

Formulation and Evaluation of Body Lotion from the Ethyl Acetate Fraction of Mangosteen Peel (*Garcinia Mangostana* L.) with the Addition of Glutathione as a Brightener

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ABSTRACT

Mangosteen peel (*Garcinia mangostana* L.) and glutathione are known as a antioxidant agents. Topical use of antioxidants can reduce UV radiation which causes skin damage. This research aims to formulate the ethyl acetate fraction of mangosteen peel with various concentrations as a body lotion that meets the physical evaluation requirement. Quantitative experimental methods were used and three formulas were made with variation in the concentration of the active substance of the ethyl acetate fraction of mangosteen peel used. The result of the physical evaluation test of the three body lotion formulations with concentrations F1(5%), F2(7,5%), and F3(10%) are brownish orange, brown, and dark brown, have a chocolate aroma and have a semi-solid texture, homogeneous with an emulsion type (o/w), the pH of 6, spreadability ranges from 4-6,26 cm, adhesion ranges from 04.19-05.85 second. Formula F3(10%) don't meet the spreadability evaluation.

INTRODUCTION

The organ that covers all surfaces of the body of living things and has a function as a body protector from external influences is called skin. The skin must be kept healthy so that the appearance is not disturbed and the skin remains healthy and avoids skin damage. Free radicals are one of the many factors that cause skin damage. Ultraviolet light is one example of free radicals that can cause skin damage. Excessive exposure to ultraviolet light can cause various problems with the skin such as redness, wrinkles, skin aging, dry skin, and decreased skin elasticity and melanin damage to cause serious skin diseases (Rusli et al., 2023). Compounds that function to protect the skin from damage caused by free radicals are called antioxidants (Hidayanti et al., 2021).

Mangosteen (*Garcinia mangostana* L.) is one of the fruits that is known in addition to its good taste, its fruit skin has many benefits. The use of mangosteen peel in Indonesia empirically by the community is usually used as a pain reliever in the stomach, diarrhea, dysentery, and open wound infections (Amelia et al., 2016). Mangosteen peel is also used by the community as a medicine for thrush and natural coloring (Rusmana, 2019). Thai people have widely used mangosteen peel as a traditional herb for generations to treat skin infections, wounds and diarrhea (Pratiwi et al., 2022).

Mangosteen peel (*Garcinia mangostana* L.) is well-known as an antioxidant and has been widely studied for its activity. This is due to the presence of a number of active compounds it contains such as flavonoids, polyphenols, tannins, and alkaloids. In addition, santone compounds contained in mangosteen peel are known to have potential as strong antioxidants that can counteract free radicals that can cause skin damage. According to the results of research conducted by (Pratiwi et al., 2016) the ethyl acetate fraction of mangosteen fruit peel showed very strong free radical capture activity with an IC_{50} of 2,78 $\mu\text{g}/\text{mL}$. Antioxidants are defined as compounds that delay or inhibit oxidation and protect the skin from free radical attack, so they are very well used on the skin (Rusli et al., 2023).

An antioxidant present in almost every cell of the body is glutathion. Glutathion in the body works as an important protection for antioxidants and detoxification. Reducing wrinkles, dark spots, and nourishing the skin are some examples of the benefits of glutathion for the skin. Glutathion is divided into two, namely in a reduced (GSH) and oxidized (GSSG) state, in the body as most of the reduced state form. As an antioxidant, GSH works by counteracting free radicals during the reductive detoxification of hydrogen peroxide and lipid peroxide (Weschawalit et al., 2017).

The antioxidant properties for the skin of *Garcinia mangostana* L. and glutathion will be easier to use if packaged in the form of cosmetic preparations such as body lotion. Body lotion is a skin moisturizing cosmetic preparation that belongs to the emollient group (softener) which has several properties, namely a soft source on the skin, making the hands and body feel soft, but not greasy and easily applied to the skin (Ariani et al., 2022).

The purpose of this study was to formulate ethyl acetate fractions of mangosteen peel with various concentrations as body lotion preparations that

meet the requirements of good physical evaluation including organoleptic test, pH, homogeneity, spreadability test, adhesion test, cream type test, irritation test, and dosage stability test.

THEORETICAL REVIEW

Mangosteen peel (*Garcinia mangostana* L.) is well-known as an antioxidant and has been widely studied for its activity. This is due to the presence of a number of active compounds it contains such as flavonoids, polyphenols, tannins, and alkaloids. In addition, santone compounds contained in mangosteen peel are known to have potential as strong antioxidants that can counteract free radicals that can cause skin damage (Rusli et al., 2023). Meanwhile, glutathion in the body works as an important protection for antioxidants and detoxification (Weschawalit et al., 2017). Glutathion has a high rating as an antioxidant by acting to neutralize free radicals and also plays a role in recycling other types of antioxidants that have the same potential. Reducing wrinkles, dark spots, and nourishing the skin are some examples of glutathion's benefits for the skin (Kirana, 2020).

METHODOLOGY

This research was conducted with a quantitative experimental design. Tools used include analytical balance, oven, aluminum foil, rotary evaporator, blender, filter paper, erlenmeyer, stir bar, black cloth, measuring cup, spatula, pipette, cup, glass jar, funnel, sieve mesh 60, knife, test tube, beaker glass, mortar and stamper, universal pH, hotplate, waterbath, TLC plate and vacuum pump. The ingredients used include mangosteen peel, glutathion, 96% ethanol, ethyl acetate, n-hexane, chloroform, aquadest, stearic acid, triethanolamine, cetyl alcohol, lanolin, glycerin, paraffin liquidum, propylenglycol, methyl paraben. The research procedure included several stages, namely preparation of raw material, mangosteen peel extraction, ethyl acetate fractionation of mangosteen peel, formulation body lotion, as well as evaluation of body lotion.

The sample in this study used mangosteen (*Garcinia mangostana* L.) obtained from Rancah village, Rancah sub-district, Ciamis district. While glutathion was obtained from one of the authorized distributors. Sample preparation starts with 10 kg of mangosteen peel, then washed thoroughly using running water, and cut into small pieces. Mangosteen peels were dried in the sun with a black cloth cover (Candra & Irwani, 2016). The next stage is oven drying at 45°C for 12 hours. The dried sample was then pulverized using a blender and sieved using a no 60 sieve (Iryani et al., 2021).

The preparation of 96% ethanol extract of mangosteen peel refers to research (Shakila et al., 2021) doing maceration with a ratio (1: 5), where as much as 500 grams of mangosteen skin powder is put in a maceration container and soaked with 2500 mL of 96% ethanol solvent. Stirred until homogeneous dissolved and allowed to stand for 3x24 hours at room temperature and stirred every 8 hours. After that, filtering was carried out to separate the filtrate from the pulp. The filtrate obtained was then evaporated with a rotary evaporator at 50 °C and then continued with thickening with a waterbath at 50 °C until a concentrated extract was formed (Sa'diyah et al., 2019).

Preparation of ethyl acetate fraction of mangosteen peel by multistage fractionation. 10 grams of mangosteen peel ethanol extract was dissolved with 100 mL of 96% ethanol. After that, it was put in a separating funnel and fractionated with 100 mL of n-hexane which was then carried out 3 times where occasionally the faucet was opened to release gas in the funnel. Then it was allowed to stand and waited until two separate layers were formed. After the formation of two layers, the lower layer was put back in the separating funnel and fractionated again with 100 mL of ethyl acetate solvent in the same way. Furthermore, it was allowed to stand until two layers were formed. The top layer as ethyl acetate fraction and the bottom layer is called ethanol fraction. The fractionation process was repeated 3 times. Furthermore, the ethyl acetate layer is concentrated with a 50 °C waterbath until a concentrated fraction is formed (Widodo et al., 2023).

Formulation and manufacture of body lotion preparation according to the table, modifikasi on the study (Iryani et al., 2021) and (Aryani et al., 2022)

Table 1. Formulation of Body Lotion Ethyl Acetate Fractions of Mangosteen Peel (*Garcinia mangostana* L.) with Glutathion

Material	Usage	Formulation (gr)			
		F0	F1	F2	F3
Ethyl acetate fraction mangosteen peel	Active substance	-	5	7,5	10
Glutathione	Brightener	2	2	2	2
Stearic acid	Emulgator	6	6	6	6
Trietanolamine	Emulgator	5	5	5	5
Cetyl alcohol	Thickener	4	4	4	4
Lanolin	Emolient	1	1	1	1
Glycerin	Humectant	10	10	10	10
Paraffin Liquidum	Emolient	5	5	5	5
Propylene glycol	Humectant	5	5	5	5
Methylparaben	Preservative	0,1	0,1	0,1	0,1
Aqua destilata	Solvent	Ad 100	Ad 100	Ad 100	Ad 100

Description :

F0 : Body lotion base

F1 : Body lotion 5% mangosteen peel ethyl acetate fraction

F2 : Body lotion 7,5% mangosteen peel ethyl acetate fraction

F3 : Body lotion 10% mangosteen peel ethyl acetate fraction

Preparation of body lotion all ingredients were weighed precisely. The oil phases (stearic acid, cetyl alcohol, lanolin, and liquid paraffin) were combined and melted on a waterbath at 70°C. The water phase (TEA, glycerin, propylenglycol, methyl paraben) is combined and melted on a waterbath at 70°C. Combine the oil phase and water phase in a mortar while crushed homogeneously and add hot distilled water slowly with constant stirring until lotion base is formed. The ethyl acetate fraction of mangosteen peel (active substance) is diluted with distilled water and then put into the lotion base that

has been formed, stirring until homogeneous. Enough weight to 100 grams using distilled water. Glutathion is diluted with a few drops of distilled water and then put into the lotion preparation and stir homogeneously. The preparation is then stored in a container and the chemical physics evaluation of the preparation is carried out (Iryani et al., 2021).

Evaluation of body lotion preparation of ethyl acetate fraction of mangosteen peel (*Garcinia mangostana* L.) with the addition of glutathion includes tests: a). Organoleptic test. Visual testing of body lotion preparations by observing the color, texture (shape), and aroma of the preparation (Budi et al., 2020). b). A total of 1 gram of body lotion preparation is dissolved with 10 mL distilled water. Then dip the universal pH to measure the pH of the handbody lotion preparation and match the color read on the universal pH box. The pH parameters of lotion according to SNI 16-3499-1996 for skin range from 4.5-8 (Megantara et al., 2017). c). Homogeneity test. a small sample of body lotion preparation is taken and then stored on both glass objects, then observed. The preparation is said to be homogeneous when no coarse particles and lumps are found, and each ingredient is evenly mixed (Mardikasari et al., 2017). d). Spreadability test. The body lotion preparation is weighed as much as 0.5 grams and stored in the center of the Petri dish, the top of the preparation is placed in another Petri dish and allowed to stand for 1 minute then record the diameter of the spread. Next, add 50 grams of weight until it reaches 100 grams, note the diameter and spread area. The parameter value of spreadability is 5 - 7 cm (Pujiastuti & Kristiani, 2019). e). Adhesive power test. A total of 0.5 grams of body lotion preparation is stored on a glass object, another glass object is placed on the preparation and given a load weighing 500 grams and allowed to stand for 5 minutes. After that, the length of time until the glass is released is calculated. Time is recorded when the object glass comes off together. The parameter for the value of stickiness for handbody lotion preparations is > 4 seconds (Ulfa et al., 2019). f). Cream type test. Take a small amount of body lotion preparation and keep it on a glass object, drop 4-5 drops of methylene blue reagent then stir until homogeneous and observed. Oil-in-water (M/A) emulsion type is characterized when the outer phase is blue (Deniansyah & Pujiastuti, 2022). g). Stability test cycling test. Various concentrations of body lotion preparations were stored at 4°C for 24 hours and then transferred to an oven at 40°C for 24 hours (one cycle). The test was carried out for 6 cycles, then observed the physical changes that occurred in the form of the presence or absence of separation (Zamzam & Musdalifah, 2022).

RESERACH RESULTS

The results of mangosteen peel extract produced from the extraction process by maceration method with 500 grams of simplisia powder and macerated using 96% ethanol as much as 2500 mL. The results of the thick extract obtained were 89,5 grams. The results of the calculation of the yield of the extract obtained amounted to 17,9%. Then fractionated with ethyl acetate until a thick extract of 61,7 grams was obtained with a fraction yield value of 68,5%. Then the results of the concentrated fraction of mangosteen peel ethyl acetate with the

addition of glutathion were formulated into body lotion preparations with various concentrations according to table 1. The body lotion preparation formulation was then carried out chemical physics such as organoleptic test, pH, homogeneity, spreadability test, adhesion test, cream type test, and preparation stability test with the results as Table 2.

Table 2. Result of Formulation of Body Lotion Ethyl Acetate Fractions of Mangoteen Peel (*Garcinia mangostana* L.) with Glutathion

Test Parameter	Formula	Before Cycling Test	After Cycling Test
Organoleptic	F0	White color, semi-solid texture, typical base aroma	White color, semi-solid texture, typical base aroma
	F1	Brownish orange color, semi-solid texture, chocolate aroma	Brownish orange color, semi-solid texture, chocolate aroma
	F2	Brown color, semi-solid texture, chocolate aroma	Brown color, semi-solid texture, chocolate aroma
	F3	Dark brown color, semi-solid texture, chocolate aroma	Dark brown color, semi-solid texture, chocolate aroma
pH	F0	6	6
	F1	6	6
	F2	6	6
	F3	6	6
Homogeneity	F0	Homogeneous	Homogeneous
	F1	Homogeneous	Homogeneous
	F2	Homogeneous	Homogeneous
	F3	Homogeneous	Homogeneous
Spreadability	F0	6,26 cm	6,4 cm
	F1	5,61 cm	6 cm
	F2	5,6 cm	5,8 cm
	F3	5,55 cm	5,65 cm
Adhesive	F0	4.05 second	4.05 second
	F1	04.74 second	4.056 second
	F2	05.24 second	05.15 second
	F3	05.83 second	05.62 second
Cream type	F0	(o/w)	(o/w)
	F1	(o/w)	(o/w)
	F2	(o/w)	(o/w)
	F3	(o/w)	(o/w)

Description :

F0 : Body lotion base

F1 : Body lotion 5% mangosteen peel ethyl acetate fraction

F2 : Body lotion 7,5% mangosteen peel ethyl acetate fraction

F3 : Body lotion 10% mangosteen peel ethyl acetate fraction

DISCUSSION

The preparation was evaluated by cycling test method. The results of stability testing at extreme temperature storage (4°C) did not occur phase separation, all formulas only became frozen. While at accelerated temperature storage (40°C) all formulas slightly changed their consistency from thick to slightly more liquid. Furthermore, each formula was tested including organoleptic, pH, homogeneity, spreadability, adhesiveness and emulsion type.

The results of the evaluation of the preparation in the organoleptical test at F0 (base without extract) have a semi-solid shape, white in color and a distinctive aroma of chocolate. Meanwhile, the preparation with the addition of the active substance of the ethyl acetate fraction of mangosteen skin produces a semi-solid shape, brownish orange (F1), brown (F2), and dark brown (F3), and each formula has a distinctive aroma of chocolate. In each formula there are differences in color ranging from brownish orange, brown, and dark brown, this is because the higher the concentration of the concentrated fraction added, the color of the resulting preparation will be more intense. As for the aroma in each formula F0, F1, F2, and F3 has a distinctive chocolate aroma because it is given the addition of chocolate essence to cover the unpleasant smell of fractions and glutathion. The results of organoleptic observations of mangosteen peel ethyl acetate fraction body lotion preparations with the addition of glutathion at various concentrations after the cycling test did not change the preparation either color, texture or aroma.

The pH test results showed that all formulas F0 (base), F1, F2 and F3 showed pH 6. The pH parameters of topical preparations according to SNI 16-4399-1996 must have a pH in accordance with the normal pH of the skin, namely pH 4.5-8.0. The observation of the pH of the body lotion preparation of the ethyl acetate fraction of mangosteen peel with the addition of glutathion at various concentrations after the cycling test did not change the pH, the results remained the same as before. The degree of acidity and basicity of the preparation affects the safety level of the preparation used. Lotions whose pH is too acidic are feared to cause irritation to the skin, while those whose pH is too basic are feared to cause the skin to become dry (Anggraeni et al., 2018).

The homogeneity evaluation results show the characteristics of body lotion preparations F0, F1, F2, and F3 show a homogeneous composition. This is indicated by not having coarse particle grains in each formula, except that in F0 (base) there are air bubbles. According to (Syafitri & Rahma 2023) the formation of air bubbles or foam is due to too fast grinding, so grinding should be done slowly and constantly. The results obtained in all formulas show homogeneous results (Febrianto et al., 2021). The results of the homogeneity test of mangosteen peel ethyl acetate fraction body lotion preparations with the addition of glutathion at various concentrations after the cycling test did not change the results were the same, namely remaining homogeneous.

The results of the spreadability test of mangosteen peel ethyl acetate fraction body lotion preparations in all formulas of the distribution value without

being given a load have a value below the predetermined parameters (<5 cm). This is because of course in the application of the preparation there is no pressure so that the preparation does not spread and produces a small distribution power. Whereas in the spreadability test using a load of 50 grams and 100 grams, only formulas F0, F1 and F2 meet the evaluation of spreadability because they have a spreadability value of 5-6 cm. Formula F3 did not meet the spreadability test because when given a load of 50 grams it only produced a spreadability value of 4.90 cm, not reaching the minimum parameter of 5 cm, so F3 did not meet the parameters of the spreadability test. From the observations, the higher the concentration of the concentrated fraction used, the consistency of the preparation becomes more concentrated and thicker, this will affect the decrease in the spreadability of the body lotion preparation. Based on research conducted by (Fitriana et al., 2022) the addition of lanolin to body lotion preparations can cause the consistency of the lotion to become thicker so that the spreadability decreases. The results of the spreadability test of mangosteen peel ethyl acetate fraction body lotion preparations with the addition of glutathione at various concentrations after the cycling test increased the diameter of the spreadability which was not too significant from before the stability test. This is because the hot temperature causes the consistency of the lotion preparation during storage to become more liquid so that the preparation spreads more easily. This is in line with previous research by (Lumentut et al., 2020) in the spreadability test before and after the cycling test experienced an increase in spread diameter. This happens because the cycling test at 40 °C storage cycle causes the body lotion preparation to become thinner in the test and makes the diameter of the distribution increase.

Based on the results of the adhesion test obtained, the four body lotion formulations of the ethyl acetate fraction of mangosteen peel meet the parameters of a good adhesion test value of >4 seconds. The results obtained are between 04.18 seconds to 05.85 seconds so it can be concluded that all formulas fulfill the adhesion test. The highest adhesion value was obtained in formula F3 with the addition of concentrated fraction concentration of 10%. The higher the concentration of fractions added makes the lotion consistency thicker so that the adhesion time increases. The longer the adhesion of a preparation, the longer the penetration time of the preparation into the skin so that absorption becomes more optimal (Nugraha et al., 2022). The results of the adhesion test of mangosteen peel ethyl acetate fraction body lotion preparations with the addition of glutathione at various concentrations after the cycling test show that all formulas that have been made meet the requirements of body lotion adhesion which is >4 seconds, but the adhesion of preparations for all formulas has decreased the adhesion time which is not too significant. This is because the hot temperature causes the consistency of the lotion preparation during storage to become more liquid so that the adhesion of the preparation is reduced due to changes in consistency.

The results of the emulsion type test are in accordance with the expected type, namely the oil-in-water emulsion type (m/a) in the four formulas with positive results marked by the formation of an evenly distributed blue color in

the emulsion. It is said that the type of oil-in-water emulsion (m/a) is due to the small amount of dispersed phase (oil/fat) used in the preparation rather than the dispersing phase (water phase) so that the oil phase is evenly dispersed and will form an m/a emulsion due to the presence of emulgators (Saidar, 2020). In addition, the combination of stearic acid and triethanolamine (TEA) emulgators will form a stable oil-in-water (m/a) emulsion. The results of the emulsion type test of mangosteen peel ethyl acetate fraction body lotion preparations with the addition of glutathion at various concentrations after the cycling test did not change the type of emulsion remained the same in the form of oil-in-water emulsion type (m/a) in the four formulas with positive results marked by the formation of an evenly distributed blue color in the emulsion.

CONCLUSIONS AND RECOMMENDATIONS

The combination of the ethyl acetate fraction of mangosteen peel (*Garcinia mangostana* L.) and the addition of glutathione can be formulated as a body lotion with the three formulations meeting the result of physicochemical evaluation such as organoleptic, pH, homogeneity, adhesive power, cream type, liking test and irritation test. While the F3 spreadability test does not meet the requirements. The limitation of this research is that brightness testing on the skin and antibacterial testing have not been carried out, so it is recommended for further research to test the brightness of the preparation on the skin and making other dosage form.

FURTHER STUDY

Given their own limited knowledge and experience, it is not surprising that researchers found many shortcomings in the terms of language, writing and presentation style when compiling this journal. Therefore, researchers expect constructive criticism and suggestion from various sources and readers to ensure that this work is perfect.

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