Jurnal Reaksi (Journal of Science and Technology)
Jurusan Teknik Kimia Politeknik Negeri Lhokseumawe
Vol. 24 No.01, June 2026 ISSN 1693-248X

FORMULATION OF HAND AND BODY LOTION BASED ON VIRGIN COCONUT OIL (VCO) AND COCONUT OIL WITH BUTTERFLY PEA FLOWER (Clitoria ternatea L.) EXTRACT AS ANTIOXIDANT

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ABSTRACT

Hand and body lotion is a cosmetic preparation used for skin care. Butterfly pea extract (Clitoria ternatea L.) was selected due to its anthocyanin, flavonoid, and phenolic content, which act as natural antioxidants. This study aims to formulate hand and body lotion based on Virgin Coconut Oil (VCO), coconut oil, and butterfly pea extract, and to evaluate its physical, chemical, and antioxidant properties. The extract was obtained through maceration using 70% ethanol with a yield of 37.28%. Lotion formulations were prepared with various ratios of VCO:Coconut Oil (1:0, 3:1, 1:1, 1:3, 0:1) and butterfly pea extract additions of 1–5 mL. The results showed that all formulations met SNI 16-3499-1996 standards with pH ranging from 5.0 to 6.6, viscosity between 43,000–47,000 cP, and specific gravity between 0.95–1.03 g/mL. Organoleptic tests indicated that the VCO:Coconut Oil ratio of 1:0 with 1–3 mL extract was the most preferred by panelists. Antioxidant activity analysis yielded an IC50 value of 1.54 ppm, indicating very strong activity. The study concludes that the combination of Virgin Coconut Oil, coconut oil, and butterfly pea extract significantly affects the physical and antioxidant characteristics of the produced hand and body lotion.

Keywords: Antioxidant, Butterfly Pea Extract, Hand and Body Lotion, Coconut Oil, Virgin Coconut Oil

1. INTRODUCTION

1.1 Background

Indonesia's tropical climate exposes skin to continuous UV rays, causing free radical damage such as premature aging, pigmentation, and potential cancer risk (Asih et al., 2024). The cosmetic industry is increasingly developing natural-based products. VCO contains lauric and oleic acids that moisturize and protect the skin (Nigrum et al., 2021), while coconut oil provides antioxidants such as vitamin E and polyphenols (Dehealth Supplies, 2023). Previous studies showed that VCO and coconut oil in lotion formulations yield good moisturizing effect and stability (Aditya et al., 2023).

VCO is coconut oil processed without heating, thus maintaining its natural composition and characteristics. The fatty acids in Virgin Coconut Oil (VCO), mainly lauric acid and oleic acid, possess moisturizing properties that have the potential to be developed as ingredients in lotion formulations. Coconut oil (VCO) is a natural moisturizer as it helps prevent damage to skin tissues and provides skin protection. Therefore, coconut oil can be used in the formulation of hand and body lotion (Nigrum et al., 2021).

Coconut oil is also rich in natural antioxidants, such as vitamin E and polyphenols. These antioxidants are able to neutralize free radicals produced in the skin due to UV exposure. By reducing oxidative damage to skin cells, the antioxidants in coconut oil play a protective role against long-term skin

damage. Previous research by Aditya et al. (2023) demonstrated that the use of Virgin Coconut Oil (VCO) and coconut oil as base ingredients in the formulation of hand and body lotion can produce products with good moisturizing properties and high stability.c

Butterfly pea flower (*Clitoria ternatea* L.), commonly known as "bunga telang" in Indonesia and belonging to the Fabaceae family, is a type of plant frequently used in traditional medicine due to its rich content of secondary metabolites such as phenolic compounds. In Indonesia, *Clitoria ternatea* L. is often referred to as "telang" or "blue flower" (Dewi K. et al., 2022). This plant is known to possess antioxidant properties. The chemical components found in butterfly pea flower extract include tannins, saponins, phenols, flavonoids, and alkaloids (Al-Snafi, 2016).

This study is expected to explore the effects of using VCO and coconut oil on the characteristics of hand and body lotion, as well as to examine the impact of adding butterfly pea flower extract to the product. The results of this research are expected to contribute valuable insights and information for the development of effective, safe, and innovative natural-based skincare products.

2. RESEARCH METHODS

Research methodology

2.1 Research Place

This study was conducted in the Chemical Engineering Laboratory, Politeknik Negeri Lhokseumawe.

2.1 Tools and Materials

2.2.1 Tools used

2.2.2 Materials used

The equipment used included a set of laboratory glassware, an analytical balance, mortar and pestle, hand blender, stirring rod, water bath, pycnometer, and a Brookfield DV-I viscometer. The main materials consisted of Virgin Coconut Oil (VCO), coconut oil, butterfly pea flower (Clitoria ternatea L.) extract, distilled water, lexemul, laurex, stearic acid, nipagin, EDTA, glycerin, and fragrance.

2.3 Experimental Treatment Design

2.3.1 Fixed Variables

- Distilled water : 172 g
- Lexemul : 3 g
- Laurex : 4 g
- Stearic Acid : 3 g
- Nipagin (Methyl Paraben) : 0.8 g
- EDTA : 1 g
- Glycerin : 4 g
- Virgin Coconut Oil : 14 g

2.3.2 Independent Variables

- Ratio of VCO and coconut oil: 1:0, 3:1, 1:1, 1:3, and 0:1
- Concentration of butterfly pea extract: 1 mL, 2 mL, 3 mL, 4 mL, and 5 mL

2.3.3 Dependent Variable

1. Moisture content of butterfly pea extract
2. Extract yield
3. Physical properties of the lotion (organoleptic evaluation, pH, viscosity, specific gravity)
4. Antioxidant activity

2.4 Experimental and Testing Procedures

2.4.1 Making Preparation of Butterfly Pea Extract

1. Dried butterfly pea flowers (1 kg) were ground into powder.
2. The powder was soaked in 70% ethanol (5 L) at a ratio of 1:5 (w/v) in a glass jar, covered with aluminum foil, and stored in the dark. The mixture was stirred daily for 2 × 24 hours.
3. The macerated solution was filtered using filter paper to obtain the filtrate.
4. The filtrate was concentrated using a rotary evaporator at atemperature below 55^{o}C to produce a viscous extract.

5. The extract obtained was collected in an amber bottle and stored at low temperature to protect it from light and degradation.

2.4.2 Procedure for Lotion Preparation

1. Heat distilled water until boiling, then allow it to cool to a warm temperature.
2. Weigh glycerin (4 g) and EDTA (1 g).
3. Dissolve both in the warm water until homogeneous, then set aside (Formula A).
4. Weigh stearic acid (3 g), lexemul (3 g), laurex (4 g), and nipagin (0.8 g).
5. Melt stearic acid, lexemul, and laurex together, then add nipagin and mix well.
6. Add the required ratio of VCO and coconut oil, stir until blended.
7. Gradually pour Formula A into Formula B while mixing.
8. Homogenize using a hand blender until a thick lotion texture forms.
9. Add the butterfly pea extract in the desired volume (1–5 mL).
10. Add fragrance and mix gently with a spatula.
11. Pour the lotion into bottles and allow it to cool before use.

3. RESULTS AND DISCUSSION

3.1 Research Results

Table 3.1 Data from Test Results and Observation Analysis

Parameter	Observed Range / Results	Notes / Interpretation
Extract Yield	37.28% (butterfly pea extract, 70% ethanol)	High yield, indicates effective extraction of anthocyanins, flavonoids, and phenolics.
Moisture Content	66.67% (fresh flower)	High water content emphasizes importance of drying prior to extraction.
Organoleptic (Color)	Purple (light to dark)	Best acceptance at 1–2 mL extract with VCO-dominant ratio (1:0, 3:1).
Organoleptic (Aroma)	Floral-fragrance with butterfly pea note	Best acceptance in VCO-dominant samples; coconut oil–dominant formulas less preferred.
Organoleptic (Texture)	Smooth, soft, non-greasy (VCO-rich) vs sticky (CO-rich)	Panelists preferred VCO-based formulations with 1–3 mL extract.
pH	5.0 – 6.6	Within SNI standard (4.5–8.0), suitable for skin application.
Viscosity	43,000 – 47,000 cP	Higher with VCO-rich formulations; decreased slightly at >3 mL extract addition.
Density	0.95 – 1.03 g/mL	Within SNI standard (0.95–1.05 g/mL), indicates good formulation stability.
Antioxidant Activity	IC_{50} = 1.54 ppm	Very strong activity (<50 ppm), highly effective in free radical inhibition.
Best Formulation	VCO : Coconut Oil = 1:0 or 3:1 with 1–3 mL extract	Produced lotion with optimal sensory, physicochemical, and antioxidant properties.

3.2 Discussion

The formulation of hand and body lotion involved ingredients such as lexemul, laurex, stearic acid, nipagin, glycerin, and fragrance. Virgin Coconut Oil (VCO) provides natural antioxidants that help prevent premature aging and maintain skin vitality, while coconut oil functions as a moisturizer that softens, smooths, and hydrates the skin. In addition, butterfly pea flower extract offers significant benefits due to its anthocyanins (particularly ternatins), flavonoids, and phenolic compounds, which act as strong natural antioxidants. caused by UV radiation and pollution.

3.2.1 Organoleptic Test

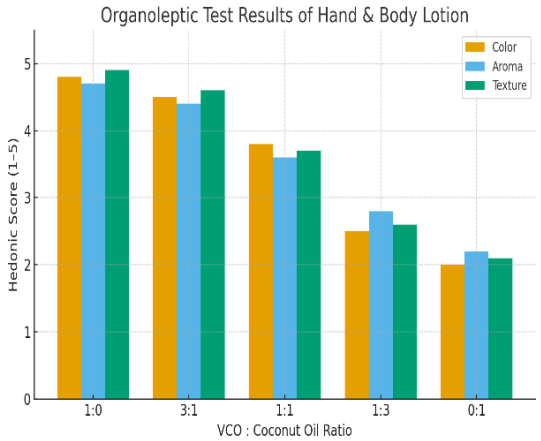

Figure 3.1 Graph of the Organoleptic Test Results on Color, Aroma, and Texture.

From this graph it can be seen that the organoleptic test with 25 panelists showed that lotions with a VCO-dominant ratio (1:0 or 3:1) and 1–3 mL of butterfly pea extract were the most preferred. These formulations produced an attractive purple color, mild aroma, and smooth texture. In contrast, coconut oil–dominant formulas and higher extract levels (>3 mL) resulted in darker color, stronger aroma, and stickier texture, which were less favored.

The organoleptic evaluation demonstrated that the ratio of VCO to coconut oil significantly affected the sensory acceptance of the hand and body lotion formulations. The highest hedonic scores for color, aroma, and texture were consistently observed in the VCO-dominant formulas (1:0 and 3:1). These formulations produced an attractive purple color, a mild and pleasant aroma, and a smooth non-greasy texture, making them most preferred by the panelists.

Overall, the results suggest that using VCO as the main oil in combination with butterfly pea extract enhances both the physical properties and consumer preference of the lotion, while excessive use of coconut oil decreases sensory quality.

3.2.2. Viscosity Test

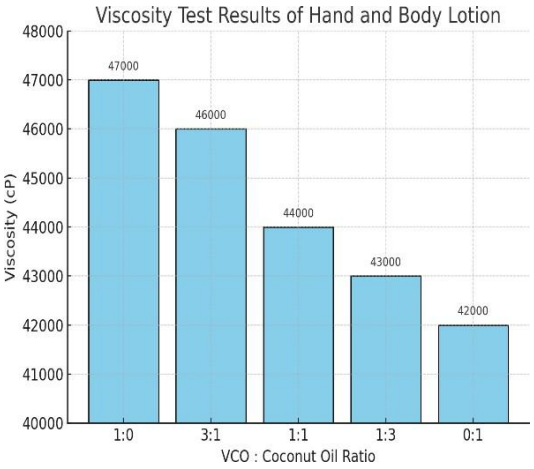

Figure 3.2 Graph of the Viscosity of Hand and Body Lotion Based on VCO and Coconut Oil Ratios

From this graph it can be seen that the viscosity test showed that the oil ratio significantly influenced the hand and body otion's consistency. Formulations dominated by VCO (1:0 and 3:1) exhibited higher viscosity (≈46,000–47,000 cP) due to the medium-chain fatty acids in VCO that form more stable emulsions. In contrast, coconut oil–dominant formulas (1:3 and 0:1) had lower viscosity (≈42,000–43,000 cP), reflecting the heavier and less stable nature of coconut oil. The 1:1 ratio produced an intermediate value (≈44,000 cP). All formulations met the SNI

standard (2,000–50,000 cP), with VCO-rich lotion showing the best stability and consistency.

3.2.3. pH Test

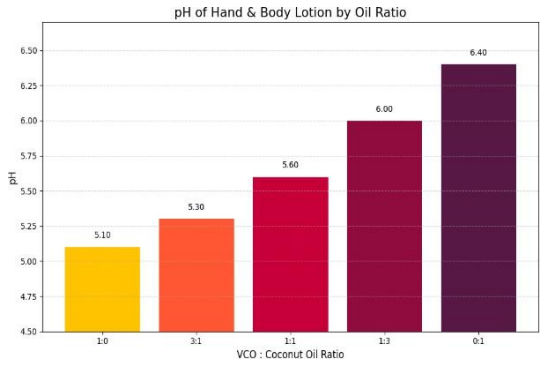

Figure 3.3 Graph of the pH of VCO and Coconutt oil

From this graph it can be seen that the pH Composition of VCO and Coconut Oil Across hand and body lotion Formulations: The study involved 25 formulations (F1–F25), systematically varied by two parameters: Virgin Coconut Oil (VCO) to Coconut Oil (CO) ratio and Butterfly Pea Extract volume (1–5 mL). Each extract level included the five oil ratios (1:0, 3:1, 1:1, 1:3, 0:1), resulting in total oil volumes ranging from 1.0 mL (pure VCO, 1:0) to 4.0 mL (3:1 and 1:3). Formulations with the highest oil content tested the emulsifier capacity and stability limits of the lotion. Pure VCO (1:0) and pure CO (0:1) served as controls to assess the individual contributions of each oil to key properties like viscosity and spreadability. This systematic design enabled independent evaluation of the combined effects of oil ratio and antioxidant (Butterfly Pea Extract) dosage on the final lotion's quality and efficacy.

3.2.4. Specific Gravity Test

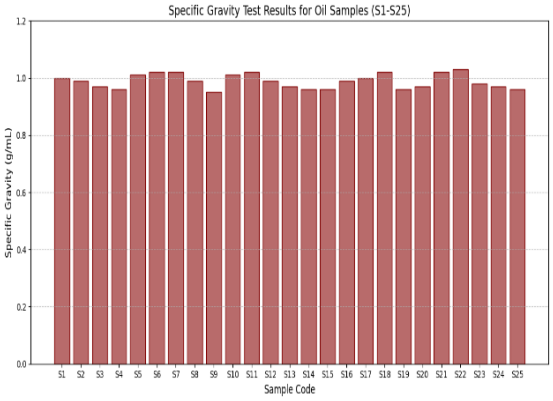

Figure 3.4 Graph of the Specific Gravity of Hand and Body Lotion Based on VCO and Coconut Oil Ratios

From this graph it can be seen that the specific Gravity (g/mL) test results for 25 oil samples, ranging from S1 to S25. Overall, the test results indicate that the specific gravity values for most samples cluster very closely around 1.0 g/mL. Only a few samples show values slightly above or below this mark, but the differences are minimal. The lowest specific gravity values appear in samples S4, S14, S15, and S20, all registering just below 1.0 g/mL, approximately between 0.96 g/mL and 0.97 g/mL. Conversely, the highest values are observed in samples S6, S7, S11, S12, S19, S21, S22, and S23, all reaching or slightly exceeding 1.0 g/mL, with some touching approximately 1.02 g/mL. These minor fluctuations demonstrate that the physical property of the oil's relative density is quite consistent across the samples. The consistency of specific gravity values close to 1.0 g/mL implies that these oils have a density nearly identical to that of pure water, which is important for ensuring the quality and purity of the oil in relevant applications.

3.2.5. Antioxidant activity

Sampel	Konsentrasi (ppm)	Absorbansi	Inhibisi	Inhibisi %	Ic50
Hand and body lotion S1 Ekstrak Bunga Telang (*Clitoria Ternate L.*)	0 Kontrol	3,2078			1,54 ppm
	50	1,5809	0,5072	50,717	
	100	1,4993	0,5326	53,2608	
	250	1,4982	0,533	53,2951	
	500	1,4973	0,5332	53,3231	
	700	1,1184	0,6513	65,135	
	1000	0,8943	0,7212	72,1211	

Antioxidant activity of the hand and body lotion formulation containing butterfly pea flower (Clitoria Ternatea L.) extract yielded highly effective results, demonstrated by a remarkably low IC50 value of 1.54 ppm. This figure categorizes the extract's activity as very strong (IC50 <50 ppm), indicating that the extract is exceptionally efficient at neutralizing free radicals, even at minimal concentrations. Further testing revealed a positive, concentration-dependent relationship between the amount of extract provided and the percentage of radical inhibition. Increasing the concentration from 50 ppm up to 1000 ppm consistently boosted the inhibitory capacity from 50.717% to 72.1211%, a trend confirmed by the decrease in the remaining free radical absorbance. Although a plateau or stabilization tendency in the inhibition percentage was observed in the 50 ppm to 500 ppm range, a significant increase was visible again at the higher concentrations of 700 ppm and 1000 ppm. Overall, these data conclusively prove that the butterfly pea flower extract is a potent antioxidant agent with high potential for application in cosmetic products like hand and body lotion to provide protection against oxidative damage to the skin.

4. CONCLUSION

4.1 Conclusion

Based on the results of the research that has been carried out, the following conclusions can be drawn:

1. The formulation of hand and body lotion using variations of Virgin Coconut Oil (VCO) and coconut oil affects the characteristics of the lotion. The formulation with a VCO:Coconut Oil ratio of 1:0 produced the best quality, with a pH of 5–6, viscosity of 43,000–47,000 cP, specific gravity of 0.95–1.03 g/mL, and was the most preferred by panelists in terms of color, aroma, and texture. This formulation provided the best results, was most favored by panelists, and met the SNI quality standards.Stirring
2. The addition of butterfly pea flower extract (Clitoria ternatea L.) significantly affects the characteristics of the lotion, with a concentration of 1–3 mL producing the best organoleptic quality and very strong antioxidant activity, with an IC50 of 1.54 ppm.

4.2 Suggestions

Based on the conclusions drawn, the following suggestions are given:

1. Adding skin irritation testing (dermatological evaluation).
2. The purpose is to ensure the long-term safety of the lotion for all skin types (especially for sensitive skin).

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