker and the spindle is inserted into the beaker until the boundary line is then rotated (Alfian et al., 2022).

Emulsion Stability Test

As much as 10 grams of lotion was put into the Ependorf tube, centrifuged for 5 hours at 4000 rpm (Pratasik et al., 2019).

RESULT AND DISCUSSION

Extraction of Temulawak

The final yield of temulawak extract is weighed and the yield percentage is calculated using the following Formula 1.

$$\text{Rendemen} = \frac{\text{Weight of Ekstrak}}{\text{Weight of Simplisia}} \times 100\% \quad (1)$$

Table 2. Rendemen of Temulawak Extraction

Weight (g)	Volume (ml)	Result (g)	Rendemen (%)
1000	10.000	20	2

Based on the data from the yield calculation Table 2, as much as 1000 grams of ginger simplicia powder with 10,000 ml of ethanol solvent obtained a viscous extract weighing 20 grams, so the resulting yield is 2%. The yield results do not meet the requirements for a good yield because it is still less than the 10-15% range (Hasan & Moo, 2014).

Result of Antioxidant Activity Test

The antioxidant activity of a compound or molecule can be seen from the IC50 value. IC_{50} is the active concentration of a sample of antioxidant compounds that can inhibit the activity of free radical compounds by 50%, the smaller the IC50 value, the less concentration needed to capture 50% of free radicals (Sholikhah et al., 2023).

The antioxidant activity test of temulawak extract was obtained by first calculating the % inhibition using the Formula 2 :

$$\%\ \text{Inhibisi} = \frac{\text{A-B}}{\text{A}} \times 100\% \quad (2)$$

where :

A : Absorbansion of Control

B : Absorbansion of Sampel

Then a linear regression curve was made to compare the percentage of inhibition with the concentration of the test solution and a linear regression equation was obtained as follows.

$$y = a + bx \quad (3)$$

where :

y : value of % inhibisi

x : konsentration of sampel (ppm)

a : constansta regresion (intercept)

b : coefisien regresion (slope)

To calculate the IC50 value (Table 3), it can be calculated using the following equation 4.

$$IC50 = \frac{50-b}{a} \quad (4)$$

Table 3. Result Antioxidant Test of Temulawak Ekstract

No.	Replikation	Regresion Equation	r	IC_{50} (ppm)
1	I	y = 0,11996x + 32,7192	0,9941	144,126
2	II	y = 0,118071x + 33,2529	0,9886	141,839
3	III	y = 0,116699x + 33,4561	0,9956	141,765

Table 4. Intensity of Antioxidant

No.	Intensity	Value of IC_{50}
1	Very Strong	< 50 ppm
2	Strong	50 – 100 ppm
3	Medium	100 – 250 ppm
4	Weak	250 – 500 ppm

The antioxidant activity of temulawak extract was seen by its ability to inhibit 50% of DPPH free radicals. The results of the IC_{50} value of temulawak extract indicated the presence of antioxidant activity and belonged to the moderate category (Table 4).

Evaluation of Lotion Physical Characteristic

Organoleptic Test

The results of organoleptic testing before and after the accelerated stability test for 7 days showed that the temulawak lotion preparation was the same between after and before the stability test, namely semi-solid form, fragrant smell, and pink in color.

pH Test

The results of testing the pH of temulawak lotion before and after the 7-day accelerated stability test (Table 5). The pH test results of the temulawak extract lotion met the requirements for a good pH. In accordance with SNI-16-4399-1996 regarding the quality requirements for skin moisturizing products, it must have a pH value that is the same as skin pH, which ranges from 4.5 – 8.0. Even though the E, F, and G formulas have increased pH values, they are still within a pH standard that is safe for the skin. The pH value of a lotion that is high or too alkaline can make the skin drier, whereas if the lotion has a pH value that is too low or acidic, it can cause irritation to the skin (Mappa et al., 2013).

Spreadability Test

The spreadability test aims to see the ability of the lotion to spread, so that it will affect whether or not the lotion is easily applied to the skin. Fast and slow absorption of lotion on the skin is influenced by good spreading power. The easier the lotion spreads, the more contact the lotion will have with the skin. Lotion that is comfortable on the skin has a spreading power of 5-7 cm (Pujiastuti & Kristiani, 2019).

The results of the lotion spreadability test showed good results, namely in the range of 5-7 cm(Pujiastuti & Kristiani, 2019). Based on these data (Table 6), the spreading power of lotion formulas E, F, G, and H meets the requirements. While formulas A and B experienced an increase and formulas C and D decreased after 7 days. The change in spreading power can be affected by changes in temperature before and after the stability test is carried out (Zamzam & Indawati, 2018).

Table 5. Result of Ph Test

No.	Formulation	Before	After
1	A	7	7
2	B	6	6
3	C	7	7
4	D	7	7
5	E	6	7
6	F	6	7
7	G	6	7
8	H	7	7

Table 6. Result Spreadability Test

No.	Formulation	Before	After
1	A	7,4 cm	7,95 cm
2	B	6,5 cm	7,35 cm
3	C	7,6 cm	6,8 cm
4	D	7,8 cm	7,05 cm
5	E	5,9 cm	5,45 cm
6	F	5,8 cm	5,85 cm
7	G	5,6 cm	5,25 cm
8	H	5,7 cm	5,5 cm

Adhesivity Test

The length of time needed for the lotion to stick to the skin can be tested by testing the adhesion. The results of the adhesiveness test of temulawak lotion before and after the 7-day accelerated stability test can be seen in Table 7.

Lotion is said to have good adhesion if it sticks to the skin for more than 1 second. The length of time the lotion is in contact with the skin will be able to provide a maximum effect. The results of the adhesiveness test for lotion formulations E, F, and G were categorized as good, but all formulations experienced a decrease in adhesion after being stored for 7 days (Hardiansyah, 2020).

Viscosity Test

A good lotion viscosity is 2000−50000 cP or 2 – 50 Pa.S. A good viscosity value will make it easier to apply lotion to the skin, so that the lotion will be more easily spread, evenly distributed and absorbed into the skin. The results of testing the viscosity of temulawak lotion before and after the 7-day accelerated stability test showed that the viscosity value of the lotion formulations A, B, C, and D decreased, while formulas E, F, G, and H increased after being stored for 7 days (Table 8). However, all formulas do not meet the requirements for good lotion viscosity. Lotion with low viscosity will spread more, but the stickiness will decrease. Conversely, a high viscosity value of the lotion tends to be more stable in the emulsion but becomes more difficult to apply due to the low spreadability and high adhesion of the lotion.

The changing viscosity value is influenced by several things, including the mixing process between the oil phase and the water phase, the speed of stirring, the choice of emulsifier type and the ratio of the dispersed phase (Pratasik et al., 2019).

In addition, in formulas E, F, G, and H, the increase in the viscosity value of the lotion was partly due to the use of several types of emulsifiers such as cetyl alcohol, glyceryl monostearate, novemer ec with different concentrations, the combination of several types of emulsifiers will also affect on the value of the viscosity of the lotion. Cetyl alcohol (fatty alcohol) is able to increase consistency, stability and can improve texture (Wulanawati et al., 2019).

Table 7. Result of Adhesivity Test

No.	Formulation	Before	After
1	A	0,94 s	0,52 s
2	B	0,56 s	0,56 s
3	C	0,6 s	0,46 s
4	D	0,54 s	0,51 s
5	E	3,50 s	0,52 s
6	F	1,77 s	0.50 s
7	G	1,05 s	0.82 s
8	H	0,96 s	0,48 s

Table 8. Result of Viscosity Test

No.	Formulation	Before	After
1	A	0,03	0,017
2	B	0,082	0,031
3	C	0,116	0,113
4	D	0,105	0,055
5	E	0,244	0,352
6	F	0,16	0,263
7	G	0,159	0,18
8	H	0,27	0,324

Emulsion Stability Test

Emulsion Stability test using centrifugation at 5,000 for 5 hours (equivalent to 1 year) produces the formula E > F > H > C > G > D > B > A (Figure 1). The decrease in emulsion stability is closely related to the viscosity value, this is because when an emulsion has a low viscosity value, the dispersed phase will more easily enter the dispersing medium, this can cause collisions between the dispersed phases so that the dispersed phases will tend to stick together. into larger particles and agglomeration occurs resulting in separation of the emulsion (Nabiela, 2013).

Figure 1. Result of Stability test for Formulation A, B, C, D, E, F, G, and H

CONCLUSIONS

The comparison between the water phase and the oil phase emulsifier will affect the physical stability of the lotion. The lotion samples with the best results are formulas E, F and H. While the recommended lotion samples are formula E.

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