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Formulation of serum preparation from the peel of variorus durian varieties *(durio zibethinus* murray*)* local, montong and musang king

Formulasi sediaan serum dari kulit buah durian berbagai varietas *(durio zibethinus* murray*)* lokal, montong dan musang king

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ABSTRACT

ABSTRAK

Background: Durian peel (Durio zibethinus Murr.), which is often discarded as agricultural waste, contains bioactive compounds such as flavonoids and tannins that exhibit antibacterial properties, particularly against acne-causing bacteria

Objective: This study aimed to evaluate the physical characteristics and stability of a serum formulation prepared with durian peel extract (*Durio zibethinus* Murr.) at a concentration of 15% and to compare the physical stability among different durian varieties.

Methods: The durian peel extract was obtained using the maceration method with 96% ethanol as the solvent and then formulated into a serum preparation. Physical quality evaluations included tests for color, homogeneity, pH, spreadability, adhesion, and viscosity.

Results: The Musang King variety produced the best formulation, characterized by a yellowish-brown color and homogeneous appearance. The pH remained stable between 4.67 and 6.65 before and after stability testing.

Conclusion: The durian peel extract–based serum demonstrated good physical quality and stable characteristics during storage, suggesting its potential use as a natural active ingredient in cosmetic formulations for acne-prone skin care.

Keywords: *Durian,Serum,Extract,Viscosity*

ABSTRAK

Latar Belakang: Kulit durian (*Durio zibethinus* Murr.) yang sering dibuang sebagai limbah pertanian ternyata mengandung senyawa bioaktif seperti flavonoid dan tanin yang memiliki sifat antibakteri, terutama terhadap bakteri penyebab jerawat.

Tujuan: Penelitian ini bertujuan untuk mengevaluasi karakteristik fisik dan stabilitas dari sediaan serum yang diformulasikan dengan ekstrak kulit durian pada konsentrasi 15%.

Metode: Ekstrak kulit durian diperoleh dengan metode maserasi menggunakan pelarut etanol 96%, kemudian diformulasikan menjadi sediaan serum. Evaluasi mutu fisik meliputi pengujian warna, homogenitas, pH, daya sebar, daya lekat, dan viskositas.

Hasil: Varietas Musang King menghasilkan formulasi terbaik dengan warna kuning kecokelatan dan tampilan yang homogen. Nilai pH tetap stabil pada rentang 4,67 hingga 6,65 sebelum dan sesudah uji stabilitas.

Kesimpulan: Serum berbasis ekstrak kulit durian menunjukkan mutu fisik yang baik dan stabilitas yang memadai selama penyimpanan. Hasil ini menunjukkan bahwa ekstrak kulit durian berpotensi digunakan sebagai bahan aktif alami dalam formulasi kosmetik, khususnya untuk perawatan kulit berjerawat.

Kata kunci: Durian, serum, extrak, viskositas

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Introduction

The skin is the largest organ of the human body. It functions as a protective barrier, helps regulate body temperature, and acts as one of the sensory organs responsible for the sense of touch. Like other tissues, human skin undergoes degenerative and aging processes.[1] Healthy skin is a reflection of overall health, well-being, youthfulness, and vitality. The characteristics of healthy skin include being soft, moist, smooth, supple, and fresh, without acne, with good elasticity, and neither excessively oily nor too dry. Acne is a skin disorder that can cause inflammation and infection, resulting from excessive sebum production by the oil glands.[2.] Acne vulgaris is a common inflammatory skin disorder that predominantly affects adolescents. Acne not only affects skin appearance but also has psychological consequences, including decreased self-esteem, impaired social interaction, and reduced quality of life. Therefore, the development of effective topical treatments with antibacterial, antioxidant, and anti-inflammatory activities is important for acne management.[3]

Skin conditions are strongly influenced by internal biological factors and external environmental exposures, both of which can accelerate inflammation and trigger acne formation.

Serum has become the latest trend in the cosmetic industry. A serum typically contains a high concentration of active ingredients but has low viscosity, allowing it to be formulated as either oil-based or water-based with excellent penetration and absorption capacity. It can be formulated as either oil-based or water-based, with high penetration and absorption abilities, making it an efficient and effective solution for various skin problems.[4] The novelty of this research lies in the development of a serum formulation containing durian peel extract as a natural active ingredient for acne management. Previous studies have mainly focused on evaluating the antibacterial activity of durian peel extract against acne-related bacteria such as *Propionibacterium acnes*, *Staphylococcus aureus*, and *Pseudomonas* species.

Serums are specifically designed to deliver bioactive molecules directly into deeper layers of the skin, enabling active compounds to act more rapidly and with higher efficacy than conventional topical formulations. In this regard, durian peel extract has gained attention as a potential natural active ingredient because previous studies have shown that durian peel possesses antibacterial activity capable of inhibiting the growth of *Propionibacterium acnes*, *Staphylococcus aureus*, and *Pseudomonas* species, making it a promising candidate for incorporation into serum formulations aimed at managing acne and preventing skin infections.[5]

Durian peel contains several key phytochemicals primarily flavonoids, tannins, and phenolic compounds that possess strong antioxidant, anti-inflammatory, and antibacterial activities, making them highly

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suitable for topical application. Flavonoids help neutralize reactive oxygen species on the skin surface, reducing oxidative stress that contributes to acne and premature aging.[6] Tannins, known for their astringent and antimicrobial properties, can inhibit the growth of acne-causing bacteria such as *Propionibacterium acnes*, while also tightening pores and reducing sebum accumulation. Phenolic compounds further enhance skin protection by supporting wound healing and reducing inflammation.[7]

Preliminary surveys have shown that durian peel possesses beneficial properties and activities that can inhibit the growth of acne-causing bacteria. Durian peel contains antibacterial active compounds such as flavonoids (4.01%), saponins (2.61%), and tannins (3.84%). These phytochemical constituents are known to exhibit strong antimicrobial, anti-inflammatory, and antioxidant properties.

Material and Methods

The experimental method is a research approach that involves conducting controlled experiments aimed at determining the effects of specific treatments. In this study, three types of durian peel extracts were used as treatment variables, making the design classified as a true laboratory experimental research with a Completely Randomized Design (CRD). In this study, the independent variable is the concentration of durian peel extract incorporated into the serum formulation, while the dependent variables are its physicochemical properties such as pH, viscosity, stability, and absorption characteristics.

The use of varying concentrations of durian peel (*Durio zibethinus* Murray) ethanol extract in serum formulations is expected to influence both the physical characteristics of the preparation and its antibacterial effectiveness. The stages of this study are as follows:

a. Preparation of Durian Peel Ethanol Extract Serum Formulation.

The extraction process of durian peel using the maceration method with a ratio of 1:10: Weigh 150 g of durian peel powder and add 96% ethanol as the solvent, then macerate the mixture for 3 days. During the maceration process, the mixture is stirred periodically. Maceration is carried out in a tightly closed dark bottle at room temperature. After the maceration process is complete, the solution is filtered, and the obtained filtrate is evaporated using a water bath at 60°C until a thick extract is formed.[8]

b. Physical Quality Evaluation

The physical quality tests performed on the durian peel ethanol extract serum (*Durio zibethinus* Murray) included organoleptic test, homogeneity test, pH test, spreadability test, adhesion test, viscosity test, stability test, irritation test, and hedonic (preference) test.

Research Materials

The main material used in this study was ethanol extract of durian peel (*Durio zibethinus* Murr.) obtained from three varieties: local, Montong, and Musang King. In addition, the serum formulation also used

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xanthan gum as a thickening agent, propylene glycol as a humectant, methyl and propyl paraben as preservatives, and distilled water (*aquadestilata*) as the main solvent.

Research Equipment

The equipment used included mortar and pestle, beaker glass, measuring cylinder, pipette, test tubes and test tube rack, pipette filler/push ball, watch glass, petri dish, funnel, digital balance, pH meter, object glass, scaled glass plate, magnetic stirrer, hot plate, climatic chamber, and Ostwald viscometer.

Simplisia Preparation

Samples of durian peel waste were collected from durian vendors located in Kanyoran Village, Semen District, Kediri Regency. The samples were cleaned and sorted first. The inner part of the durian peel was separated from the spiky outer shell, cut into small pieces, and arranged on trays. The drying process was carried out for approximately one week in a shaded area, protected from direct sunlight.

Extraction of Durian Peel

Durian peel extraction was performed using the maceration method with 96% ethanol at the Herbal Materia Medica Laboratory, Batu, East Java. Simplified durian peel powder from the local, Montong, and Musang King varieties (200 grams each) was used, yielding a thick extract from the local variety weighing approximately 148.5 grams.

Phytochemical Screening

Phytochemical screening of the durian peel extract was conducted based on the method adapted from reference.[9] The purpose of this test was to detect the presence of bioactive compounds, including flavonoids, tannins, and saponins.

Preparation of Serum Formulation

The preparation of the serum formulation was carried out through several stages. All ingredients were weighed according to the composition listed in Table 1. In the initial stage, xanthan gum was dispersed in hot water at a ratio of 1:20 of its weight. The solution was then left to stand for approximately 10 minutes until it formed a serum base, referred to as phase A.

Next, the additional ingredients propylene glycol, methyl paraben, and propyl parabenwere mixed in a separate container and stirred evenly using a magnetic stirrer at a speed of 500 rpm until homogeneous. This mixture was referred to as phase B.

After both phases were prepared, phase A and phase B were combined and homogenized again using the same stirring speed. Once completely mixed, the ethanol extract of durian peel from each variety (Local, Montong, and Musang King), which had been dissolved in distilled water (*aquadest*), was added according to the concentration specified for each formula. The final mixture was then homogenized once more and transferred into sterile containers for serum storage.[10]

Table 1. Formulation of durian peel serum from various varieties (*Durio zibethinus* Murray)

Material	Formula (%B/V)		
	F1	F2	F3
Durian peel extract	15	15	15
Xhantam gum	0,3	0,3	0,3
Propilen glikol	15	15	15
Methyl paraben	0,2	0,2	0,2

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Propil paraben	0,02	0,72	0,02
Aquadest add	100	100	100

Physical Quality Evaluation

Organoleptic Test

Organoleptic evaluation involves the senses of sight and smell to directly assess the physical condition of the preparation. The observation focuses on three main parameters: color, form or consistency, and odor.[11]

Homogeneity Test

The homogeneity test aims to ensure the uniform mixing of components in the serum preparation. About 0.1 grams of the sample is taken and spread thinly on the surface of a glass slide. The preparation is considered homogeneous if no coarse particles or irregular material distribution are observed, and the texture appears evenly distributed to the naked eye.[12]

pH Test

The pH test is performed to evaluate the acidity level of the serum and ensure its compatibility with the physiological pH of the skin. Measurement is carried out using a digital pH meter, with the electrode immersed directly into the sample to ensure optimal contact. The ideal pH range for facial topical preparations is 4.5–6.5 to match the natural skin pH and minimize irritation risks.

Spreadability Test

The spreadability test aims to assess the serum's ability to spread over the skin surface, which affects comfort and active ingredient distribution. Approximately 0.5 grams of the sample is weighed and placed in the center of graph paper, then subjected to incremental weights (10–200 grams) every 1 minute. The spread area is measured after spreading ceases to determine the effectiveness of serum application.[13]

Adhesion Test

The adhesion test measures how long the serum preparation remains attached to a surface. About 0.2 grams of serum is placed between two glass plates and subjected to a 250-gram weight for 5 minutes. The longer the separation time, the stronger the adhesive property of the serum.[14]

Ostwald Viscosity Test

The Ostwald viscometer operates based on the capillary viscometer principle, measuring the time required for a fluid to flow through a capillary tube from the upper to the lower mark. The procedure begins by filling the left tube with the test fluid (lubricant or serum) until half of tube A is filled. The fluid is then drawn through the right tube until it passes tube B and reaches the start line. The fluid is allowed to flow by gravity; when it reaches the start line, the stopwatch is started and stopped when the fluid touches the stop line. According to standards, suitable viscosity for serum formulations ranges from 230–3000 cPs.[15]

Freeze and Thaw Stability Test

The stability test is conducted to evaluate the resistance of the serum preparation to fluctuating extreme temperatures, simulating long-term storage conditions. About 5 grams of serum are weighed and placed in a sealed vial inside a climatic chamber. The stability is

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tested by storing the preparation at 4°C for 24 hours, followed by 40°C for another 24 hours. One cycle consists of these two temperature stages, repeated for six consecutive cycles. After completing all cycles, observations are made for possible phase separation and reevaluation of organoleptic characteristics, homogeneity, and pH before and after testing. This test aims to assess the physical stability and quality of the formulation under extreme temperature changes.[16]

Irritation Test

The irritation test is conducted by applying the sample openly to the inner upper arm area (±5 cm). After 1 hour, the skin is observed for any reactions such as redness, itching, or swelling.[17]

Hedonic (Preference) Test

The hedonic test evaluates parameters such as texture, aroma, and color to determine respondents' preference levels for the three serum formulas made from durian peel extract from different varieties.[18]

Data Analysis Method

Data related to the preparation of serum formulations from durian (Durio zibethinus Murr.) peel extracts of various varieties were analyzed using descriptive methods and statistical tests. The analysis was performed using One Way ANOVA. If the significance value ($p < 0.05$), the test was followed by an LSD test to determine differences between treatments (13). If the data did not meet normality and homogeneity assumptions, the Kruskal-Wallis test was used, and if a significant difference was found, it was followed by the Mann-Whitney test.[19]

Results and Discussion

Results of Durian Peel Extraction

This study includes the formulation and quality testing of serum preparations made from durian peel (*Durio zibethinus* Murr.) of three varieties: local, Montong, and Musang King.

The results obtained are presented as follows:

Table 2. Yield Result

Formula	Weight of Simplisia	Solvent	Yield
F1			11,2 %
F2	200 Gram	Etanol 96%	10,0 %
F3			12.5 %

Source: Research Data 2025

Table 3. Phytochemical Identification

Formula	Result		
	Flavonoid	Tanin	Saponin
F1	(+)	(+)	(-)
F2	(+)	(+)	(-)
F3	(+)	(+)	(-)

Source: Research Data 2025

Based on the table above, it shows that durian peel from various varieties contains flavonoid and tannin compounds, both showing positive results, while the saponin test showed a negative result.

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Table 4. Organoleptic Test

Formula	Test		
	Form	Color	Odor
F1	Liquid	Brown	Characteristic
F2	Liquid	Yellowish brown	Characteristic
F3	Liquid	Yellowish brown	Characteristic

Source: Research Data 2025

The table above shows the organoleptic results for F1, F2, and F3 based on observations of the three formulas. All formulas exhibited a liquid form with the characteristic durian scent. In terms of color, F1 appeared brown, while F2 and F3 showed a yellowish-brown color.

Source: Research Data 2025

Figure 1. Durian Extract Formulas (F1, F2, and F3)

Table 5. Homogeneity Test

Formula	Examination	
	Form	Description
F1	Homogeneous	Meets the requirements
F2		
F3		

Source: Research Data 2025

Based on the table above, the results of the homogeneity test for formulas F1, F2, and F3 show that all preparations are homogeneous, with evenly mixed components and no coarse particles, in accordance with the homogeneity test criteria.[20]

Table 6. pH Test

Formula	Avarage	Standard	Description
F1	7,07 ± 0,26		
F2	7,05 ± 0,18	5-7	Meets the requirements
F3	6,83 ± 0,16		

Source: Research Data 2025

From the table above, it can be seen that the pH test results for F1, F2, and F3 meet the pH test requirements.[21]

Based on the data in the table above, the results of the spreadability test on the serum preparations show that formulas F1, F2, and F3 have spreadability values ranging from 5–7 cm. These values are in accordance with the standard parameters for topical preparations, which state that a good preparation should have sufficient spreadability to facilitate application and ensure even distribution of active ingredients on the skin surface.[22]

Discussion

This study aims to evaluate the characteristics of durian peel extract from three varieties local, Montong, and Musang Kingas well as the quality of the resulting serum formulations. The yield test showed variations among the three formulas, namely 11.2% for F1, 10.0% for F2, and 12.5% for F3. These differences in yield are likely influenced by variations in secondary metabolite content

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across durian varieties, the ripeness level of the fruit, and the physical structure of the raw material. This finding is consistent with previous research reporting that different durian varieties possess varying levels of bioactive compounds, particularly flavonoids and total phenolics, which may affect extraction yield (Rahman et al., 2020).[23]

The phytochemical screening in this study showed that all three formulas (F1, F2, and F3) tested positive for flavonoids and tannins but negative for saponins. The presence of flavonoids and tannins in durian peel has been reported in previous studies as the main components contributing to strong antioxidant, anti-inflammatory, and antibacterial activities.[24] Flavonoids act through free-radical scavenging and modulation of inflammatory signaling, while tannins exhibit astringent and antimicrobial properties, making them particularly useful in cosmetic applications such as anti-acne and antioxidant serums. The results of this study align with these findings, as all three varieties demonstrated consistent phytochemical profiles.

Previous studies have also reported that durian peel extract exhibits antibacterial activity against *Propionibacterium acnes*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*, making it highly relevant for cosmetic applications, particularly for acne-prone skin.[22] Therefore, the phytochemical findings in this study further support the potential of durian peel as an active ingredient for herbal serum formulations.

The organoleptic evaluation showed that all formulas exhibited a liquid consistency with the characteristic durian aroma. The color differences observed among formulas were influenced by the composition of flavonoids, the degree of oxidation of phytochemical components, and the extraction process. This result is in agreement with Adawiyah et al. (2020)who reported that plant extracts rich in phenolic compounds tend to produce brown to yellowish-brown coloration due to oxidation.[25]

In the homogeneity test, all formulas demonstrated uniform consistency with no coarse particles, meeting the criteria for topical preparations. Homogeneity is an essential parameter, as inhomogeneous products may affect stability and the distribution of active compounds on the skin.

The pH test results showed that the three formulas had pH values ranging from 6.83 to 7.07, which fall within the acceptable skin pH range (5–7). This parameter is important for maintaining skin barrier integrity and preventing irritation.

The spreadability test results showed that all serum formulations had spreadability values of 5–7 cm, which meet the standard criteria for topical preparations. Good spreadability enhances ease of application, user comfort, and effective penetration of active compounds. This finding is consistent with Puspitasari et al. (2020), who stated that the ideal spreadability range for serum and gel preparations is between 5–7 cm to ensure uniform application on the skin surface.[26]

Overall, the results of this study demonstrate that durian peel extract from the three varieties can be formulated into serums that meet physical quality parameters (organoleptic properties, homogeneity, pH, and spreadability) and contain phytochemicals with potential antioxidant and antibacterial effects. Supported by previous studies reporting the ability of durian peel extract to inhibit acne-causing bacteria and oxidative stress, durian peel–based serum has strong potential to be developed into an effective herbal cosmetic product.

CONCLUSION

a. Serum formulations made from various durian peel varieties (local, montong, and musang king) showed different organoleptic colors, which influenced the pH parameter. The stability test showed no observable changes, indicating that the serums were stable. The hedonic (preference) test showed that Formula 3 was the most preferred. None of the formulations caused irritation in most respondents.

b. The Freeze and Thaw stability test results confirmed that all durian peel serums were physically stable.

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