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Stability of Emulsion Cream Extract Turmeric (*Curcuma domestica* Val.) in Various Concentration

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Abstract

This research aims to: 1) determine the stability of the emulsion cream turmeric extracts (*Curcuma domestica* Val.) in various concentrations, 2) determine the concentration of extract that produce the best emulsion stability. This study consists of five concentrations of turmeric extract (50, 75, 100, 125, and 150 mg in 200 ml VCO). This experiment grouped into 3 based on time implementation of cream manufacture. Observations were made every week for 5 weeks. Observed variables are: homogeneity, separation ratio, dispersive power, adhesive power, pH, viscosity, and antioxidant capacity. Creamy emulsion stabilized to a concentration of 150 mg extract of turmeric on all variables except the dispersive and adhesive power. The characteristics of the best cream is obtained from the addition of extract turmeric 75 mg with the following characteristics: pH 7.2, viscosity 6,400 cPs, antioxidant capacity 8,334 mg GAEAC/100 g sample, homogeneous, no separate, dispersive power 3.93 cm, and adhesive power 17 seconds.

Keywords: turmeric extract, stability, cream, concentration, antioxidant

1. Introduction

In Premature aging is the process of skin aging which is occurring faster than it should and can affect anyone. External factors that are causing of premature aging are free radicals and sunlight (Swastika *et al*., 2013). External factors formation of free radicals is the sun's ultraviolet rays at 10:00 to 15:00, pollution, cigarette smoke and factories, motor vehicle emissions and consumption of alcohol (Prahl *et al*. 2008). ROS can lead to diffusion of cells by electron capture of component lipids, proteins, and deoxyribonucleic acid (DNA). When the body's cells lose electrons, then the cell will also be a free radical which will initiate a series of subsequent similar process. This will lead to cellular damage, including aging of skin (Pinnell 2003). The skin is an organ that is directly exposed to ultraviolet light (UV) from the sun. Rays of Ultraviolet B (UVB) with wavelengths of 290-320 nm is absorbed by the DNA will cause direct damage, while chromosome absorbing ultraviolet A (UVA) with wavelength of 320-400 nm will cause damage through the formation of ROS (reactive oxygen species) (Debuys *et al*. 2000). Therefore, the body especially the skin requires a material that can protect against free radicals.

One alternative that can prevent premature aging is to use a cream that contains antioxidants. Antioxidants are capable of capturing free radicals that emanated from the sun or from within the body (Kikuzaki *et al*. 2002). Turmeric is one source of antioxidants because of the content of curcumin (Purba & Martosupono 2009). Curcumin may act as an antioxidant because it contains phenol compounds. Research on the cream of antioxidants from natural materials which have been done for example cream antioxidant of ethanol extract of garlic forest (Sharon *et al*. 2013), cream extract ethanol of *Syringodium isoetifolium* (Juwita, *et al*., 2013), cream extract turmeric methanol (Alakh *et al*. 2011).

Research on the effect of the extract on the characteristics and stability of the cream has been done for example the effect of different concentrations of the ethanol extract of juicy tubers *(Pachyrrhizus erosus, Urb)* in cream to their physical properties (Windriyati *et al.* 2007), the effect of the concentration of ethanol extract of green tea leaves in cream on the physical properties and activities antibacterial (Widyaningrum *et al.* 2012). The addition of extract with various concentrations in a cream formula has an influence on the characteristics and stability of cream product. However, research on stability of emulsion cream extract turmeric in various concentration yet done so need to do further research.

2. Research Methodology

In this experiment consisted of five treatments turmeric extract concentration, namely: 50 (K1), 75 (K2) 100

(K3), 125 (K4), and 150 (K5) mg / 200 ml Virgin Coconut Oil (VCO). Each treatment was stratified by timing of creams manufacture and each treatment was repeated 3 times. Observations were made every week and storage for 5 weeks. Objective data were analyzed graphically during storage.

Formula cream turmeric is used based on a percentage (weight / weight) with the turmeric extract according to treatment, and other ingredients such as stearic acid, triethanolamine, VCO, mineral oil, moisturizer, conditioner, cetyl alcohol, methyl paraben, propyl paraben, sodium metabesulfite, EDTA, distilled water (Modification Alakh *et al*. 2011). In the manufacture of cream, there are two phases, namely the aqueous phase and the oil phase (Swastika *et al*. 2013). The oil phase consisting of stearic acid, VCO, mineral oil, cetyl alcohol, propyl paraben, and water phase is water (distilled water), triethanolamine, paraben metyl, moisturizer, conditioner, EDTA, and sodium metabisulfite. The oil phase and the water are heated at a temperature of 65ºC separately. The heating is done until oil phase melted and water phase dissolves in all its components with stirring. Phase mixture of water added to the oil phase mixture while stirring constantly until homogeneous and the temperature decreases. Turmeric extract in VCO is then added into the cream and stirred until homogeneous.

The variables were observed in the manufacture of cream turmeric are: homogeneity (Michael & Ash 1997), the ratio of the separation of cream, dispersive power, adhesion (Michael & Ash, 1997), pH (Tranggono & Latifah 2007), the viscosity, and the antioxidant capacity.

3. Results and Discussions

3.1 Homogeneity Cream

The test results in Table 1 shows that all cream samples turmeric extract is a homogeneous cream. Turmeric extract concentration had no effect on the homogeneity of the cream. The spread of color and mixing of cream component remains equally and there are no lumps. This is thought to occur because of the nature the active ingredient of turmeric extracts i.e. flavonoids are easily mixed with cream ingredients so there is no clumping. According to research Juwita *et al.* (2013), formulation of the cream of ethanol extract of leaves of sea grass (*Syringodium isoetifolium*) stating the cream component there are no lumps and allegedly due to the nature of the active substance sea grass leaf extract i.e. phenols are easily mixed with cream ingredients. The whole of this treatment remain homogeneous for 5 weeks because it contains phenols which are classified flavonoids in turmeric.

Table1. The observation of homogeneity and the separation ratio of turmeric cream

Turmeric extract concentration treatments	Homogeneity (weeks)						Separation ratio (weeks)						
	0	1	2	3	4	5	0	1	2	3	4	5	6
K1 = 50 mg/200 ml VCO	h	h	h	h	h	h	tt	tt	tt	tt	tt	tt	tt
K2 = 75 mg/200 ml VCO	h	h	h	h	h	h	tt	tt	tt	tt	tt	tt	tt
K3 = 100 mg/200 ml VCO	h	h	h	h	h	h	tt	tt	tt	tt	tt	tt	tt
K4 = 125 mg/200 ml VCO	h	h	h	h	h	h	tt	tt	tt	tt	tt	tt	tt
K5 = 150 mg/200 ml VCO	h	h	h	h	h	h	tt	tt	tt	tt	tt	tt	tt

Note: h = homogeneous, th = not homogeneous
t = separate, tt = no separate

3.2 Cream separation ratio

Based on Table 1 it can be seen that the whole turmeric cream does not separate or stable at room temperature for 5 weeks of storage. Cream does not separate because stable emulsion. Emulsion cream can be damaged due to impaired stability. Turmeric extract which is added to emulsion, does not interfere the cream because turmeric extract is phenol compounds that soluble in oil, so it does not interfere the emulsion of cream. This is why no-separation of cream or cream remains stable.

3.3 Dispersive power

Component of cream is said to have a good dispersive power if cream component easily removed from the container and when the cream is used on the skin, the skin is not irritated. Specifications of dispersive power expected are diameter 5.0-7.0 cm (Garg *et al*. 2002). Dispersive power has a close relationship with the viscosity

of the cream. Testing of the dispersive power is inversely proportional to the viscosity of the cream. The observation of dispersive power is presented in Figure 1. The results showed that the value of the dispersive power at weeks 0 at range 4.2-2.7cm and in week 5 is 3.7-4.3 cm. At the beginning of the cream is made, the cream is not eligible for dispersive power. This is presumably because the materials used in this study differs from previous studies (Alakh *et al*. 2011) thus affecting the quality of the resulting cream.

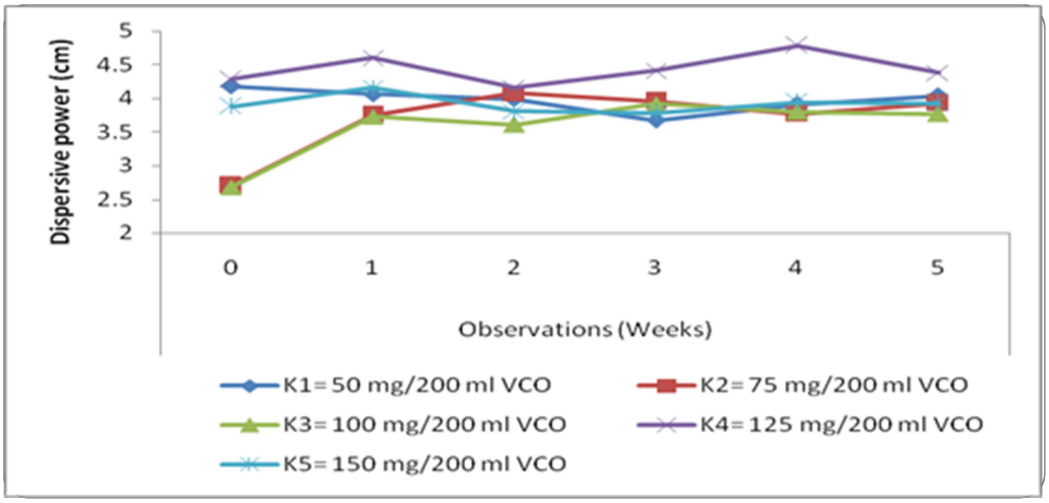

Figure 1. Observations dispersive power of turmeric extracts cream during storage

Based on Figure 1, it can be seen that all treatments during the five weeks of storage showed an increasing trend of the dispersive power of cream but has not qualified the dispersive power of cream. This shows that the water phase is less than the oil phase so that the dispersive power also reduced. In contrast to research Widyaningrum *et al*. (2012) on the effect of the concentration of ethanol extract of green tea leaves (*Camellia sinesis* L.), that each extract were added, the consistency of the cream will be more concentrated and will affect the decline of the dispersive power of cream. In this study, the concentration of the extract did not affect the stability of the emulsion so that no influence on the dispersive power of cream.

3.4 Adhesive power

Adhesive power describes the ability of the media of cream to sticky at the skin during use. The better the stickiness of the cream, the longer they are attached to the skin. Parameter used is the time of sticky. The measurement results stickiness of turmeric cream with 5 degree of concentration can be seen in Figure 2. Based on the observation chart can be seen increasing of adhesive power trend during the five weeks of storage. The value adhesive power of creams in week 0 was at the range of 9-22 seconds and the 5th week at 14 -19 seconds. The increasing value of adhesiveness of cream in this research is due to the evaporation of water during 5 weeks of storage of turmeric cream. This is suitable with research done by Windriyati *et al.* (2007), which says that an increase or decrease in stickiness strength is influenced by the amount of water content in cream media. Based on the observation chart can be seen that the most stable sticky power during 5 weeks of storage are the cream concentration of K2, and in the week 2nd with a value of 24 seconds.

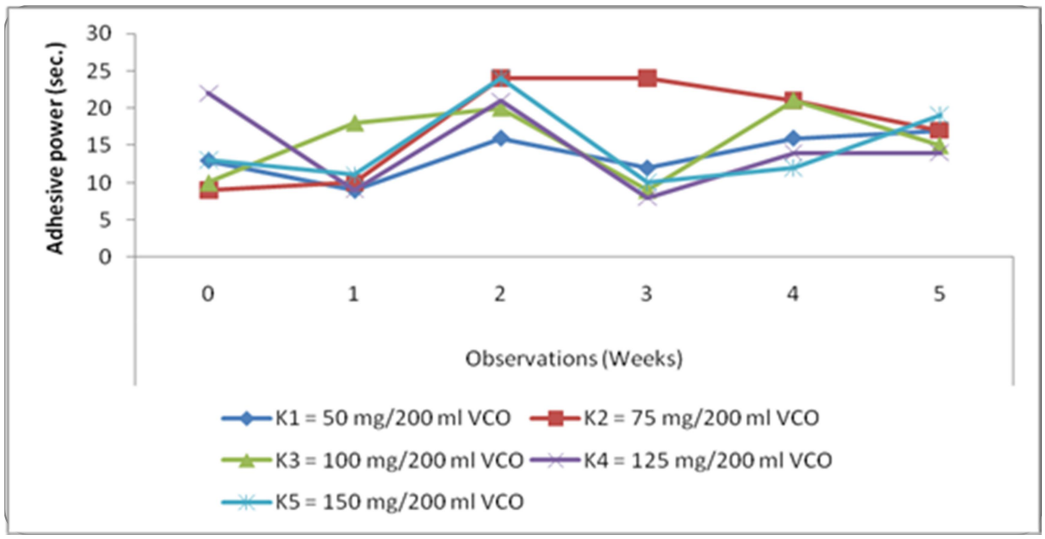

Figure 2. Observations adhesive power of turmeric extracts cream during storage

3.5 Degree of acidity (pH)

The pH testing is done to determine the safety of the cream when used in skin. The pH of the cream must be adapted to the skin's pH is about 6-7, when it is not going to cause skin irritation. The observation of pH test can be seen in Figure 3. Based on observations are showed that the pH range of cream at week 0 were in the 5.04 - 7.12 and the 5th week i.e. from 7.03 - 7.19. pH conditions cream during 5 weeks of storage are relatively neutral pH and the trend has increased. The addition of the extract with 5 concentration level does not affect the pH conditions because there are phenol compounds in the extracts that react during 5 weeks of storage. This is consistent with research Sharon *et al*. (2013), which says that a decrease or an increase in pH that may occur due to other substances that join react which can affect pH conditions. In this study, the cream has remained stable during the five weeks of storage. The condition of the most stable pH cream is cream concentration K2 and also meets the criteria of pH.

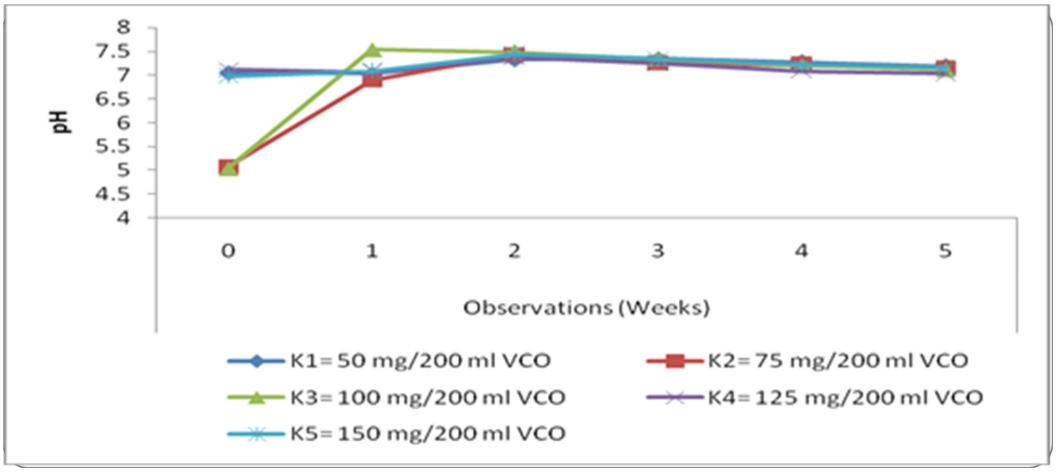

Figure 3. Observations pH of turmeric extracts cream during storage

3.6 Cream viscosity

In this study, the viscosity of the cream was measured with viscometer "spindle" no.7 at a speed of 20 rpm.

Viscosity measurement is done every week for the storage of cream at room temperature. Cream otherwise well if the viscosity is in the range from 2.000 to 50.000 cPs. Trend viscosity of cream decreased at range of values the viscosity of cream at week 0 was 6.067 - 12.00 cPs and week 5th is 5.267 - 10.833 cPs (Figure 4). During the five weeks of storage the turmeric cream has a viscosity which is good because its value meets the criteria. Creamy viscosity values increasing with increasing extract is added to the cream. This occurs because the active ingredient in the extract are phenol compounds and viscosity of cream turmeric extract decreased during 5 weeks of storage. The cream of extract turmeric the most stable in this research is concentration of K3 with viscosity 21.000 cPs.

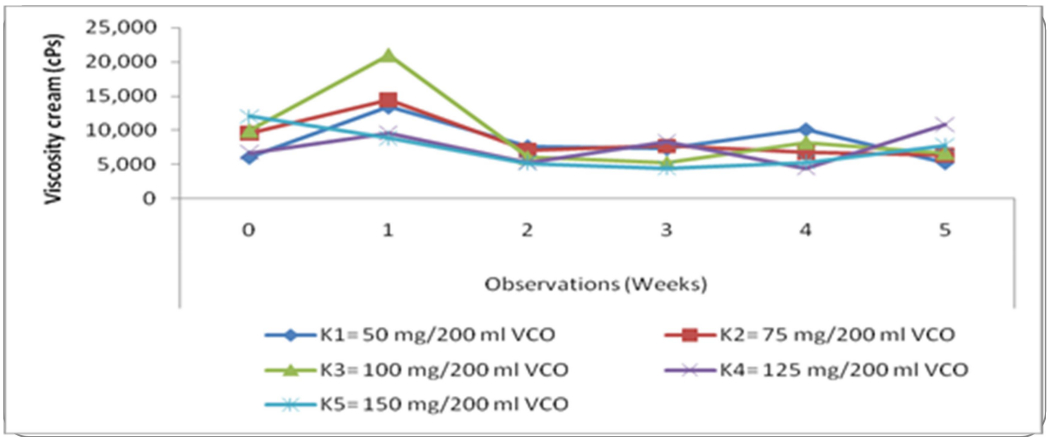

Figure 4. Observations viscosity of turmeric extracts cream during storage

3.7 Antioxidant capacity

Value of antioxidant capacity of turmeric cream had a declining trend during the storage of 5 weeks (Figure 5). Value of antioxidant capacity of cream at week 0 was at 9.356 – 10.897 mg GAEAC / 100g and at week 5th at 8.085 – 8.466 mg GAEAC / 100g. The antioxidant capacity of cream increases with increasing concentration of turmeric extract in the cream, and during storage at room temperature for 5 weeks antioxidant capacity decreased at each concentration. Based on the chart also showed that the cream of extract turmeric the most stable are the cream of turmeric extract in K5 concentration at week 5th i.e. 8.466 mg GAEAC/ 100g.

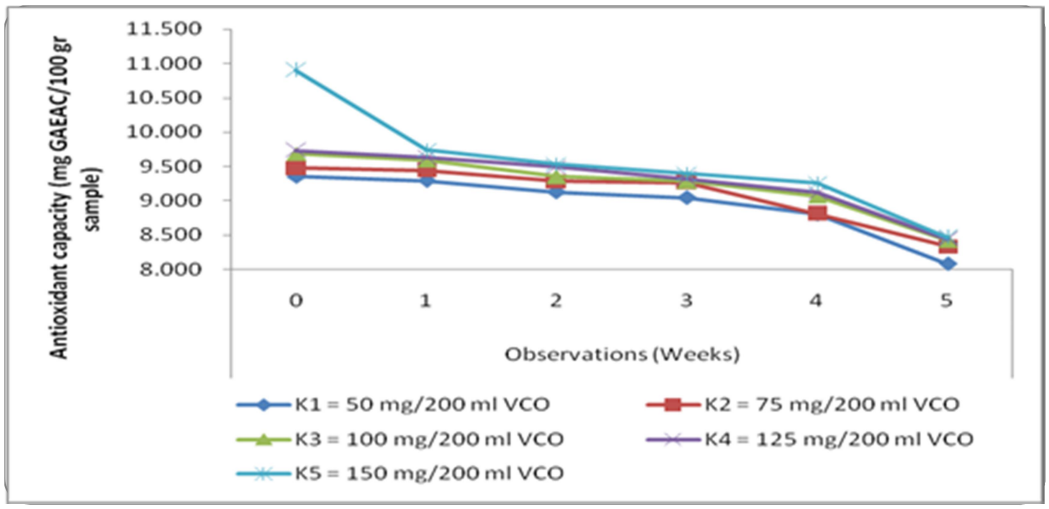

Figure 5. Observations antioxidant capacity of turmeric extracts cream during storage

3.8 Election of cream with best characteristics

Based on the preceding discussion, the recapitulation of the test variable turmeric cream in each treatment during 5 weeks of storage is presented in Table 2. Based on these results it can be seen that the concentration of the best turmeric cream is K2 (75 mg / 200 ml VCO) because the cream at most meet the criteria of existing variables.

Table 2. The test results cream variables in each treatment

Variables and Standards	Treatments				
	K1	K2	K3	K4	K5
Homogeneity	✓	✓	✓	✓	✓
Cream separation ratio	✓	✓	✓	✓	✓
Dispersive power (5-7 cm)	-	-	-	✓	-
Adhesive power (sec.)	-	✓	-	✓	-
pH (6-7)	-	✓	-	-	-
Viscosity (2,000-50,000 cPs)	✓	✓	✓	✓	✓
Antioxidant capacity	✓	✓	✓	✓	✓

Note: ✓ = meet the standards
- = not meet the standards

4. Conclusion

(1) Cream of turmeric extract till a concentration of 150 mg its emulsion stable on observation until the 5th week for all the observed variables except the dispersive power and adhesive power.

(2) Turmeric extract with a concentration of 75 mg produce creams with the best characteristics, i.e.: pH 7.2, viscosity of 6,400 cPs, the capacity of antioxidant 8.334 GAEAC mg / 100 g sample, homogeneous, not separation, the dispersive power 3.93 cm, and adhesive power 17 seconds.

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