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ResearchArticle

Formulation and Characteristic Test of Handbody Lotion Preparation of Pucuk Merah Leaf Extract (*Syzygium myrtifolium* Walp.) as An Antioxidant

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Abstract (in English)

Lotions made from natural ingredients are increasingly favored by the public, primarily due to the addition of active compounds that are functional for the skin, such as antioxidants. Antioxidants play an important role in maintaining health by improving skin texture. One potential source of natural antioxidants is the pucuk merah leaf (*Syzygium myrtifolium* Walp.), which is known to contain phenolic and flavonoid compounds. This study aimed to determine the physical characteristics and antioxidant activity of pucuk merah leaf extract lotion with varying extract concentrations: F1 (0.5%), F2 (2.5%), and F3 (12.5%). The results showed that all formulas met the standards for a good lotion based on organoleptic tests, homogeneity, pH, viscosity, adhesion, spreadability, and emulsion type. Formula 1 was identified as the best formulation based on its organoleptic properties, showing a better dosage form compared to the other formulas. The antioxidant activity was classified as very strong, with IC50 values for each formula being 49.609 ppm (F1), 47.202 ppm (F2), and 35.809 ppm (F3). The antioxidant activity of each formula increased with higher extract concentrations.

Keywords: Lotion, Pucuk Merah Leaves, Antioxidants

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1 Introduction

The demand for natural-based skincare products has significantly increased in line with growing consumer awareness regarding the importance of maintaining skin health. The skin is the body's outermost organ and plays a crucial role in protecting against both internal and external factors, including exposure to ultraviolet (UV) radiation [1]. Excessive UV exposure makes the skin highly susceptible to free radicals, which can damage skin cell components and lead to various skin problems, such as scaling, roughness, dryness, wrinkles, redness, cracking, increased risk of skin cancer, and premature aging characterized by reduced elasticity and firmness, as well as the appearance of wrinkles and fine lines [2].

Skin damage not only affects overall health but also diminishes an individual's aesthetic appearance. Natural-based cosmetics have become a preferred choice due to their potential benefits, including reduced risk of irritation, environmental friendliness, and greater safety. These products contain active compounds derived from natural sources that offer various functional benefits for the skin, one of which is antioxidants, which help improve skin health and neutralize free radicals [3]. Antioxidants are compounds that work by halting the oxidative chain reactions caused by free radicals, thereby preventing further damage to skin tissues. Studies have shown that the application of antioxidants to the skin can enhance appearance, reduce inflammation, slow down the aging process, and provide better protection against UV-induced damage. Moreover, antioxidants aid in repairing damaged skin tissue and stimulate cell regeneration, helping to maintain skin moisture and health [4].

One promising natural antioxidant source is the pucuk merah plant (*Syzygium myrtifolium* Walp.), which has been proven to contain phenolic and flavonoid compounds, both of which are known contributors to antioxidant activity. Pucuk merah leaves also contain alkaloids, triterpenoids, steroids, and saponins. Previous research using the DPPH method to assess the antioxidant activity of pucuk merah leaf ethanol extract reported an IC_{50} value of 2.195 ppm, indicating a very strong antioxidant capacity [5]. Additionally, antioxidant activity of pucuk merah leaf extract tested using the ABTS method was also classified as very strong, with an IC_{50} value of 3.5987 ppm [6]. The antioxidant activity of infusions made from red and green pucuk merah leaves using the DPPH method showed IC50 values of 31.689 ppm and 30.559 ppm, respectively, which also fall into the very strong category [7].

With advancements in the cosmetic industry, various skincare products that offer protective, cleansing, and aesthetic enhancement benefits are widely available on the market. One such product is hand and body lotion. Hand and body lotions are formulations with high water content, allowing easy application on the skin surface, good spreadability and penetration, a non-greasy feel, and a cooling or refreshing sensation upon use [8].

This study aims to explore the utilization of pucuk merah leaf extract in hand and body lotion formulations as an antioxidant. The goal is to develop a product that not only provides moisturizing effects but also contributes to maintaining skin health by improving skin texture.

2 Method

2.1 Tool and Materials

The tools used in this study were Herb grinder simplisia, vacuum rotary evapotator, UV-Vis spectrophotometer, vortex, micropipette, cuvette, homogenizer, brookfield viscometer, pH meter, analytical scales, weights, hot plates, adhesion test equipment, coolers, incubators, freezers, lotion containers, and glass utensils (Pyrex).

The materials used in this study are red leaves of pucuk merah (*Syzygium myrtifolium* Walp.) obtained from Samarinda Ulu District, Samarinda City, East Kalimantan, 96% ethanol, ethanol p.a, HCl 2N, dragendroff reactant, Mayer reagent, Wagner reagent, magnesium powder, concentrated HCl, FeCl3 1%, gelatin, Liebermann-Burchard reagent, Anhydrous acetic acid, Sulfuric acid, NaOH, Stearic

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acid, Cetyl alcohol, Triethanolamine, Propylene glycol, Liquid paraffin, Methyl paraben, Propyl paraben, Oleum rosae, aquadest, aluminum foil filter paper, plastic wrap, and methylene blue

2.2 Extraction of Pucuk Merah Leaf

The extraction process was carried out using the maceration method. A total of 700 grams of simplicia powder was macerated with 96% ethanol solvent at a ratio of 1:10. The maceration was conducted over a period of 3×24 hours, with the filtrate collected every 24 hours and subjected to re-maceration. The combined macerates were then concentrated using a vacuum rotary evaporator at a temperature of 55°C to obtain a thick extract.

2.3 Secondary Metabolite Testing of Pucuk Merah Leaf

2.3.1 **Identification of Alkaloids**

Pucuk merah leaf extract is added with dragendroff, mayer, and wagner reagents, respectively. The presence of alkaloid compounds is characterized by the formation of red or orange deposits in the Dragendorff test, the formation of white or yellowish deposits in the Mayer test, and the formation of reddish-brown deposits in the Wagner test [9].

2.3.2 **Identification of Phenolic**

Pucuk merah leaf extract is added with 1% FeCl3 resin. The presence of phenolic compounds is characterized by a change in greenish or blackish-blue color [10].

2.3.3 **Identification of Flavonoid**

Pucuk merah leaf extract is added magnesium powder and concentrated hydrochloric acid. The presence of alkaloid compounds is characterized by a change in color to yellow or orange, or red [11].

2.3.4 **Identification of Tannin**

Tannin compound testing used two tests, namely with the addition of a 1% FeCl3 reagent and using a gelatin solution. Positive results from extracts with 1% FeCl3 reagent are marked by greenish or blackish-blue discoloration. As for extracts that are added to the gelatin solution, white or yellow deposits will form [12].

2.3.5 **Identification of Steroid/Terpenoid**

Extract of the leaves of pucuk merah is added n-hexane, beaten. The top layer is taken and added with the Liebermann Bauchard (LB) reagent. Positive reactions of steroid compounds are characterized by a change in blue or bluish-green color. While positive terpenoids are purple or orange [13].

2.3.6 **Identification of Saponin**

Pucuk merah leaf extract is added hot aquedest and beaten. Foam/foam is formed for 10 minutes, then HCl 2N is added. The presence of saponin compounds is characterized by the formation of foam as high as ± 1 cm [11].

2.4 Formulation of Handbody Lotion Preparation

The hand and body lotion was prepared using the dry gum method, which consists of two phases: the oil phase and the aqueous phase. Both phases were heated on a hot plate at a temperature of 70–75°C until completely melted, and then stirred until a homogeneous mixture was formed. The oil phase was then gradually added to the aqueous phase while continuously stirred using a homogenizer at 5000 rpm for 30 minutes, until a uniform lotion mass was formed [14]. Pucuk merah leaf extract (*Syzygium myrtifolium* Walp.) was added to the base formulation at concentrations of 0.5%, 2.5%, and 12.5%,

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followed by stirring until homogeneous. A fragrance (oleum rosae) was then added and mixed until a uniform hand and body lotion preparation was obtained [15].

Table. 1 Pucuk Merah Leaf Extract Handbody Lotion Formula

Material	Concentration (%)				Function
	F0	F1	F2	F3	
Pucuk Merah Leaf Extract	-	0,5	2,5	12,5	Active Substances
Stearic acid	4	4	4	4	Emulsifier
Setile alcohol	5	5	5	5	Stiffening agent
Propylene glycol	8	8	8	8	Humektan
Triethanolamine	1	1	1	1	Alkalizing agent
Liquid paraffin	2	2	2	2	Emolia
Oleum rosae	q.s	q.s	q.s	q.s	Aroma
Methyl paraben	0,15	0,15	0,15	0,15	Preservatives
Propyl paraben	0.05	0.05	0.05	0.05	Preservatives
Aquadest	add 100	add 100	add 100	add 100	Solvent

2.5 Antioksidan Activity Testing

2.5.1 **Manufacture of DPPH Solution 40 ppm**

As much as 4 mg of DPPH powder is weighed and then dissolved with ethanol p.a until it reaches a volume of 100 mL, so that a DPPH solution of 40 ppm is obtained. The solution is stored in a container protected from light by coated with aluminum foil [16].

2.5.2 **Blank Solution Manufacturing**

A total of 2 mL of ethanol p.a is put in a chocolate vial and added 2 mL of 40 ppm DPPH solution (1:1 ratio), then the solution mixture is homogenized. Next, the solution is incubated for 30 minutes. The absorption of the blank solution was measured using a UV-Vis spectrophotometer in the wavelength range of 400 – 600 nm to obtain an absorbance of 0.2-0.8 [17].

2.5.3 **Manufacture of Vitamin C Extract and Comparator Test Solution**

A total of 2.5 mg of pucuk merah leaf extract and vitamin C were weighed and then each dissolved in 25 mL of ethanol p.a with a concentration of 100 ppm. Then from the parent solution a concentration series of 1 is made; 2; 3; 4; and 5 ppm [18].

2.5.4 **Manufacture of Test Solution Handbody Lotion Preparation**

A total of 2.5 mg of handbody lotion preparation was weighed and then dissolved in 25 mL of ethanol p.a with a concentration of 100 ppm. Then a series solution of concentration of 10 is made; 20; 30; 40 and 50 ppm [19].

2.5.5 **Antioxidant Activity Measurement of Extracts, Handbody Lotion and Vitamin C**

Each of the test and comparator solution concentrations in a 2.0 mL pipette was put in a brown vial, then 2.0 mL of DPPH solution was added and homogenized. The solution was then incubated for 30 min and its absorption was measured using a UV-Vis spectrophotometer at a wavelength of 517 nm [20].

2.5.6 **Penentuan Inhibitory Concentration 50% (IC_{50}).**

The percentage of radical suppression inhibition of DPPH is calculated using the formula:

$$\%\text{Inhibition} = \frac{Absorbansi\ kontrol - Absorbansi\ sampel}{Absorbansi\ kontrol}\ x\ 100\%$$

The IC_{50} value is calculated based on the percentage of immersion to DPPH from each sample solution concentration. After obtaining the results of the percentage of attenuation at each concentration, the equation y = a + bx is determined by calculation using regression [21].

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2.6 Physical Stability Testing of Handbody Lotion Preparation

2.6.1 Hot-Cold Test

The test uses temperatures of 4°C and 40°C with a storage time of 48 hours. Testing was carried out in 6 cycles. Every cycle, the physical characteristics of the handbody lotion preparation were observed [22].

2.6.2 Test Freeze Thawing

The test uses temperatures of -21°C and 25°C with a storage time of 48 hours. Testing was carried out in 6 cycles. Every cycle, the physical characteristics of the handbody lotion preparation were observed [22].

2.7 Physical Characteristics Testing of Handbody Lotion Preparation

2.7.1 Organoleptic Test

The test method is carried out to evaluate the physical characteristics of the preparation, such as the shape or texture, color, and aroma of the handbody lotion product by utilizing the human five senses [23].

2.7.2 Homogeneity Test

The test is performed on the glass of the object. Observed the arrangement of coarse particles or the inhomogeneity of the handbody lotion preparation. The requirement for handbody lotion preparations is said to be homogeneous in the absence of coarse particles during observation [24].

2.7.3 pH Test

pH testing is carried out using a pH meter. The good pH requirement for handbody lotion preparations is in the range of 4.5-6.5 according to the normal pH of the skin [25].

2.7.4 Viscosity Test

The test used a Brookfield spindle number 4 viscometer at a speed of 30 rpm. The viscosity value range of topical preparations of handbody lotion is 2000-50,000 cPs [26].

2.7.5 Adhesive Strength Test

The test used object glass that was given a load of 50 grams for 5 minutes, then the length of time the two object glass came off. Good adhesion to handbody lotion preparations is in the range of >4 seconds [25].

2.7.6 Dispersion Test

The test used glass plates with a load of 50 – 200 grams, each for 1 minute, then the distribution of the diameter of the preparation was observed. The good spreadability of handbody lotion is in the range of 5-7 cm [24].

2.7.7 Emulsion Type Test

The test was carried out using the coloring method, namely by taking a small amount of handbody lotion preparation with methylene blue as much as 1 drop. Then the color uniformity of the mixture of lotion preparations and methylene blue was observed. Handbody lotion preparations are generally preparations with an oil-in-water emulsion type (O/W) marked with an internal phase dyed blue [27].

3 Result and Discussion

3.1 Pucuk Merah Leaf Extract

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The extraction process has the goal of separating the secondary metabolite compounds contained in the plant from the mixture. 700 grams of pucuk merah leaf powder was extracted using the maceration method using 96% ethanol as a filter with a ratio of 1:10 [28]. 96% ethanol is chosen in the extraction process because it has non-toxic, selective, and high filtering properties so that it can be used in treating polar, semi-polar and non-polar compounds. Another advantage is that ethanol 96% has better penetration ability into the cell wall of the sample compared to ethanol with lower concentrations, so the extracts produced from the use of 96% ethanol tend to be more optimal [29]. The extract obtained was 373.03 grams. The yield percentage result is calculated by comparing the extract yield obtained with the weight of the simplicia used. The percentage of yield of ethanol extract of pucuk merah obtained with high yield is 53.29%.

3.2 Secondary Metabolite Test of Pucuk Merah Leaf Ethanol Extract

Secondary metabolite testing of ethanol extract of pucuk merah aims to identify the content of secondary metabolite compounds contained in the sample so as to obtain a process of testing antioxidant activity. An extract of natural material is made up of several secondary metabolite compounds that affect in its biological activity.

Testing of secondary metabolite compounds is carried out using qualitative tests and is identified with certain reagents by observing the occurrence of discoloration, the formation of sediments and foam or foam. The results obtained from the pucuk merah leaf extract were identified to contain alkaloids, flavonoids, phenolics, tannins, saponins, and steroids. The results of secondary metabolite tests are consistent with previous studies [30]. Flavonoid and phenolic compounds were identified in pucuk merah leaf extract which indicates that pucuk merah leaves have activity as antioxidants.

Test flavonoid compounds with the addition of Magnesium powder (Mg) with concentrated hydrochloric acid (HCl). The use of concentrated HCl aims to hydrolyze flavonoids into their glycones, namely hydrolysing O-glycosyl. The glycosyl group will be replaced by H+ from the acid because it has electrophilic properties. The results of the flavonoid compound test were positive which was marked by a change in color to orange which indicates that the extract of the leaves of pucuk merah contains leukoanthocyanin compounds [10].

Phenolic compound test with the addition of FeCl3 reagent used to determine phenol clusters contained in pucuk merah leaf extract [10]. The results of the phenolic compound test were declared positive which was characterized by a change in color to blue-black which indicates the presence of phenol compounds in the pucuk merah leaf extract. The results of the secondary metabolite compound test of the extract can be seen in Table 2.

Table 2 Secondary Metabolite Compounds of Pucuk Merah Leaf Extract

Compound Groups	Reagents	Observation	Result
Alkaloid	Mayer	White/yellow deposits	(+)
	Dragendorf	Red/orange deposits	(+)
	Wagner	Reddish-brown deposits	(+)
Flavoniod	Concentrated Mg+HCl powder	Red/yellow/orange color	(+)
Phenolic	FeCl3	Greenish / blackish-blue color	(+)
Tannins	FeCl3 dan Gelatin	Greenish / blackish-blue color and white or yellow deposits	(+)
Saponins	Hot Aquades and HCl 2N	Foam	(+)
Steroids	Lieberman Bauchard	Blue or bluish-green color	(+)
Terpenoid	Lieberman Bauchard	Purple/orange color	(-)

3.3 Formulation of Handbody Lotion Pucuk Merah Leaf Extract

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In this study, a handbody lotion preparation was made using the active substance of pucuk merah leaf extract. Lotion preparations are made into three formulas with different variations in extract concentration, namely formula 1 (0.5%), formula 2 (2.5%) and formula 3 (12.5%). The variety of extracts used in handbody lotion preparations is used to determine the physical characteristics of each preparation and to see the activity of the preparation at low, medium and very high concentrations.

The handbody lotion preparations that have been made are tested for physical stability using two methods, namely heat-cold (4°C and 40°C) and freeze thawing (-21°C and 25°C). Physical stability is an important parameter that must be met by an optimum formula because it describes the durability of a product to certain limits during storage and use, or the shelf life of a product, where the product still has the same characteristic properties as at the time of manufacture [22].

3.4 Physical Characteristics of Handbody Lotion Preparation Pucuk Merah Leaf Extract

Organoleptic testing of preparations aims to evaluate the extent to which the characteristics of the preparations meet aspects that are acceptable to the public as consumers. Based on Table 3, it shows that the pucuk merah leaf extract handbody lotion preparation from each formula before and after storage for 6 cycles, namely formulas 0, 1, 2, and 3, has a semi-solid shape, and has a typical rose aroma due to the use of oleum rosae in lotion preparations which aims to mask the aroma of the extract added in the preparation. The color of the lotion preparation in Formula 0 is white, Formula 1 is light brown, Formula 2 is dark brown, and Formula 3 is reddish brown. The color difference that occurs due to variations in the concentration of pucuk merah leaf extract added in the preparation. From the data from the organoleptic test results, there was no difference in testing in the storage cycle 0 to 6 either in the hot-cold or freeze thaking method.

Homogeneity testing of the preparation was performed to determine whether the active substances and additives used in the preparation were evenly mixed, there were no particles or coarse granules in the preparation [31]. Based on Table 3 shows that the preparation of pucuk merah leaf extract handbody lotion on formulas 0, 1, 2, and 3 is homogeneous both before and after the hot-cold storage period and freeze thawing.

pH testing is carried out to determine the acidity or alkaline level of the formulated lotion preparation. The appropriate pH value for topical preparations, such as lotions, is in the range of 4.5 to 6.5. This range is the natural pH range of the skin. This is important to prevent skin irritation. Preparations with a pH below 4.5 are too acidic and irritating, while pH above 6.5 is too alkaline, which risks causing dry and flaky skin [32]. pH measurements are carried out using a pH meter to obtain accurate results. Based on Table 3, the pH of the lotion preparation in each formula undergoes a change in pH from cycle 0 to 6. The pH change in formula 0, 1, 2, and 3 lotion preparations decreased, but tended to be stable. Changes in pH during storage can be caused by both internal and external factors. External factors include temperature and humidity, while internal factors have to do with the characteristics of the extracts used, which have a relatively acidic pH. Nonetheless, the pH of the lotion preparations made is still within the pH range appropriate for topical preparations. It is known that there is a difference in pH caused by the treatment given. Lotions with the addition of different concentrations of extracts showed significant changes in pH [33].

Viscosity is a parameter related to the viscosity and consistency of the preparation. The appropriate viscosity value will make it easier to apply the preparation to the surface of the skin and ensure that the preparation can adhere well. If the consistency is too high, it can hinder the convenience and effectiveness of the use of the preparation by consumers. The stability of the preparation is directly related to the viscosity value, both at the beginning of measurement and during storage. Therefore, in this study, the viscosity of the lotion was measured in each storage cycle, starting from cycle 0 to cycle 6. The tool used was a Brookfield viscometer with a spindle number 4 with a speed of 30 rpm [34]. The measurement results showed that the viscosity of the formulas F0, F1, F2, and F3 had decreased significantly.

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This change in viscosity is thought to be caused by several influential factors, one of which is a change in room temperature. An increase in temperature during storage can disrupt the bond between the water phase and the oil phase, as well as increase the movement of the globules in the dispersed phase, leading to a decrease in viscosity. In addition, pH is also an internal factor that affects the viscosity of the preparation. A drop in pH can lead to a decrease in viscosity. The addition of higher amounts of the extract in the lotion preparation will decrease the viscosity of the lotion [33]. Despite the decrease in viscosity, the viscosity measurement results on all formulas were still within the permissible range for lotion preparations, which is between 2,000 and 50,000 cPs. This range indicates that the preparation still meets the appropriate viscosity requirements for topical use [26].

Adhesion testing of lotion preparations aims to evaluate the ability of the formulation to adhere to the skin surface for a certain period, thereby ensuring optimal delivery of the active ingredient [35]. The adhesion requirement for topical preparations is not less than 4 seconds to guarantee stability and effectiveness upon application [25]. Based on the adhesion test results, lotion formulations containing red shoot leaf extract (F0, F1, and F2) met the required criteria, with adhesion values equal to or greater than 4 seconds. In contrast, formulation F3 showed an adhesion value below the standard, measured at 3.56 seconds. Stability testing of each formulation indicated a decrease in adhesion over the storage period; however, the reduction was not significant from cycle 0 to cycle 6. A higher concentration of extract in the lotion was identified as a contributing factor to the decline in adhesion across formulations. Generally, as the concentration of red shoot leaf extract increases, the adhesion of the lotion tends to decrease. This may be attributed to changes in the structure or consistency of the formulation, which affect the lotion's ability to remain adhered to the skin surface [36].

Lotion preparations are expected to spread easily over the skin surface without requiring excessive pressure. Therefore, the dispersion test is conducted to evaluate the ease of spreading and the even application of the active substance on the skin. A larger dispersion diameter indicates a broader area of skin covered by the lotion. An ideal lotion formulation typically exhibits a spreading diameter of 5–7 cm, reflecting a smooth consistency and ease of application. Based on the dispersion test results, formulations F0, F1, and F2 met the standard dispersion range for a good lotion, which is 5–7 cm [32]. In contrast, formulation F3 exhibited a spreading diameter exceeding 7 cm from cycle 4 to cycle 6. This increase suggests physical changes in the formulation after undergoing stability testing (including heating–cooling cycles and freeze–thaw conditions), as evidenced by increased dispersion values per cycle.This increased dispersion is consistent with the decrease in viscosity observed in the formulations. The lower the viscosity of a lotion, the greater its dispersion. This is due to the formulation's physical characteristics, which allow it to flow and spread more readily across the skin surface without requiring much pressure. Low-viscosity formulations facilitate a more uniform distribution of the active ingredient, potentially enhancing its effectiveness [37].

Emulsion type testing is a test that is carried out to determine whether the preparation includes the emulsion type O/W (oil in water) or W/O (water in oil). The emulsion type test was carried out using the staining method with methylene blue. Handbody lotion preparations are generally preparations with an oil-in-water emulsion type (O/W) that are marked by an internal phase colored blue [27]. Based on Table 3 Pucuk Merah leaf extract lotion preparations have an oil-in-water emulsion type (O/W).

Table 3. Physical Characteristics of Hand and Body Lotion Formulated with Red Shoot Leaf Extract

Cycle	*Cycling Test*				*Freeze Thaw*			
	F0	F1	F2	F3	F0	F1	F2	F3
	Viscosity (cPs)							
0	18.773±0,12	16.853±0,00	11.449±0,12	5.760±0,00	18.702±0,12	16.853±0,00	11.449±0,12	5.760±0,00
1	18.702±0,00	16.853±0,00	11.449±0,12	5.760±0,00	18.702±0,12	16.853±0,00	11.449±0,12	5.760±0,00
2	18.702±0,12	16.782±0,12	11.378±0,12	5.689±0,12	18.702±0,12	16.853±0,00	11.449±0,12	5.760±0,00
3	18.631±0,12	16.782±0,12	11.378±0,12	5.689±0,12	18.631±0,12	16.782±0,12	11.378±0,12	5.760±0,00
4	18.631±0,12	16.711±0,12	11.307±0,00	5.618±0,12	18.631±0,12	16.782±0,12	11.378±0,12	5.689±0,12
5	18.560±0,00	16.711±0,12	11.236±0,12	5,618±0,12	18.631±0,12	16.711±0,12	11.307±0,00	5.689±0,12
6	18.489±0,12	16.640±0,12	11.236±0,12	5.547±0,00	18.560±0,00	16.711±0,12	11.307±0,12	5.618±0,12
	pH							

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0	6,47±0,03	6,28±0,01	6,17±0,02	5,87±0,01	6,47±0,03	6,28±0,01	6,17±0,02	5,87±0,01
1	6,47±0,05	6,26±0,06	6,16±0,01	5,86±0,03	6,47±0,02	6,25±0,01	6,16±0,01	5,85±0,03
2	6,45±0,03	6,29±0,01	6,14±0,03	5,85±0,01	6,45±0,03	6,26±0,02	6,13±0,01	5,83±0,05
3	6,42±0,01	6,28±0,01	6,13±0,01	5,86±0,03	6,45±0,03	6,24±0,03	6,12±0,03	5,81±0,01
4	6,41±0,02	6,31±0,06	6,12±0,01	5,83±0,04	6,43±0,03	6,23±0,01	6,12±0,01	5,84±0,00
5	6,38±0,02	6,26±0,01	6,12±0,02	5,80±0,02	6,41±0,03	6,24±0,03	6,10±0,02	5,84±0,01
6	6,38±0,03	6,26±0,03	6,10±0,01	5,78±0,03	6,38±0,02	6,26±0,02	6,10±0,07	5,83±0,04
				Adhesive Strength (s)				
0	6,20±0,03	5,88±0,03	5,48±0,02	3,56±0,03	6,20±0,03	5,88±0,03	5,48±0,02	3,56±0,03
1	6,21±0,02	5,84±0,02	5,44±0,02	3,51±0,03	6,23±0,03	5,86±0,02	5,46±0,01	3,53±0,03
2	6,17±0,02	5,80±0,03	5,40±0,02	3,46±0,03	6,20±0,01	5,82±0,02	5,43±0,04	3,49±0,02
3	6,15±0,03	5,74±0,06	5,34±0,05	3,41±0,01	6,18±0,02	5,78±0,02	5,40±0,01	3,45±0,03
4	6,12±0,04	5,64±0,08	5,28±0,04	3,37±0,04	6,16±0,02	5,71±0,02	5,33±0,03	3,42±0,06
5	6,09±0,01	5,55±0,03	5,23±0,02	3,33±0,02	6,16±0,04	5,72±0,03	5,28±0,02	3,37±0,02
6	6,08±0,03	5,53±0,01	5,21±0,01	3,28±0,04	6,12±0,02	5,69±0,04	5,25±0,04	3,30±0,02
				Dispersion (cm)				
0	5,73±0,62	5,83±0,62	6,05±0,56	6,75±0,68	5,73±0,62	5,83±0,62	6,05±0,56	6,75±0,68
1	5,75±0,62	5,87±0,61	6,10±0,57	6,83±0,70	5,74±0,62	5,86±0,63	6,08±0,57	6,80±0,69
2	5,77±0,62	5,89±0,62	6,16±0,59	6,89±0,70	5,75±0,62	5,88±0,62	6,11±0,58	6,85±0,70
3	5,81±0,65	5,93±0,62	6,20±0,61	6,96±0,71	5,79±0,63	5,90±0,62	6,17±0,61	6,91±0,71
4	5,84±0,66	5,95±0,62	6,26±0,60	7,02±0,72	5,81±0,65	5,93±0,61	6,22±0,61	6,98±0,71
5	5,88±0,68	5,98±0,64	6,32±0,60	7,08±0,72	5,84±0,67	5,95±0,62	6,27±0,59	7,03±0,73
6	5,96±0,66	6,05±0,62	6,38±0,60	7,18±0,79	5,90±0,66	5,99±0,61	6,33±0,58	7,13±0,78

3.5 Antioxidant Activity of Pucuk Merah Leaf Extract and Preparation Handbody Lotion

The antioxidant activity of the ethanolic extract of red shoot leaves (*Syzygium myrtifolium* Walp.) and the hand and body lotion formulations was evaluated using the DPPH method. This method is commonly used for in vitro antioxidant testing due to its simplicity, faster analysis time, and minimal requirement for sample and chemical reagents. The antioxidant activity test was conducted by measuring the inhibition percentage of DPPH free radicals using UV-Vis spectrophotometry. This spectrophotometric method operates on the principle that antioxidants react with DPPH through an electron transfer or hydrogen atom donation mechanism, thereby neutralizing the free radical nature of DPPH. When all the unpaired electrons of DPPH radicals are neutralized, the solution changes color from purple to yellow [38].

The antioxidant activity of the ethanolic extract and lotion formulations was determined based on the IC_{50} value (Inhibition Concentration 50%), which represents the sample concentration required to inhibit 50% of the DPPH free radicals [5]. The antioxidant measurements for both the extract and lotion formulations, as shown in Tables 4 and 5, indicate that increasing the sample concentration results in lower absorbance values. This occurs because higher concentrations enhance antioxidant activity, which is reflected by a fading of the DPPH color and a greater percentage of inhibition. Following the calculation of inhibition percentages, a graph was plotted with sample concentration on the (x) and percentage inhibition on the (y). These data were then analyzed using linear regression to determine the IC_{50} value. A lower IC_{50} value indicates stronger antioxidant activity.

According to the data presented in Table 4, the ethanolic extract of red shoot leaves exhibited an IC_{50} value of 4.162 ppm, which falls within the category of very strong antioxidant activity. However, this value is still slightly higher than that of vitamin C (used as the reference), which had an IC_{50} of 4.085 ppm, indicating that the antioxidant activity of the extract is slightly lower than that of vitamin C. The antioxidant activity of the hand and body lotion formulations F1, F2, and F3 showed IC_{50} values of 49.609 ppm, 47.202 ppm, and 35.809 ppm, respectively. All three formulations are classified as having very strong antioxidant activity because their IC_{50} values are below 50 ppm. Antioxidant activity can be classified as very strong (IC_{50} < 50 ppm), strong (IC_{50} 50–100 ppm), moderate (IC_{50} 100–150 ppm), weak (IC_{50} 151–200 ppm), and very weak (IC_{50} > 200 ppm) [39], with the results for the lotion formulations summarized in Table 5.

There is an inverse relationship between IC_{50} values and antioxidant potency: the smaller the IC_{50}, the stronger the antioxidant activity in the sample. This strong activity is attributed to the presence of

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secondary metabolites in the red shoot leaf extract, particularly phenolic compounds. Phenolics possess antioxidant potential due to their hydroxyl groups, which act as hydrogen atom donors when reacting with free radicals via an electron transfer mechanism, thereby inhibiting oxidative processes [40].

Table 4. Inhibition Percentage of Pucuk Merah Leaf Ethanol Extract

Sample	Concentration (ppm)	Absorbansi Blanko	Sample Absorbance	% Inhibition	IC50 (ppm)	Ket.
Pucuk Merah Leaf Ethanol Extract	1	0,496	0,396	20,228	4,162	Very Strong
	2		0,347	29,973		
	3		0,309	37,769		
	4		0,246	50,336		
	5		0,312	57,056		
Vitamin C	1	0,487	0,347	30,533	4,085	Very Strong
	2		0,315	37,000		
	3		0,288	42,400		
	4		0,249	50,133		
	5		0,222	55,600		

Table 5. Inhibition Percentage of Pucuk Merah Leaf Ethanol Extract

Sample	Concentration (ppm)	Absorbansi Blanko	Sample Absorbance	% Inhibition	IC50 (ppm)	Ket.
Formula 1	10	0,509	0,426	16,241	49,609	Very Strong
	20		0,384	24,492		
	30		0,337	33,792		
	40		0,299	41,323		
	50		0,252	50,491		
Formula 2	10	0,500	0,401	19,733	47,202	Very Strong
	20		0,357	28,600		
	30		0,314	37,200		
	40		0,280	44,067		
	50		0,242	51,850		
Formula 3	10	0,548	0,387	29,319	35,809	Very Strong
	20		0,351	35,949		
	30		0,312	43,000		
	40		0,253	53,771		
	50		0,202	63,139		

4. Conclusion

Based on the results of the physical characteristics test of the lotion preparation, it was found that all formulas met the requirements of a good lotion. However, the best formulation is obtained in Formula 1, because it has the most optimal form of preparation compared to other formulas. The results of the activity of handbody lotion preparations from formulas 1, 2 and 3 have very strong antioxidant activity which has IC_{50} values of 49.609 ppm, 47.202 ppm, and 35.809 ppm.

5. Declarations

5.1 Acknowledgements (Optional)

All authors contributed to the writing of this article.

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5.2 Author contributions

All authors contributed to the writing of this article

5.3 Ethics

This study did not involve any procedures requiring ethical approval.

5.4 Conflict of Interest

No conflicts of interest have been declared by the authors.

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