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Formulation And Physical Evaluation of Body Scrub Cream From 95% Ethanol Extract of Breadfruit Peel (*Artocarpus altilis*) as Antioxidants

Meta Safitri[1]*, Arini Aprilliani[2], Mohammad Zaky[1], Siti Mukammila Azkiya[1]
[1]Department of Community Pharmacy, Faculty of Pharmacy, A.R. Fachruddin University, Tangerang, Indonesia
[2]Center for Human Resource Development for Food and Drug Monitoring, Indonesian FDA, Jakarta, Indonesia

*Corresponding author: metaunimar@gmail.com
Orcid ID: 0009-0009-3422-3441

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Abstract

Background*: Breadfruit (Artocarpus altilis) peel contains many chemical compounds including alkaloids, flavonoids, saponins, polyphenols, and steroids/terpenoids. Breadfruit peel has potential as an antioxidant because it contains phenolic compounds, especially flavonoids and polyphenols.* ***Objective****: The aim of this study was to formulate and physically evaluate the preparation of a scrub cream from a 95% ethanol extract of breadfruit peel (Artocarpus altilis) and test its antioxidant activity.* ***Methods****: Body scrub cream formulations were prepared using different extract concentrations, such as F1 (no extract), F2 1%, F3 3%, F4 5%, and F5 (Vit C as an equalizer for the antioxidant activity test). Body scrub cream was formulated as an oil-in-water type cream preparation using breadfruit starch as a scrub. Physical evaluation of this preparation consisted of organoleptic, homogeneity, viscosity, pH, spreadability, adhesiveness, and room-temperature storage tests. The antioxidant activity was evaluated using the DPPH method.* ***Results****: The results of the physical evaluation test showed that the body scrub cream produced good results and complied with the requirements of cream products. Antioxidant activity test results show the IC_{50} value of each formula is F1 (without extract) 107.8 µg/mL, F2 (1%) 72.48 µg/mL, F3 (3%) 56.54 µg/mL, F4 (5%) 43.40 µg/mL and F5 (vitamin C K+) 38.94 µg/mL.* ***Conclusion****: Based on these observations, the best formula is Formula 3 because the antioxidant test results are classified as strong, and the physical evaluation tests are considered stable.*

Keywords*: antioxidant, breadfruit peel, cream body scrub, DPPH*

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INTRODUCTION

Indonesia is positioned along the equator, which means that it has a tropical climate. Tropical regions receive constant sunlight owing to their position relative to the equator. Excess exposure to UV rays is a source of free radicals that can damage the skin and cause cancer. Skin damage is caused by frequent exposure to sunlight, vehicular emissions, and other chemicals. In skin cells,, free radicals attack collagen so that skin moisture is reduced, and the skin feels dry and brittle. This causes wrinkles on the skin ,commonly referred to as aging (Azkianti and Lestari, 2022). Antioxidants can minimize skin damage caused by free radicals. Antioxidants are small-molecular-weight compounds that can inhibit or counteract free radicals. Antioxidants will protect the skin from oxidized damage so that the dangers of free radicals on the skin, such as aging, will be reduced (Masaki, 2010). Therefore, it is important to scrub the body from the outside. Scrubbing involves removing dirt, oil, or dry skin by massaging the entire body. The results can be seen immediately: the skin becomes firmer, smoother, and healthier. Traditional scrubs are one of cosmetic preparations made from fresh or dried natural ingredients from plants and fruits (Agata and Sulandjari, 2017).

One of the plants with natural antioxidant activity is breadfruit. Breadfruit peel is reported to have good antioxidant activity, and breadfruit peel was chosen because it is still rarely utilized by the community because of the lack of information about its potential and benefits. According to research conducted by (Wibowo et al., 2017), the antioxidant activity of breadfruit peel ethanol extract by the DPPH method obtained IC_{50} value of 57.430 ppm; this result states that the antioxidant activity of breadfruit peel ethanol extract is categorized as strong. From the results of phytochemical screening of died breadfruit peel and breadfruit peel extracts containing chemical compounds of polyphenolic groups, flavonoids, quinones, steroids or triterpenoids and monoterpenes or sesquiterpenes (Wibowo et al., 2017).

The use of breadfruit peel extract as an antioxidant can be applied to one of the dosage forms of body scrub cream, which is a pharmaceutical preparation in the form of a beauty product that functions to smooth the skin and remove dry skin cells with the help of scrub ingredients. Breadfruit peel is used as a scrub because it contains nutritious substances that benefit the skin. Antioxidants in breadfruit can make the skin brighter and shinier and protect it from free radicals that can damage it. Scrubs can be made from synthetic materials or natural materials such as plant seeds or fruits (Musdalipah et al., 2016).

MATERIALS AND METHODS

Materials

Breadfruit peel (*Artocarpus altilis*) from ripe breadfruit was collected from the Jl. KH. Kuding RT. 003/ RW.006 Kel. Belendung, Kec. Benda, Tangerang City, Banten 15123. Determination of breadfruit was carried out at the Biology Lab UAD Yogyakarta, 95% ethanol (Sentra Kimia, Jakarta, Indonesia), stearic acid (Brataco, Tangerang, Indonesia), purified water (JMI, Sidoarjo, Indonesia), adeps lanae (PRET, Johnsonville, USA), methylparaben (MCE, New Jersey, USA), propylparaben (ALPHA, Mumbai, India), liquid paraffin (Asian Oil, Mumbai, India), cetyl alcohol (Akoma, Derby, England), span 60 (NOF Corporation, Tokyo, Japan), tween 60 (ICE Pharma, Reggio Emilia, Italy), propyleneglycol (Brataco, Tangerang, Indonesia), DPPH (TCI, Tokyo, Japan), methanol p. a (Merck, Darmstadt, Germany), vitamin C (Merck, Darmstadt, Germany).

Method

Preparation of breadfruit peel extract

The harvested breadfruits were collected, wet sorted, washed with flowing water, drained, and peeled off the fruit skin. The peel is taken from the outer to the inner peel, which borders the fruit. bread-fruit skin was thinly sliced. Then, it dried in the sun. The dried breadfruit skins were then sorted. The dried breadfruit peel was pulverized and sieved using a blender. The result of the die breadfruit peel powder was 1.04 kg. Dried breadfruit peel powder (1 kg) was macerated in 10 L of 95% ethanol. The dried breadfruit peel was soaked by stirring every 6 h for 3×24 h. It is then filtered to separate the pulp from the macerate. The process was repeated once with the same type of solvent, and the amount of solvent volume was half the volume of the first solvent, which was 1 kg of die breadfruit peel added to 5 L of solvent (1:5), after which it was filtered again, and the macerate produced was evaporated using a rotary evaporator at 60°C. After evaporation, the liquid extract is heated in a water bath to make a thick extract.

Phytochemical screening

Alkaloid

The sample (2 g) was crushed in a mortar containing 25% ammonia. Subsequently, 20 mL of chloroform was added and mixed vigorously. The mixture was filtered, and the filtrate obtained was dripped onto filter paper and tested using Dragendorff's reagent. The orange color indicates the presence of alkaloids in the sample. The

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residue was extracted twice in a separatory funnel using 10% HCl, and the aqueous layer was separated from the organic layer. The aqueous layer was then placed in a test tube and tested using Mayer's and Dragendorff's reagents. A positive result was indicated by the formation of a white precipitate with Mayer's reagent and a red precipitate with Dragendorff's reagent (Aprilliani et al., 2018).

Flavonoid

A 2 g sample was heated in 100 mL of water for 15 min, filtered, and the resulting filtrate was collected (filtrate A). Five millilitres of filtrate A was taken and mixed with 0.1 g of magnesium powder, 1 mL of HCl, and amyl alcohol (5 mL). The mixture was then shaken and allowed to separate. The presence of flavonoids was indicated by the formation of a red, yellow, or orange color in the amyl alcohol layer (Aprilliani et al., 2018).

Tannin/polyphenol

Filtrate A (5 mL) was added to the three test tubes. In the first tube, the sample was tested with FeCl3 solution, and a blue-green color was found, which is a sign of the presence of phenol group compounds. Gelatin was added to the second tube as a specific reagent for tannins. The formation of a white precipitate indicates the presence of tannins in the sample. In the third tube, Stiasny reagent was added and heated for 10 min. The formation of a pink precipitate indicated the presence of concentrated tannins. The precipitate was filtered, filtrate was added sodium acetate until saturated and added a few drops of iron (III) chloride solution, formed a blue-black color indicating the presence of gallic tannin compounds (Aprilliani et al, 2018).

Saponin

Filtrate A (10 mL) was added to the test tube and shaken vigorously for 10 s. If foam was formed that lasted for 1 min, it was suspected that it contained saponins. Then the HCl 2 N solution into the test tube. If the foam does not disappear, it shows that the sample is positive for saponins (Aprilliani et al, 2018).

Steroid/triterpenoid

A 1 g sample was macerated with 20 ml of n-hexane for 2 h, filtered, and the filtrate was collected. Five milliliters of the filtration was evaporated in a vaporizer cup. Liebermann-Burchard reagent was added to the evaporated residue. The formation of green color indicates the presence of steroids, and the formation of red to violet color indicates the presence of triterpenoids in the sample (Aprilliani et al, 2018).

Preparation of Breadfruit Starch

The bread was cut into small pieces and ground into a coarse pulp. It was mixed with clean water, stirred while squeezed, and filtered through a mesh to separate the residue. The starch was allowed to settle, and after precipitation was complete, the precipitated water was discarded. The starch was then dried in an oven for 24 h at 45°C. The dried starch was sieved using a 60-mesh sieve (Zuhra et al., 2016).

Preparation of body scrub cream

The scrub cream was prepared by weighing the ingredients. Subsequently, the oil and liquid phases separated during melting. The oil phase (stearic acid, cetyl alcohol, Adeps lanae, Span 60, and propylparaben) was melted in a porcelain cup at 70°C in a water bath and stirred until homogeneous. The water phase (methylparaben was dissolved with hot water, and propylene glycol was added to Tween 60; then, liquid paraffin was added) was diluted in a porcelain cup in a water bath at the same temperature while mixing until homogenized. After everything was melted, a cream was made by mixing the oil phase with the water phase using an electric stirrer for 3 min. It was then allowed to stand for 20 s and stirred until homogeneous. After the cream base was formed, 95% ethanol extract of the breadfruit peel and starch was added. Finally, a physical evaluation of the cream was conducted.

Table 1. Formulation of 95% Ethanol Extract Scrub Cream of Breadfruit Peel (*Artocarpus altilis*)

Composition	Concentration %				
	F1	F2	F3	F4	F5
95 % Ethanol Extract of Breadfruit Peel	-	1	3	5	-
Vitamin C	-	-	-	-	1
Breadfruit starch	10	10	10	10	10
Stearic acid	5	5	5	5	5
Span 60	0.85	0.85	0.85	0.85	0.85
Tween 60	2.15	2.15	2.15	2.15	2.15
Cetyl alkohol	3	3	3	3	3
Propylenglykol	0.2	0.2	0.2	0.2	0.2
Parafin liquid	5	5	5	5	5
Adeps lanae	5	5	5	5	5
Metil paraben	0.1	0.1	0.1	0.1	0.1
Propil paraben	0.05	0.05	0.05	0.05	0.05
Purrified water *ad*	100	100	100	100	100

Physical evaluation of body scrub cream

Organoleptic test

Organoleptic observations that will be made include observations such as color, aroma, and texture. (Hilda et al, 2021).

P-ISSN: 2406-9388
E-ISSN: 2580-8303

Homogeneity test

One gram of body scrub preparation was applied to the Petri dish, and the color of the preparation and the bases were clotted by paying attention to the texture of the preparation visually with the eyes while palpating. The preparation is considered homogeneous if the color of the preparation and the active substance is evenly distributed and there is no clumpy base (Lestari et al, 2017).

pH test

The cream preparation (1 g) was dissolved in 1 mL of purified water. A pH meter was placed in the solution. Wait until the pH is constant. The value shown on the pH meter is the pH of the preparation (Hilda et al., 2021).

Spreadability test

On the glass instrument , 0.5 grams of body scrub was placed, and the glass was covered with a glass cover for 1 minute. The diameter of the cream that spread was measured. Subsequently, it was repeated with the addition of 50 g every 1 minute. The diameters were observed and recorded. (Hilda et al., 2021).

Adhesiveness test

On the object glass, 1 g of body scrub was placed and covered with another object glass with pressure and a load of 1 kg for 5 min. The load is lifted from the object glass and then separated between the two object glasses, and the separation time between the two is recorded(Hilda et al, 2021).

Viscosity test

The viscosity test uses a Lamy Rheology viscometer with a spindle L4 speed of 100 rpm and a time of 1 minute (Zaky et al., 2021).

Room temperature storage test

Room-temperature storage testing was carried out by determining the organoleptic properties, pH, and viscosity at time intervals of 1, 3, 5, and 7 days after storage. (Hilda et al., 2021).

Antioxidant activity test

The antioxidant activity was determined by measuring the absorbance value using a UV-Vis spectrophotometer. Antioxidant activity was evaluated quantitatively through DPPH (1,1-diphenyl-2-picrylhydrazyl) method. The principle of quantitative measurement of antioxidant activity using the DPPH method is related to the change in intensity of the purple color from DPPH, which is a free radical with unpaired electrons. This color will turn yellowish when electron pairs (Molyneux, 2004).

Preparation of sample

The 2 mg of DPPH powder was weighed and placed into a 100 mL volumetric flask, then dissolved in methanol p.a until the mark and shaken until homogenized (Hilda et al., 2021). A solution of vitamin C was then prepared. Vitamin C powder (5 mg) was weighed and dissolved in 50 mL of methanol p. a. in a 50 mL measuring flask to achieve a concentration of 100 ppm (main solution). From the main solution, a 5 mL concentration series of 2, 4, 6, 8, 10, and 12 ppm was then prepared (Wibowo et al., 2017) (Hilda et al., 2021). A concentration series solution was also prepared with 2.5 mg of ethanol extract from breadfruit peel, which was dissolved in 25 mL of methanol p. a. in a 25 mL volumetric flask to obtain a concentration of 100 ppm (main solution). A 5 mL concentration series of 5, 10, 25, 50, 75, and 100 ppm was subsequently prepared (Hilda et al., 2021).

Wavelength determination

To determine the maximum wavelength, the absorbance of the 0.05 mM DPPH concentration was measured as much as 4 mL using a spectrophotometer with a wavelength range of 500-525 nm, so an absorbance of 0.2-0.8 was obtained. The maximum wavelength that produces the largest absorbance is the maximum wavelength (Hilda et al., 2021).

Determination of operating time

The operation time is defined by taking 50 μL of extract standard solution and then adding 4 mL of 0.05 mM DPPH solution, homogenized, measuring the absorbance at minutes 0, 5, 10, 15, 20, 25, and 30 of the maximum wavelengths that has been obtained. The DPPH radical binding time that produces the most stable absorbance is the operating time (Hilda et al., 2021).

Antioxidant activity testing of breadfruit peel extract

(2 mL, 0.05 mM DPPH solution was added to the test tube, and 2 mL of ethanol extract of breadfruit peel was added according to the concentration series that had been made. The samples were homogenized and stored in the dark for 40 min. The absorbance was measured using UV-Vis spectrophotometry at a wavelength of 516 nm. The percent of antioxidant activity of ethanol extract from breadfruit peel was calculated (Hilda et al., 2021).

Antioxidant activity testing of body scrub cream

The cream (1 g) was weighed and placed in an Erlenmeyer flask, 10 ml of methanol p. a. solution was added, and the mixture was heated in a water bath until the cream and methanol became homogeneous and then cooled with ice cubes. The filtered solution was added to a test tube, centrifuged at 3000 rpm for 10 min, and

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stored in the dark for 30 min. The absorbance were read using UV-Vis spectrophotometry at a wavelength of 516 nm. The % antioxidant activity of breadfruit peel ethanol extract cream was calculated using the formula (Hilda et al., 2021).

$$\%\ \text{Inhibisi} = \frac{\text{Abs Blanko} - \text{Abs sampel}}{\text{Abs Blanko}} \times 100\ \%$$

The percent inhibition value was obtained, a curve was plotted against the concentration of the comparison or test solution, and a linear regression curve was constructed to obtain the following equation:

$$y = bx + a$$

The IC_{50} value as an antioxidant parameter is calculated from the regression equation to find the x value by entering 50 in the y value so that the effective concentration will be known (Binuni, 2020).

Data analysis

The results of the physical evaluation test were analyzed using a descriptive method. The results of the antioxidant activity test were analyzed using the SPSS method, using several tests, such as the normality test using the Kolmogorov-Smirnov test, with the condition that p>0.05. The homogeneity test was performed using the Levene statistic test, with the condition that p>0.05. A one-way ANOVA test was used to prove the hypothesis related to the antioxidant activity of the 95% ethanol extract of breadfruit peel, with the following criteria: H0 is accepted, and Ha is rejected if (p>0.05) there is no significant average difference, H0 is rejected, and Ha is accepted if (p<0.05) there is a significant average difference.

RESULTS AND DISCUSSION

Phytochemical screening results

The results of the phytochemical screening are not in accordance with the research by Wibowo et al. (2017), which states that the 95% ethanol extract of breadfruit peel contains flavonoids, polyphenols, and triterpenoid/steroid compounds. The difference in results was influenced by differences in the location of growth of the breadfruit. According to Katno (2008), differences in the environmental conditions where they grow can cause differences in the types and amounts of secondary metabolites contained in plants that grow in certain areas with other areas. The results of the phytochemical screening of the 95% ethanol extract of Breadfruit peel (*Artocarpus altilis*) are shown in Table 2.

Table 2. Phytochemical Screening Test Results

No.	Phytochemical Test	Result
1.	Alkaloid	+
2.	Flavonoid	+
3.	Saponin	+
4.	Tannin	-
5.	Polyphenol	+
6.	Triterpenoid/Steroid	+

*Exp : (+) Positive
(-) Negative

Based on Table. 2, the secondary compounds obtained in breadfruit peel (*Artocarpus altilis*) are known to have the dominant metabolite content alkaloid, flavonoid, saponin, polyphenol and triterpenoid/steroid.

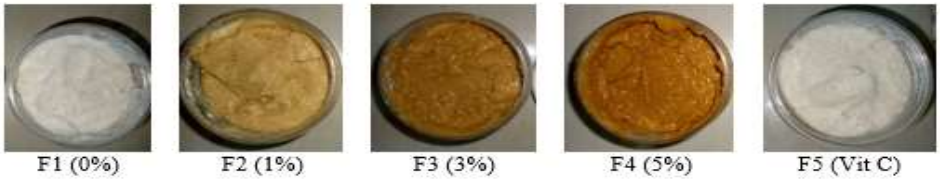

Figure 1. Organoleptic Results of Body Scrub Cream

Table 3. Result of Physical Evaluation of Body Scrub Cream

Parameter	Formula				
	F1	F2	F3	F4	F5
Color	Pure white	Beige	Ochre brown	Clay brown	Pure white
Odor	Typical starch	Typical starch	Typical starch	Typical starch	Typical starch
Texture	Soft	Soft	Soft	Soft	Soft
Homogenity	Homogeneous	Homogeneous	Homogeneous	Homogeneous	Homogeneous
pH	5.03	4.69	5.77	5.25	4.51
Viscosity (cPs)	7296	7444	7705	6701	7103
Spreadability (cm)	5.27	5.48	5.69	5.65	6
Stickiness (s)	5	5	5	6	6

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The organoleptic test results showed that the body scrub cream formulas changed color with increasing extract concentration. As the concentration of the extract given to a preparation increases, it experiences a darker color change, except for the negative and positive control preparations. All formulas had a consistent texture and odor, characterized by a distinctive smell and soft, non-rough texture.

The homogeneity test results showed that the scrub cream preparation had a homogeneous composition, which met the requirements. Body scrub cream preparations must be evenly distributed and homogeneous so as not to cause irritation when applying on the surface of the skin (Azkianti and Lestari, 2022).

The pH test is used to evaluate the safety of the resulting cream; if the pH is too low,, it irritates the skin. Based on SNI 16-4399-1996 that, the pH value of skin cosmetic products is required to range from 4.5-8.0 (SNI, 1996). The pH test results showed that the body scrub cream preparation had a qualified pH, which ranges from 4.5-5.7.

A viscosity test was performed to determine the viscosity of the preparation. Based on SNI8 16-4399-1996 that, the viscosity value of skin cosmetic products is required to range from 2000-50000 cPs (SNI, 1996). The viscosity test results showed that the body scrub cream preparation had a viscosity that still met the requirements, ranging from 6000-7000.

The spreadability test aims to determine the speed at which the cream spreads on the epidermis when applied. The spreadability of the preparation illustrates the ability of the active substance to encounter the skin. The requirement for spreadability for topical preparations is around 5-7 cm (Malik et al., 2020). The results of the spreadability test showed that the body scrub cream preparation had a spreadability that still met the requirements, ranging from 5.2-6 cm.

The stickiness test of the body scrub cream preparation aimed to determine the closeness of the cream to the skin. Good adhesion ability for topical preparations is more than 1 second (Yusuf et al., 2017). Based on the results of the stickiness test, these cream scrub preparations have an adhesion that still meets the requirements, which range from 5 to-6 seconds.

The test was carried out for seven days, with a range of days 1, 3, 5, and 7. The observations were organoleptic tests, pH tests, and viscosity tests. The results of the organoleptic test for room-temperature storage of each cream preparation showed that all preparations had no difference or were declared physically stable (Figure 2).

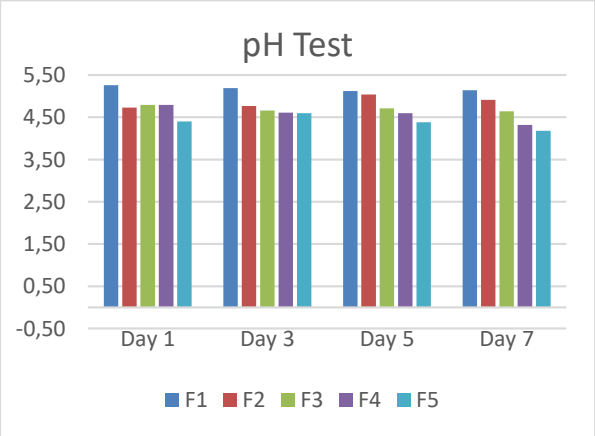

Figure 2. pH test

The results of the room temperature storage pH test showed no difference from the pH values of formulas 1, 2, and 3. These results were stable and satisfied the pH requirements of the skin. Meanwhile, formula 4 was used at the 7th day storage time with a low pH of 4.32. Formula 5, in which vitamin C was added as a positive control, had a low pH value during the room temperature storage test because vitamin C has a high acidity level. The change in the pH is affected by environmental factors like temperature, non-optimal storage and a combination of extracts that are less stable in the preparation due to oxidation (Putra et al., 2014).

The results of the room-temperature storage viscosity test of all formulas showed no significant difference; these results can be declared stable and still meet the requirements (Figure 3).

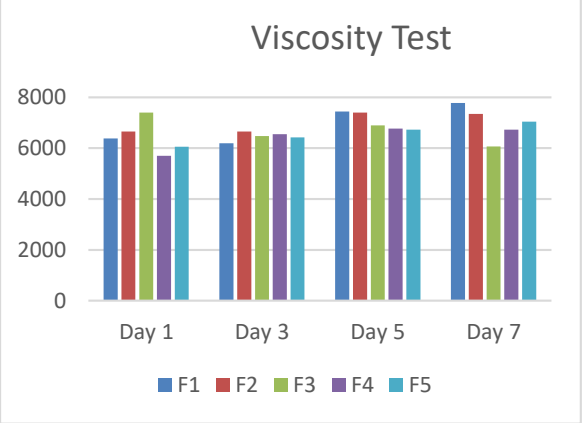

Figure 3. Viscosity Test

Antioxidant activity results

The results of antioxidant activity testing on breadfruit peel extract (*Artocarpus altilis*) obtained an IC_{50} value of 26.3 µg/mL, while vitamin C, which acts as positive control has an IC_{50} value of 9.33 µg/mL.

The results of antioxidant activity testing on each formula obtained IC_{50} values, which are formula 1

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without the addition of extracts is 107.8 µg/mL, formula 2 with 1% extract concentration is 72.48 µg/mL, formula 3 with 3% extract concentration is 56.54 µg/mL, formula 4 with 5% extract concentration is 43.40 µg/mL and formula 4 with the addition of vitamin c as positive control had an IC_{50} value of 38.94 µg/mL.

Based on the results of antioxidant activity, there were differences from the IC_{50} results of breadfruit peel extract (*Artocarpus altilis*) with body scrub cream preparations supplemented with extracts. This difference is because the extract has a small amount (only a few percent) when it is prepared in contrast to the pure extract and when it is prepared, there are already many mixtures of other additional ingredients. This is one of the factors causing the different results of the IC_{50} value of body scrub cream with pure extract (Aljanah et al., 2022).

The results of this study showed that the compounds that have potential as antioxidants are flavonoids and polyphenols. This compound is a phenolic compound that has antioxidant activity so that it can block the process of oxidation caused by free radicals (Kurniawati and Sutoyo, 2021).

Table 4. Antioxidant activity result of breadfruit peel extract

Sampel	Concentration (ppm)	Absorbance			Average Abs	% INHIBITION
		R1	R2	R3		
Breadfuit peel extract	Blanko	0.533	0.533	0.533	0.533	
	5	0.285	0.285	0.284	0.285	46.529
	10	0.278	0.278	0.277	0.278	47.842
	25	0.266	0.266	0.266	0.266	50.094
	50	0.249	0.248	0.248	0.248	53.471
	75	0.230	0.230	0.229	0.23	56.848
	100	0.214	0.215	0.214	0.214	59.850

R1= Replication 1 R2= Replication 2 R3= Replication 3

Y	A	B	R	IC_{50}
50	46,396	0,1369	0,998	26,3

Table 5. Antioxidant activity result of vitamin C

Sampel	Concentration (ppm)	Absorbance			Average Abs	% INHIBITION
		R1	R2	R3		
Vitamin C	Blanko	0.533	0.533	0.533	0.533	
	2	0.322	0.322	0.322	0.322	39.587
	4	0.308	0.308	0.308	0.308	42.214
	6	0.290	0.290	0.290	0.290	45.591
	8	0.278	0.277	0.277	0.277	48.030
	10	0.263	0.263	0.263	0.263	50.657
	12	0.245	0.245	0.245	0.245	54.034

R1= Replication 1 R2= Replication 2 R3= Replication 3

Y	A	B	R	IC_{50}
50	36,681	1,4277	0,999	9,33

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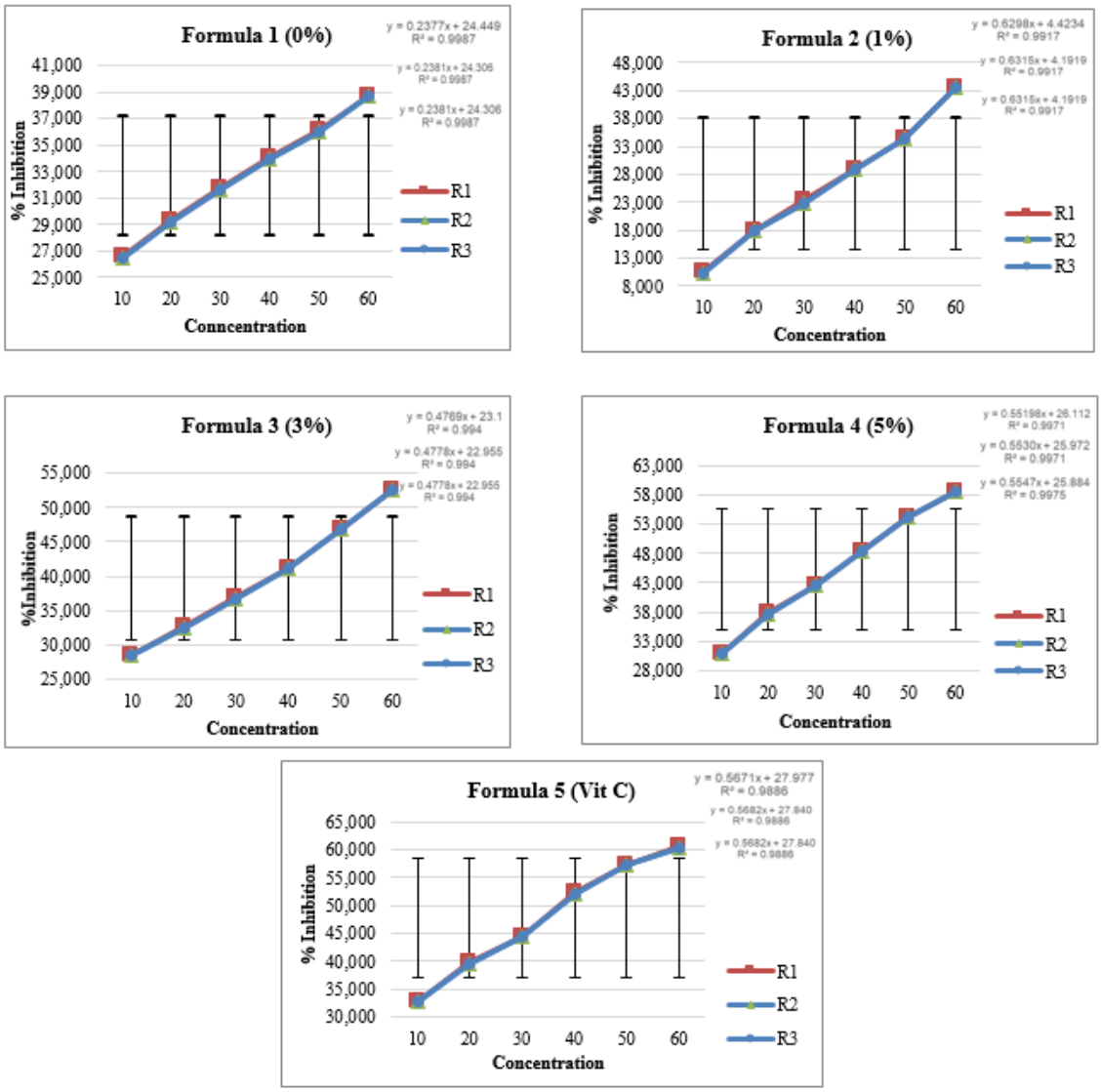

Figure 4. Formulas

Data analysis results

A normality test determines whether the independent and dependent variables are normally distributed (Ghozali, 2018). If the significance value was p>0.05, the data were normally distributed. From this test, the IC_{50} value was 0.073 (p>0.05), indicating that all data were normally distributed. The next analysis was a homogeneity test using Levene's test. A homogeneity test was conducted to determine whether the population variance was the same. If the significance value is p>0.05, it can be concluded that the variance of the data group is homogeneous.

The results of the homogeneity test obtained a p-value or significance of 0.070, indicating that the data were homogeneous because the significance value was p <0.05. Further analysis using the one-way ANOVA method was used to determine whether there was a significant difference in each treatment group. A significance value of 0.000 indicates that there is a significant average difference for each formula because the p-value <0.05, suggesting that H0 is rejected, which means that there is a significant difference in antioxidant activity between each formula.

The next analysis was carried out using post-hoc Tukey honestly significant Difference) to determine the level of difference in the effect of each formula. If the significance is p<0.05, then H0 is rejected, and Ha is accepted, meaning there is a difference in each formula. If the p>0.05, the Ln H0 is accepted, Ha is rejected, meaning there is no difference in each formula. In further analysis with Tukey's HSD, the result of the comparison of each formula shows a significance value of 0.000, which means there is a significant difference from each formula because the p-value is <0.05.

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CONCLUSION

Based on the results of this research, the following conclusions can be drawn: the results of the physical evaluation of the body scrub cream preparation formulation of 95% ethanol extract of breadfruit peel (*Artocarpus altilis*) were good physical evaluation results. Body scrub cream preparation of 95% ethanol extract of breadfruit peel (*Artocarpus altilis*) antioxidant activity with IC_{50} values in each formula are F1 (without extract) 107.8 µg/mL, F2 (1%) 72.48 µg/mL, F3 (3%) 56.54 µg/mL, F4 (5%) 43.40 µg/mL and F5 (Vitamin C K+) 38.94 µg/mL. Based on the observation results, the best formula is Formula 3 because the antioxidant test results are classified as strong, and the physical evaluation test is classified as stable. Compared to formula 4, which has very strong antioxidants, the physical evaluation test results for formula 4 were less stable during the pH test. From the analysis data using one-way Anova, it was concluded that there was a significant difference in antioxidant activity between each formula.

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AUTHOR CONTRIBUTIONS

Conceptualization: A.A., S.M.A.; Methodology: M.S., A.A., S.M.A.; Software, S.M.A., M.Z.; Validation, A.A., M.Z.; Formal Analysis, A.A., S.M.A., M.Z.; Investigation, S.M.A.; Resources, S.M.A.; Data Curration: A.A., M.S., S.M.A.; Writing - Original Draft, M.S., A.A., S.M.A.; Writing - Review and Editing, M.Z.; Visualization, A.A., M.S., S.M.A.; Supervision, M.S.; Project administration, M.S.; Funding Acquisition, M.S., S.M.A., A.A.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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