Tengkawang (Borneo Illipe) Butter Optimization Study as a Cost-Effective Substitution of Cocoa Butter in Body Lotion Formula

Fajrin, Anita[1]; **Indiarto, Nur Huda Arif[1*];** Purwadi, Ronny[2]; Kresnowati, Made Tri Ari Penia[2]; Lestari, Dianika[2]; Junior, I Wayan Iswara Jay[2]; Wilhelmina, Alexandra[2]

[1] PT Paragon Technology and Innovation, Tangerang, Indonesia; [2] Department of Bioenergy and Chemurgy Engineering, Bandung Institute of Technology, Bandung, Indonesia

* Nur Huda Arif Indiarto, Tangerang, +6281952949220, nur.haindiarto@paracorpgroup.com

Abstract

Background: The need for more sustainable and economical use of emollients in lotion formulas is increasing, so better alternatives are needed to meet these demands. Cocoa butter has a quite high cost, meanwhile, the tengkawang butter has a similar fatty acid composition to cocoa butter at a cheaper cost. This research aims to find the optimal composition of Illipe butter to substitute cocoa butter in a body lotion formula.

Methods: The Illipe butter substitution fraction starting from 0%, 25 %, 50%, 75%, and 100% ratio. Formulated lotions were then evaluated using initial characterization, an accelerated stability test (25°C controlled room, 45°C chamber, 50°C chamber, and under sunlight condition for 1 month), organoleptic, pH, viscosity, and globule homogeneity. Finally, occlusive properties were evaluated by in vitro measurement.

Results: Developed formulation resulted in stable lotions even after centrifugation, and throughout storage duration with a similar characteristic profile, regardless of degree substitution and storage condition. The tengkawang butter substitution resulted in a minor change in pH, viscosity, rheology, and degree of liking of all sensory attributes except for aroma, where a high substitution degree can hurt it and is projected to lower overall liking and consumer preference. The tengkawang butter also tends to increase the occlusive properties of a lotion.

Conclusion: The optimal composition of tengkawang butter that can be used as cocoa butter substitution comfortably up to 50% and 75%, respectively. Although higher substitution is possible stability-wise, additional considerations are needed to minimize the possible downsides in terms of sensory attributes.

Keywords: Illipe, Butter, Lotion, Cocoa, Substitution

Introduction.

Cosmetics are substances that are applied to various parts of the human body such as skin, hair, nails, and lips. In cosmetics that are applied topically, moisturizer is one of the core components that function to maintain skin surface moisture (stratum corneum, SC). Based on the mechanism of action, moisturizer is divided into three types, i.e., humectant, occlusive, and emollient. Emollient is a moisturizer that helps the role of the skin barrier in maintaining skin moisture by filling the gaps between SC corneocyte cells[1]. Various types of lipids can be used as emollients such as hydrocarbon, vegetative oils/fats, fatty acid, and long-chain esters[2]. The development of the use of emollients in cosmetics that is attracting attention is the exploration of the substitution of conventional emollients with alternatives in the cosmetics development of cosmetic product formulation trends.

In this study, a system of emollient substitution was compared in the preparation based on lotion, namely the substitution of cocoa butter with tengkawang butter. Cocoa butter derived from chocolate beans (*Theobroma cacao*) is an important butter that is often used in cosmetic products such as creams, lotions, and lip balms for their qualities as moisturizers and skin risers. Even so, this quality is offset by the price of butter which is classified as higher than other vegetable fats. Therefore, studies regarding the exploration and development of cocoa butter alternatives to improve the economy of cocoa butter products were being the topic of research. Tengkawang butter derived from the fruit of the *Shorea stenoptera* tree that spread in Southeast Asia (Indonesia, Malaysia, and the Philippines), have a composition of fatty acids like cocoa butter so it is often classified as Cocoa Butter Substitute (CBS)[3], [4]. The use of tengkawang butter in the field of cosmetics has been researched several times in products in the form of creams and lipsticks in terms of their stability and acceptability[4]–[6]. However, with its reputation as CBS, few studies are comparing tengkawang butter and cocoa butter in cosmetic preparations. The study of properties related to the function of tengkawang butter as emollients is also hard to find.

Based on these problems, the study aims to examine the usual opportunities for emollient substitution used with emollients alternative to the quality of lotion preparations. The results of lotion formulations are evaluated through organoleptic aspects, physicochemical properties, and sensory analysis in the form of hedonic tests and ranking tests. Study stability is then carried out under normal conditions, high temperatures, and sun exposure to check the physical and chemical stability of lotions. Finally, the occlusion properties of lotions are evaluated in vitro.

Materials and Methods.

Lotion Preparation

The components and composition of the formulated lotion can be seen in Table 1. The variety that is used is a solid emollient composition, where the CT is for the substitution of cocoa butter with tengkawang butter. The water and oil phases are initially heated to 75°C separately and stirred until homogeneous. When the temperature of the second phase is uniform, phase B is then added little by little to phase A while homogenized at 3000-3200 rpm for 5 minutes. The resulting emulsion is cooled to 40°C and then phase C is added little by little accompanied by homogenization at 2000-2500 rpm for 5 minutes. The emulsion is then cooled to room temperature with stirring at 1000-1500 rpm so that it forms a base lotion preparation.

Table 1. Lotion Composition

Material Name	Composition (%w/w)				
	CT1	CT2	CT3	CT4	CT5
Phase A (water)					
RO Water	85,07	85,07	85,07	85,07	85,07
EDTA	0,10	0,10	0,10	0,10	0,10
Glycerin	4,00	4,00	4,00	4,00	4,00
Carbomer	0,13	0,13	0,13	0,13	0,13
Phase B (Oil)					
Isopropyl myristate	1,00	1,00	1,00	1,00	1,00
Dimethicone	1,00	1,00	1,00	1,00	1,00
Cocoa butter	2,00	1,50	1,00	0,50	-
Tengkawang butter	-	0,50	1,00	1,50	2,00
Stearic acid	1,00	1,00	1,00	1,00	1,00
Palmitic acid	1,50	1,50	1,50	1,50	1,50
Glyceryl monostearate	3,00	3,00	3,00	3,00	3,00
BHT	0,20	0,20	0,20	0,20	0,20
Phase C					
Triethanolamine	0,70	0,70	0,70	0,70	0,70
Phenoxyethanol	0,72	0,72	0,72	0,72	0,72
Ethylhexylglycerin	0,08	0,08	0,08	0,08	0,08

Lotion Characterization

Organoleptic Characterization

The organoleptic characteristics of each lotion sample are qualitatively observed through appearance, color, texture, and homogeneity. The look and color of the lotion are visually observed, while homogeneity and texture are performed through direct application. The presence/absence of coarse particles and consistency are used to evaluate homogeneity and texture. Sensory aspects such as skin feel and after-feel of the fingers are also evaluated.

Centrifugation Test

A sample of lotion is inserted into a centrifugation tube. The tube is then inserted into the centrifuge and centrifuged at 3000 rpm and 25±2℃ for 20 min. The sample is declared resistant to interference mechanical when not subjected to physical changes.

pH

The pH value was measured using a digital pH meter at 25±2℃. Before electrode measurements are carried out the pH meter has been calibrated at pH 4.01; 7.00; and 9.21. Measurements are carried out on a triple basis.

Viscosity

Digital viscometers are used to measure the viscosity of preparations. Viscosity is measured by spindle number 6 at 25±2℃. To observe the rheology of the system, the spindle rotation rate is varied at 0.5, 1, 2, 4, 5, 10, 20, and 50 rpm. Measurements are carried out on a triple basis.

Globule Homogeneity

Morphological observations and homogeneity of oil globules on lotion emulsions were carried out using an optical microscope with a magnification of 40x. The average globule diameter is obtained from a diameter measurement of 200 oil globules using the help of ImageJ® software. In addition, the polydispersity index (PDI) is calculated using the following equation[7].

$$\mathrm{PDI} = \left(\frac{\sigma}{d}\right)^2$$

Where PDI = Polydispersity index; σ = Standard deviation; and d = Average diameter of the globule.

Sensory Analysis

Sensory analysis is carried out in the form of affective tests through hedonic tests and ranking tests. Panelists who used numbered 19 people (Aged 19-27 years) and were semi-trained. In the hedonic test, there are five rated sensory attributes: texture, aroma, application, after-feel, and overall preferences. Favorability level assessed using a 9-point hedonic scale (1 = 'Very disliked'; 5 = 'Neutral'; 9 = 'Very fond'). The definition of each sensory attribute is shown in Table 2.

Table 2. Definition of sensory attributes of hedonic test lotions.

Attribute	Definition
Texture	The texture and consistency of the lotion when taken from the packaging.
Aroma	The aroma gave when the lotion has been applied.
Application	The difficulty of the spreading process when applying lotions and the difficulty of lotions seeping on the surface of the skin.
After-feel	The taste that is left behind after the application of lotion on the surface of the skin and fingers (oiliness, stickiness, watery).
Overall preference	The overall favorability levels.

The ranking test was carried out by measuring the preference level of each variation. Panelists were instructed to sort the preference level from rank 1 (most preferred) to 5 (least preferred). Repeated application of the sample can be done when there is doubt about the consideration of ranking decisions.

Accelerated Stability Test

Stability tests are performed for each of the variations on several storage conditions. Condition the storage used is 25°C (room temperature), drying condition, 45°C, and 50°C. Data measurements are performed every 7 days for 28 days. The observed characteristics of its stability include organoleptic characteristics, pH, viscosity, and globule homogeneity. The centrifugation test is then carried out again at the end of the storage period. The entire sample was triple tested under every storage condition, except for the drying condition was duple tested.

Occlusion Factor

The occlusion factor is determined in vitro based on the method used by Silva (2020) and Wissing (2001). At first, 30 g of distilled water is put in a glass jar (top diameter 4.3 cm) and a jar covered with cellulose filter paper (Whatman, number 2, pore size 8 μm). The 0.2 g of lotion sample is then evenly spread (13.77 mg/cm^2) on the surface of the filter paper and the vessel circuit is stored at 40°C for a duration of 24 and 48 hours. An unsampled set of tools is used as a blank and the occlusion factor is calculated with the following equation.

$$F = \left(\frac{A-B}{B}\right) \times 100\%$$

Where A and B are the masses of water lost in the jar with and without samples sequentially. Measurement is done triple.

Statistical Analysis

The statistical analysis carried out is a T-test and one-way analysis of variance (ANOVA) for comparing the mean values over the various treatments. Further analysis in the form of the Tukey Test continued to significant difference ($P < 0.05$). The Pearson correlation coefficient (r) is calculated to find out the correlation between sensory attributes of lotions. The ranking test data were analyzed using non-parametric methods through the Friedmann Test to find out the significance of the differences in the preferences of the sample. The entire calculation is carried out using SPSS software v.26 and Microsoft Excel 2019.

Results.

Initial Characterization of Lotion

Organoleptic properties

The entire variety of lotion preparations produces a stable (homogeneous) emulsion both before and after the centrifugation test is performed (Figure 1). A high cocoa butter fraction (50% and above) causes yellowing in the color of the preparation so that the former white color is more like vanilla white. Meanwhile, in terms of appearance, consistency lotions increase along with an increase in cocoa butter fraction.

Organoleptic observation of the preparation briefly shows a similar sensory effect for the entire preparation, where the entire preparation produces a moisturizing effect on the skin, is not oily, and is easily spread and absorbed on the surface of the skin. Although there are slight deviations in some variations, the entire preparation can be is considered to have quite satisfactory cosmetic qualities. This is coupled with the quality of stability a good one which indicates that the entire variation is appropriate to review at the advanced testing stage.

Figure 1. The appearance of lotion preparations of CT variation.

pH

The pH value of lotions ranges from 7.5 to 8.0 and is not significantly affected by the emollient composition of CT.

Viscosity

The results of the initial viscosity measurement of lotions (Figure 2a) show that a significant difference occurs ($P < 0.05$). In CT variations, there is no constant trend of viscosity changes to an increase in the emollient substitution fraction. The downward trend in viscosity occurs up to the degree of substitution of 50%, but the viscosity value in lotions with substitutions of 75% and 100% has a viscosity comparable to 0% and 25% substitution in a row. Despite the trend of viscosity of lotions, CT variations are classified as irregular in the composition of substituted emollients, there is a significant difference between viscosity lotion with only cocoa butter (CT1) and only tengkawang butter (CT5). Figure 2b shows the effect of the rate rotation against the viscosity of the preparation. The whole variety has pseudoplastic rheological properties, more precisely ticsotropic. From the viscosity curve profile, it can be concluded that CT variations of alternative emollients resulted in any influence significant on viscosity in high shear, and more influential on initial viscosity (low shear).

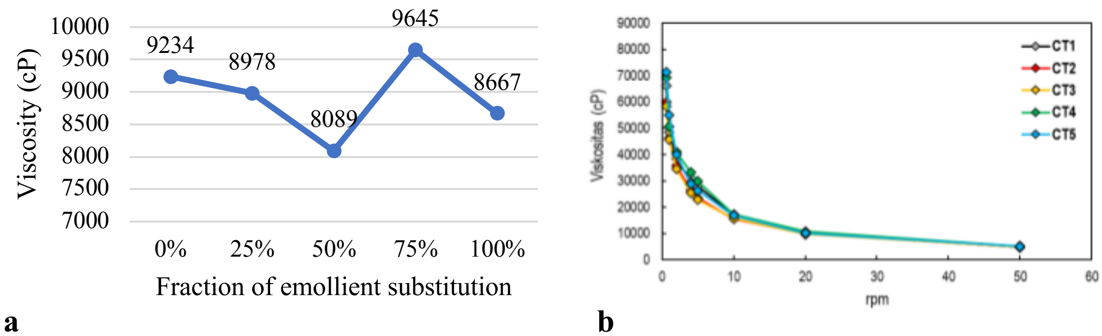

Figure 2. (a) Initial viscosity as a function of emollient substitution fractions; (b) Viscosity curve against spindle rotation rate.

Sensory Analysis

Based on the Friedman Test in the ranking test results (Figure 3a), it was found that there is no significant difference between the value of the number of rank sums ($P > 0.05$). So, it can be concluded that there is no statistically meaningful difference in the perception of lotion quality overall. Descriptively, lotions with only tengkawang butter are lotion preparations selected overall, and the variety containing cocoa butter, in general, gets a better perception. The lowest number of rankings was obtained in the CT4 variation, while the preparations with only cocoa butter (CT1) had the second-highest number of rankings after CT5, despite the difference being quite substantial. In this variation, preparations with substituted emollients (CT2 to CT4) have a better degree of preference than variations with one type of emollients alone, signifying that the distillation of tengkawang butter in lotions containing cocoa butter has the potential to increase the perception of the consumer.

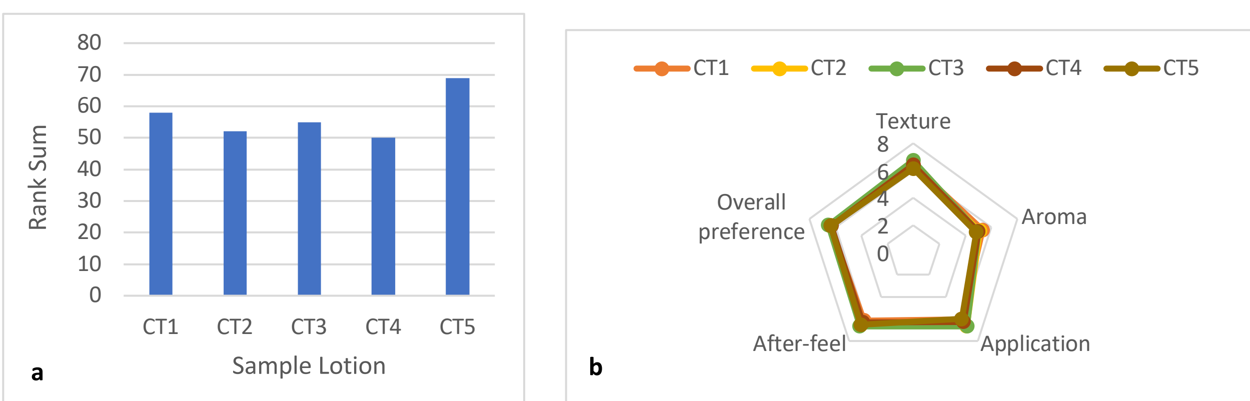

Figure 3. Rank sum ranking test (a) and spider web test hedonic (b) of lotion preparations.

The results of the hedonic test (Figure 3b) in a degree of liking that is generally in response to favorability on the positive spectrum (score ≥ 6), except for the aroma attribute. In the CT group, negative effects are generated on aroma attributes along with an increase in the tengkawang butter fraction, although the effect is insignificant ($P > 0.05$). As discussed earlier in the ranking test, variations with composite emollients also resulted in a generally more favorability level height of variation with one type of emollient on hedonic test results. Specifically for this group, the correlation between sensory attributes relating to textural aspects, named as textures (0.706; $P < 0.01$), application (0,717; $P < 0.01$), and after-feel (0.797; $P < 0.01$) has a strong correlation with overall product liking. Therefore, this group selected three variations as representatives of substitution namely CT1 (without substitution), CT3 (low substitution limit), and CT4 (high substitution limit).

Accelerated stability studies

Table 3 showed the physical stability during storage conditions. During the storage period, there is no change in the smell of the entire preparation. Meanwhile, the decrease in consistency occurs in a high proportion of tengkawang butter (CT3 and CT4). The opposite effect is obtained in conditions of 45°C and 50°C and is more significant at higher temperatures. The centrifugation test results at the end of the storage period also did not interfere with the emulsion stability of the entire variation physically. Even so, there is a discoloration in the form of yellow patches (figure 4) on the lotion when kept in a drying state.

Table 3. Physical stability of CT variation lotions

		W1			W2			W3			W4		
		CT1	CT3	CT4	CT1	CT3	CT4	CT1	CT3	CT4	CT1	CT3	CT4
Appearance	Room	0	0	0	0	0	0	0	0	0	0	0	0
	Dry	0	0	0	0	0	0	0	0	1	0	-1	-1
	45°C	0	0	0	1	1	1	2	1	1	1	1	1
	50°C	1	1	1	2	1	1	2	2	2	2	1	1
Bulk color	Room	PK	PK	P	PK	PK	P	PK	PK	P	PK	PK	P
	Dry	PK	PK	P	PK	PK	P	PK	PK	P	PK*	PK*	P*
	45°C	PK	PK	P	PK	PK	P	PK	PK	P	PK	PK	P
	50°C	PK	PK	P	PK	PK	P	PK	PK	P	PK	PK	P
Smell	Room	0	0	0	0	0	0	0	0	0	0	0	0
	Dry	0	0	0	0	0	0	0	0	0	0	0	0
	45°C	0	0	0	0	0	0	0	0	0	0	0	0
	50°C	0	0	0	0	0	0	0	0	0	0	0	0

Bulk color :P, White; PK, White ivory; *, there are yellow patches. Display (0: No change occurred, +/-1: Increase/decrease mild consistency, 2: Moderate consistency improvement). Smell (0: No change in smell), W: Week of observation.

Figure 4. The display of the preparation after 28 days is kept in a drying state. (From left to right: CT1, CT3, CT4).

The pH profile during storage in room temperature, sunlight, oven 45°C, and oven 50°C condition are quite stable. Meanwhile for the viscosity profile showed some changes especially in oven 50°C condition (the viscosity at day 0 to day 7 tend to increase and then keep stable until day 28).

The optical micrographs of each of the variations are presented in Figure 6. An emulsion with a small globule size with an average of between 3.35 μm (CT4) to 5.24 μm (CT3) is formed. At initial conditions, the shape of the globule is generally not spherical and is more asymmetrical. On CT variation after four weeks of storage, it can be visually observed that there is an increase in the sphericality of the oil globule. It can also be seen that there are symptoms of the process of destabilizing the emulsion of the preparation after 4 weeks of storage, mainly an increase in the size of the globules that can be caused by Ostwald ripening and collision-coalescence events (Table 4).

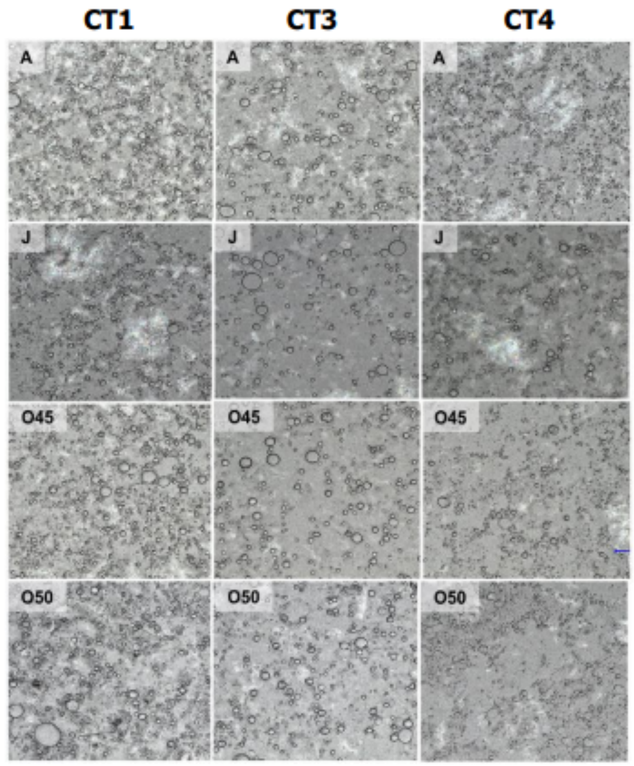

Figure 5. Optical micrograph (40×) lotion preparation at the initial condition (A) and after storage for 4 weeks (J, O45, and O50 for drying conditions, 45°C, and 50°C respectively).

Table 4. The average size of globules and PDI lotion preparations under various storage conditions.

Variation	**Globule Size (μm, mean $\pm$ SD)**				PDI			
	Initial	Dry (4W)	45°C (4W)	50°C (4W)	Initial	Dry (4W)	45°C (4W)	50°C (4W)
CT1	4,33±2,19a	4,45±1,99	5,15±2,81	5,20±2,70	0,255	0,200	0,298	0,269
CT3	5,24±2,31b	5,80±3,27	6,10±2,86	5,57±2,23	0,194	0,318	0,220	0,161
CT4	3,35±1,28c	4,48±2,06	4,21±1,69	4,60±2,00	0,146	0,211	0,160	0,190

Occlusive properties

Based on the measurement of occlusive factors (Figure 8) it was found that there were differences in significance between variations in preparations in both 24-hour and 48-hour durations ($P < 0.05$). The low occlusive factor was experienced in the CT with only cocoa butter (CT1). It can also be seen that in the CT variation, the variation containing tengkawang butter produces an average occlusive factor, and the fraction of tengkawang butter has a positive correlation with the occlusive factor of lotion. At 48 hours there is a reduction in the performance of occlusive factors on variations of CT3, while the CT4 variation still retains. Overall, it can conclude that tengkawang butter has better occlusive properties than cocoa butter.

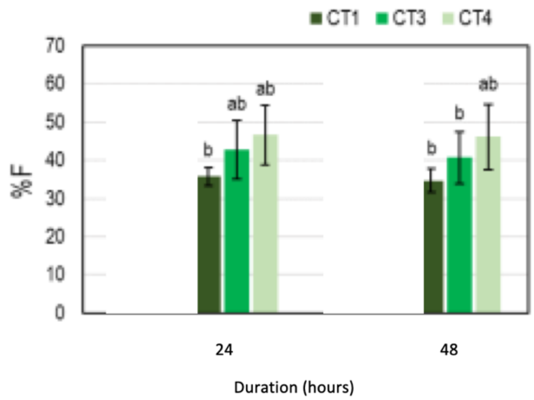

Figure 6. Occlusive factor in vitro lotion preparations at 24 and 48 hours.

Discussion.

This study aims to find out the best formula for substituting cocoa butter with tengkawang butter followed by its evaluation for each formula. On organoleptic tests, a formula with a high fraction of cacao butter (50% and above) showed a vanilla white color, this can be caused by the basic color of the cocoa butter being yellow, like the typical colors of vegetable fats in general, as well as with tengkawang butter of paler color. Meanwhile, the higher cocoa butter fraction also increases the consistency of the lotion that can correspond to the solid fraction of emollients under space conditions.

On pH test showed that all of the formulas were in the range of 7.50 to 8.00. Although it is more alkaline, the pH of the preparation is still at an acceptable level because no symptoms of skin irritation are observed during application.

On CT3, CT5, and CT2 respectively they have lower viscosity. Viscosity values can be attributed to the perception of consumers who think lotion products with lower viscosity have a skin feel or better ease of application than products with higher viscosity[8], [9]. Previous studies on the correlation between viscosity and descriptive sensory attributes for various types of emollients also produce a positive correlation with the difficulty of spreading and stickiness while negatively correlated to softness and slipperiness[10]. (Shear-thinning events that are correlated with rheological properties in lotion preparations can help improve quality in terms of stability, applicability, and manufacturing. High viscosity under low shear stress conditions can reduce the phase separation rate of emulsions and can also be positively correlated to emulsion yield stress thereby improving the consistency of lotions[9], [11]. While on high shear shows whether lotions can be spread evenly[9].

Sensory analysis is performed to select the most preferred variations that will be further reviewed their stability and occlusive properties. Since there are no significant differences in the ranking test, the analysis of sensory attributes individually through degrees of liking (hedonic) and acceptability is performed[12]. In addition, hedonic tests are also carried out because the ranking test cannot explain the reason why one variation is preferred over other variations through more specific sensory attributes. The result, it is indicating that the three attributes (texture, application, and after-feel) can be used as a good indicator in assessing the quality of lotion preparations the resulting. This conclusion also encourages CT3 as the preferred variation for low substitution rates compared to CT2 because it generally has a texturally higher favorability rate, plus with more economical properties of tengkawang butter than cocoa butter.

An accelerated stability test is used to observe the stability of preparations against the effects of different storage conditions. This is useful for ensuring the quality control aspect, safety, and efficacy of the preparation remain valid throughout the storage period[13]. The result showed that there was discoloration which indicates the instability of a component in the lotion formula. Although this can occur because of the oxidation of vegetable fats used as emollients, the major factor is the degradation of butylated hydroxytoluene (BHT) which is used as an antioxidant. BHT degradation in the form of oxidation and dimerization will produce by-products that are yellow and initiated through autooxidation and photooxidation mechanisms[14]–[16].

Evaluation of viscosity stability is useful for assessing the consistency and fluidity of the preparation. From the result, in drying condition storage there was a downward trend in viscosity which indicates that sun exposure gives the effect of destabilizing the integrity of the formed emulsion. Destabilizing processes can also occur in gel tissues formed by thickeners. Carbomer polymers used as thickeners can be subjected to oxidative degradation when there is the presence of oxygen and is catalyzed by sunlight and UV[17], [18]. Common causes that can promote an increase in viscosity at high temperatures is an increase in the evaporation rate of water at lotion preparations. This will lead to an increase in the volume fraction of the dispersed phase which can increase the viscosity of the preparation[11]. Gel tissue formed by carbomers can also become more elastic at a rise in temperature increasing viscosity[19].

Homogeneity of oil globules on the entire variation of lotions is observed to assess the characteristics of lotion emulsions microscopically. Looking at how oil phase globules are dispersed, globules tend to form floc rather than evenly dispersed. This behavior occurs both in the initial state and after storage for 28 days. Two factors that can be behind the phenomenon is the formation of Pickering emulsion and liquid crystal structure. The structure of this type of emulsion can be actualized on lotions formulated because they contain solid emollients, emulsifying wax, and carbomer as solid particles that can stabilize such structures[20], [21]. Adsorption of polymers to the interphase surface will also cause globules to sheathe the gel tissue and be more easily aggregated against each other. In addition, the addition of long-chain triglycerides in the oil phase can lower ζ-potential thereby reducing the repulsive force between dispersed particles and encouraging flocculation globule[22]. The liquid crystal phase can accommodate floc because it has a lamellar structure[23].

Globule size, Polydispersity Index (PDI), and sphericality are some of the hydrodynamic factors that can correlate with the rheology of the preparation. In general, the larger size of the globule, the more it will cause a decrease in viscosity and shear thinning effect on O/W emulsions[24]. At the initial conditions, it can be said that the substitution of tengkawang butter can decrease the size of the globule, although the trend is not consistent. This is different from the results of previous studies which stated that the distillation of triglycerides to hydrocarbon-based emollients can reduce the size of oil globules very significantly in the process of spontaneous emulsification[22]. Meanwhile, the PDI value indicates the degree of homogeneity of dispersed particles in the emulsion, where the PDI value is low ($PDI < 0.1$) expressing a homogeneous size distribution (monodisperse)[7]. Emulsions with higher PDI will have a lower viscosity due to the reduction of hydrodynamic resistance in the flow[24],

[25]. The degree of globule sphericality is also seen to correlate with a viscosity at low shear conditions, where the variations CT1 and CT4 (asymmetric) have a higher initial viscosity than CT3 (spherical). CT variation globules tend to be symmetric. It is influenced by the polarity of the emollients used and their influence on the structure of the liquid crystals around the globules of oil[26], [27].

However, changes in hydrodynamic properties due to changes in the structure of globules cannot always be attributed to changes in the emulsion rheology of lotions, due to their complex emulsion properties. For example, an increased globule size on storage at 50°C also increases viscosity substantially during storage, so it can be predicted that there are non-hydrodynamic factors that dominate the hydrodynamic factor more. Based on how droplets are dispersed in the emulsion, the increase in viscosity can be related to the structure packing droplets that are tighter (dense) after storage at 45°C and 50°C. On the whole variety, the increase in storage temperature from 45°C to 50°C has no significant effect on the difference in size globules at the end of the storage period ($P>0.05$).

Occlusive factors are used to verify emollient potential in hydrating the surface of the skin. Higher occlusive factor values signal the capacity to inhibit evaporation in SC which is getting better. The composition of fatty acids, the size of the globule, and the colloidal type of the preparation can affect the occlusive properties of preparation[28]. All vegetable fats have sufficient water retention ability in SC satisfactory on the formula used even least. The quality of the moisturizing effect should not only be seen in vitro through a reduction rate of evaporation rate (occlusive factor). In vivo assessment via measurement of the influence of emollients on sebum concentration, SC thickness, melanin levels, and erythema levels as well as a parameter that defines the quality of a material as an emollient. On those parameters, some previous studies have shown that topical preparations with fat-based emollients vegetable/triglycerides have added value in vivo compared to hydrocarbon-based emollients[29], [30].

Conclusion.

Based on the comparison of the initial characteristics, stability, and occlusive properties, it can be stated that the substitution can be conveniently carried out to 75% TB in CB-TB on the formula used. Under the conditions of the limit, all variations of the preparation show comparable sensory characteristics and good emulsion stability. TB also has a higher occlusive properties as an emollient.

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Conflict of Interest Statement.

NONE.

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