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The Effect of Coconut Oil Concentrationon Physical and Chemical Properties of Cosmetic Emulsions

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Abstract

A research on "The effect of coconut oil concentration on physical and chemical properties of cosmetic emulsions has been done. Emulsions were made by mixing the water phase (glycerine, distilled water, and triethanol amine) and oil phase (coconut oil, stearic acid, cetyl alcohol and lanolin) by emulsification method. to study the effect of oil concentration on the properties of emulsion, coconut oil was added at various concentration : 0 %, 2%, 4%, 6%, 8%, 10% and 12% (w/w). Then, the physical and chemical properties such as pH, viscosity, droplet size, and absorption of ultraviolet radiation of emulsions were determined. The results ofthis research showed thatthe pH of the emulsions were between 7,49 to 7,66. When the coconut oil concentration increased from 0% to 12% (w/w), the viscosity of emulsion also increased from 60 dPas to 176 dPas, the droplet size of emulsion also increased from small size to large size, and the absorption of ultraviolet (UV) radiation of the emulsions in wave length of 272-290 nm also increased from 0.4 to 1.07. This means that the concentration of coconut oil affectedthe physical and chemical properties of cosmetic emulsions.

Keywords : coconut oil concentration, physical and chemical properties, cosmetic emulsion, water phase, oil phase

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Introduction

Most of skin care cosmetics sold in the marked are in the form of lotion and cream,which are included in a class of emulsion.Emulsions in a type of oil in water (O/W) are the most commonly formulated. These types of emulsions tend to feel less greasy and have a lower formulation cost, because of higher water content [1]. Skin care cosmetics used to soften and moisturize the skin can be made in the form of a cream with soap emulsifier from the reaction between stearic acid and triethanolamine [2]. in the manufacture ofthiscreams can be added ahumectants such as glycerine andemollients such as oil to further enhance the moisturizing effect. in the manufacture of cosmetic emulsions, oil plays an important role, because oil have a great influence on the rheological behaviour of emulsion. Usually viscosity of the oil affect the viscosity of emulsion [3].Currently, it has been conducteda lot of researches on formulation of skin care cosmetic by using vegetable oil.This oil has many function, include as a humectant, emollient, and can help to restore skin moisture balance [4]. One of the vegetable oil that can be used in manufacture of cosmetic emulsion, especially in formulation of sunscreen cosmeticis coconut oil [5].

Coconut oil is a triglyceride derived from coconut meat, contains92% saturated fatty acids. The greatest percentage of saturated fatty acids found in coconut oil is auric acid (45-56%) [6].Most of the saturated fatty acids in coconut oil are medium-chain fatty acids (MCFA) with 10-12 carbon atoms. The researchshowed that MCFA found in coconut oil have a lot of health benefits. Coconut oil auric acid, in the human body is converted into monolaurin which serves as antiviral, antibacterial, and antimicrobial [7]. MCFA coconut oil easily absorbed into the skin's layers, and can maintain skin elasticity and softness. Coconut oil is a natural lotion, to prevent the formation of free radicals and protect against free radicals [8]. Coconut oil is a good sunscreen, very good to prevent sunburn, especially if the oil is consumed. This oil has a Sun Protection Factor (SPF) of 4, can block 20% of ultraviolet radiation [9]. The research results byKaur and Saraf (2010) showed that coconut oil has an SPF value of 7.119. A sunscreens that havea high value of SPF, it will be higher their ability to protect against ultraviolet (UV)

radiation[5].Because coconut oil has many benefits, so in recent years, this oil is favoured by the people, not only for cooking but also used widely in the world of cosmetics for beauty.

To study the effect of coconut oil concentration on properties of emulsion,especially on pH, viscosity, droplet size and absorption of ultraviolet radiation of cosmetic emulsions, it is necessary to do a research on preparation of cosmetic emulsions in various concentration of coconut oil, using an emulsifier which is resulted from the reaction between stearic acid and triethanolamine (TEA).

Methodology

Materials and Apparatus

The materials used in these research were coconut oil (from PT Surya Coco Jaya, Yogyakarta), stearic acid, cetyl alcohol, lanolin, glycerine (from CV Brataco, Yogyakarta), triethanolamine (TEA) (e-Merck from LPPT, UGM) and distilled water (from Physical Chemistry Laboratory, Gadjah Mada University).

The apparatus used in these research werelaboratory glassware such as beaker glass,measuring cups, mixing glass, watch glass, glass funnel, thermometer, electric stove, analytical scales, electric scales, digital pH meters, Brook field viscometer, Olympus CH 20 binocular micrometre microscope, and Shimatzu Reflectance Ultraviolet Spectrophotometer.

Preparationand characterization of cosmetic emulsions invarious concentration of coconut oil

In this research, the emulsion was prepared by, a certain amount of water phase in the beaker glass of 250mL was heated on the electric stove until it reached a temperature of 70 °C. Then, a certain amount of oil phasein the beaker glass of500 mL was heated on electric stove until it reached a temperature of 70 °C, too (Emulsion formula contained in Table 1). After that, the water phase is added to the oil phase while stirring. Stirring was continued until the temperature of the mixture reached atemperature of±35 °C.The resulting emulsions were characterized to determine the physical and chemical properties include pH, viscosity, droplet size, and ultraviolet spectra. The pH of emulsions were measured by using digital pH meters, viscosity of emulsions were measured using brook field viscometer, droplets size of emulsions were determined using Olympus CH 20 binocular micrometre microscope, and absorbency of ultraviolet radiation of emulsion were determined usingthe Shimatzu Reflectance Ultraviolet Spectrophotometer.

Table 1. Emulsion formula with various concentrations of coconut oil

Materials	Sample/by percent weight						
	1	2	3	4	5	6	7
Oil Phase :							
Coconut Oil (w/w %)	0	2	4	6	8	10	12
Stearic Acid (w/w %)	8	8	8	8	8	8	8
Cetyl Alcohol (w/w %)	1	1	1	1	1	1	1
Lanolin (w/w %)	1	1	1	1	1	1	1
Water Phase :							
Glycerol (w/w %)	8	8	8	8	8	8	8
Aquadest (w/w %)	81.25	79.5	77.5	75.5	73.5	71.5	69.5
TEA (w/w %)	0.75	0.75	0.75	0.75	0.75	0.75	0.75

Results and Discussion

Preparation and characterization of cosmetic emulsions in various concentrationof coconutoil

By using the formula in Table 1, seven cosmetic emulsions with different concentrations of coconut oil have been formulated. The concentration of coconut oil were 0%, 2%, 4%, 6%, 8%, 10% and 12%. (w/wW).The emulsion withcoconut oil concentration of 0% (w/w) was used as a comparison.The resulting emulsions were creamy, white colour, soft texture, washable andthe emulsions include in a type of oil in water emulsion (O/W). in this type of emulsion, the droplets of coconut oil were dispersed into the water phase as a dispersing medium, and stabilized by triethanolamine stearate as an emulsifier. to study the effect of coconut oil concentration on the properties of emulsions, it has been measured the pH, viscosity, droplet size and the absorption of UV radiation of the cosmeticemulsion. The data obtained in thisstudywere presented in Figure 1, 2, 3and 4.

Effect of Coconut oil Concentration on pH of Emulsions

From the data contained in Figure 1, it can be seen that the pH of emulsions were between 7,49 to 7,66. The resulting emulsions have a pH value above 7, but still meet the NationalStandard of Indonesia for cosmetic (SNI),especially for sunscreen cosmetic.

According to SNI, the pH of sunscreen cosmetics, were 4.5 to 8. The addition of coconut oil with a concentration of 2% to 12% into the emulsion, it did not indicate a difference in pH. to determine whether the concentration of coconut oil, affect the pH of emulsion, it is necessary to do research by adding

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coconut oil with concentrations greater than 12%. from the data resulted in this study,it can be concluded that coconut oil concentration from2% w/w to 12% w/w did not show significant changes in pH of emulsion.

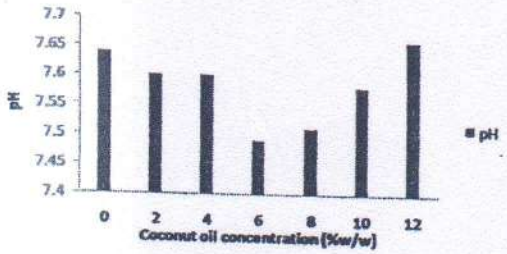


Figure 1. The pH of emulsions at various concentration of coconut oil

Effect of Coconut Oil Concentration on Viscosity of Emulsions

Figure 2. showed that, if the concentration of coconut oil increased, the viscosity of the emulsions also increased. The viscosity of emulsion increased as coconut oil concentration increased from 2% w/w to 12% w/w. This was due toan increasing in phase volume of internal phase in emulsion. Other researchers also found that the addition of oil, with increasing concentration, it will also increase the viscosity of the emulsion [10]. Usually, if the oil viscosity is very high, the viscosity of the emulsion will also be high.This mean the viscosity of an oil affect the viscosity of the emulsion. When in the formulation of emulsion was added a high concentration of coconut oil, so the viscosity of the emulsion will also be higher.This means that concentration of coconut oil affected the viscosity of the emulsions.

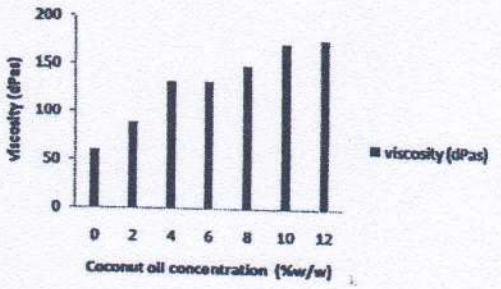
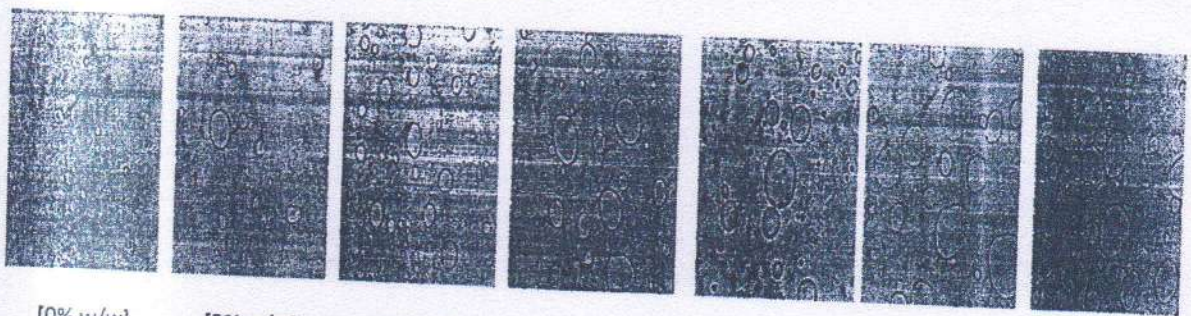


Figure 2. Effect of coconut oil concentration viscosity of emulsions

Effect of Coconut Oil Concentration on Droplet size of Emulsions

The results showed that emulsion with coconut oil concentration of 2% w/w has a small droplets size than emulsion with coconut oil concentration of 4% w/w. The more concentration of coconut oil was added to an emulsion, the greater the resulting droplets size of oil in the emulsions. This was due to the increasing of coconut oil concentrationin the emulsion, it will cause a reduction in the ability of emulsifiers to emulsify the oil phase and water phase. This condition causes the droplets size become larger.



[0% w/w] [2% w/w] [4% w/w] [6% w/w] [8% w/w] [10% w/w] [12% w/w]

Figure 3. Effect of coconut oil concentration on droplet sizes of cosmetic emulsions

The research resulted by Eid, Baie and Arafat (2012) showed,ifthe oil concentration in the formulation of emulsion increased, their droplets size were increased also and the system will not be stable [11]. Figure 3 showed that if the coconut oil concentration increases, the droplets size of the emulsion also increase. This means that the concentration of coconut oil affects the droplets size of cosmetic emulsion.

Effect of Coconut oil Concentration on Absorption of Ultraviolet Radiation of Emulsions

Ultra violet spectra (Figure 4),showedthat there is anincreased absorption of ultraviolet radiation of emulsions, due to higher coconut oil concentrations. Coconut oil is composed of saturated fatty acids, which contains a C=O groups and unsaturated fatty acids, which contains a C=C and C=O groups. Because of the existence of this group, so the coconut oil can absorp theUV radiation. The higher concentration of coconut oil added to the emulsion, it will also increase

the UV absorption of the emulsion. The emulsion that does not contain coconut oil, also showed the UV absorption, this is due to the emulsion contain stearic acid andtriethanolamine stearate which has a C=O group. The research resulted by Kumar and Viswanathanindicatedthat coconut oil show poor absorption of UV radiations[12].

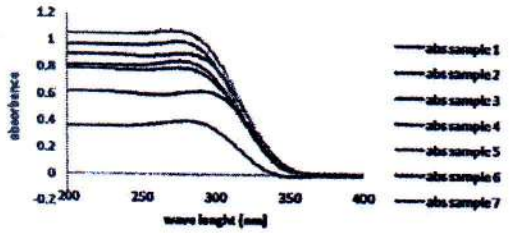


Figure 4.Effect of coconut oil concentration on absorption of ultraviolet radiation of cosmetic emulsions

Conclusion

From the research, it can be concluded that the pH of the emulsions were between 7,49 to 7,66.When the coconut oil concentration increased from 0% to 12% (w/w), the viscosity of emulsion also increased from 60 dPas to 176 dPas, the droplet size of emulsion also increased from small size to large size, and the absorption of ultraviolet (UV) radiation of the emulsions in wave length of 272-290 nm also increased from 0.4 to 1.07. This means that the concentration of coconut oil affectedthe physical and chemical properties of cosmetic emulsions.

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