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Exploring the Potential of Betung Bamboo Charcoal (Dendrocalamus Asper) as a Mask for Acne-Prone Facial Skin Care

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ABSTRACT

Acne is a common dermatological condition that negatively impacts facial appearance and self-confidence, often hindering daily activities. Bamboo charcoal derived from Dendrocalamus asper (Betung bamboo) is known to contain activated carbon, which has the ability to adsorb impurities and cleanse clogged pores, potentially reducing blackheads and acne. This study aimed to evaluate the potential of Betung bamboo charcoal as a facial mask through laboratory tests (pH, antioxidant, and antimicrobial activity), organoleptic assessments (texture, aroma, and adhesion), and hedonic tests (user preferences). A quantitative experimental approach was employed in this research. The findings revealed that the mask preparation had a pH value of 8.4, an antioxidant activity of 0.491%, and no antimicrobial activity against Staphylococcus aureus. Organoleptic evaluation showed that 71% of panelists rated the mask texture as very smooth, 86% identified the aroma as a distinctive bamboo charcoal scent, and 57% considered the mask's adhesive properties acceptable. In the hedonic test, 57% of panelists expressed overall satisfaction with the mask formulation. These results highlight the potential of Betung bamboo charcoal masks as a natural alternative for skin care, particularly for individuals with acne-prone skin. However, further improvements in antimicrobial efficacy are recommended to enhance its functional benefits.

Keywords: *acne treatment, bamboo charcoal, dendrocalamus asper, powder mask.*

INTRODUCTION

The facial skin is a prominent part of the human body, being the first to catch the eye. Therefore, it requires meticulous care to maintain its health and cleanliness, which significantly influences one's aesthetic appearance. The skin serves as a protective barrier against environmental pollution, particularly the facial skin, which is frequently exposed to ultraviolet (UV) radiation. This exposure can lead to various skin issues, including wrinkles, aging, acne, and enlarged pores, highlighting the importance of proper skincare (Sulastri & Chaerunisaa, 2018). Among these concerns, acne is a recurring issue. According to Veronica et al. (2020), acne can significantly affect an individual's self-confidence, with 30–50% of people suffering from acne reporting decreased confidence due to its impact on their appearance and daily activities. Acne often became a problem and reduce the confidence of the sufferer. Acne vulgaris is common in 13-19 years old adolescents and nearly 85% of 12 to 25 years old had experienced acne in varying degrees, there are several risk factors can lead to acne, they are genetic, hormonal, food, cosmetics, psychical stress, and other

(Minerva *et al*., 2019). Acne is a condition where the skin is in an abnormal condition characterized by inflamed skin and infection of the human oil glands. Common causes of acne growth on human skin are hormonal changes, genetics, the menstrual cycle, stress, hyperactive sebaceous gland activity, cleanliness, food, and the use of cosmetics that can stimulate the oil glands in the skin. Acne is caused by blockage of skin pores so that oil secretion becomes obstructed and then enlarges and dries up into pimples (Mardhiyah & Rosalina, 2023).

Facial masks are a cosmetic preparation widely used for skincare, offering benefits such as moisturizing, improving texture, rejuvenating, tightening, nourishing, softening the skin, unclogging pores, brightening skin tone, relaxing facial muscles, and aiding in the healing process (Kartikasari & Anggraini, 2015). Among various types of facial masks available powder masks, cream masks, gel masks, and sheet masks powder masks are particularly popular (Rohmah & Maspiyah, 2013). Masks are treatments intended to lighten the skin's tone and treat the skin with the ingredients contained in cosmetic, for facial/facial skin care which has the benefits of providing moisture, stimulating skin cells, removing dirt and horn cells (Amalia *et al*., 2018).

Betung bamboo (*Dendrocalamus asper*) charcoal has garnered attention as a promising ingredient in skincare due to its exceptional ability to absorb impurities and excess oil from the skin (Dwivedi et al., 2014). Bamboo charcoal is produced through the carbonization of bamboo under high temperatures, resulting in activated carbon capable of removing dirt, toxins, and harmful substances from the skin, promoting healthier skin and serving as an effective natural acne remedy. Additionally, bamboo charcoal is rich in minerals such as calcium, magnesium, acetic acid, and hydroxybenzene, which can inhibit bacterial growth and provide sterilization and antiseptic functions (Dwivedi et al., 2014). This study aims to explore the potential of Betung bamboo charcoal as a facial mask for acne-prone skin by evaluating its laboratory properties (pH, antioxidant activity, and antimicrobial activity), organoleptic characteristics (texture, aroma, adhesion), and hedonic attributes (panelist preferences).

THEORETICAL FRAMEWORK

Betung bamboo (*Dendrocalamus asper*) is rich in polyphenolic compounds, which are known for their potent antioxidant properties, beneficial for skin health and beauty. Activated carbon derived from bamboo charcoal is effective in acne treatment due to its ability to absorb excess oil, dirt, dust, and toxins from the skin, thus improving skin health (Dwivedi et al., 2013). The charcoal obtained from Betung bamboo, referred to as activated bamboo charcoal, is a solid product resulting from high-temperature carbonization (Sujarwanta & Zen, 2020). This type of charcoal contains calcium, magnesium, and other minerals that provide antimicrobial and antiseptic effects. For this study, Betung bamboo sourced from Lubuk Minturun, Koto Tangah District, Padang City, West Sumatra, was processed into fine charcoal powder for further analysis.

RESEARCH METHODOLOGY

This study employed a quantitative experimental approach to investigate the potential of Betung bamboo charcoal as a facial mask for acne treatment. The research was conducted at the Pharmacy Laboratory of Universitas Perintis Indonesia from October 17 to November 23, 2024.

Mask Preparation:

Fresh Betung bamboo was cleaned, cut, and carbonized into charcoal. The resulting charcoal was ground into fine powder and sieved. For the mask formulation, 10 g of bamboo charcoal powder was mixed with 90 g of starch base and 200 mL of methanol solvent. The mixture was stirred until homogenous, resulting in a powder mask preparation.

Equipment:

The equipment used included scales, containers, a blender, sieves, bamboo saws, a carbonization drum, mortar and pestle, spatula, beaker glass, measuring glass, volumetric flask, pipettes, a magnetic stirrer, and aluminum foil.

Data Collection:

Data were collected through observation, documentation, and observational sheets. The research included:

1. Laboratory tests to evaluate pH, antioxidant activity, and antimicrobial activity.
2. Organoleptic testing for texture, aroma, and adhesive properties.
3. Hedonic testing to assess panelist preferences.

RESULTS AND DISCUSSION

1. Preparation of Betung Bamboo Charcoal Mask

Before conducting laboratory, organoleptic, and hedonic tests, Betung bamboo (*Dendrocalamus asper*) was processed into a fine charcoal powder to be used in the mask formulation. Fresh bamboo was cleaned, cut into pieces, and carbonized to produce charcoal. The charcoal was then ground and sieved to obtain fine powder. For the mask preparation, 10 g of bamboo charcoal powder was mixed with 90 g of amylum as a base and 200 mL of methanol solvent. The mixture was stirred until homogeneous to create the Betung bamboo charcoal powder mask.

2. Laboratory Test Results

The laboratory tests aimed to evaluate the pH level, antioxidant content, and antimicrobial properties of the Betung bamboo charcoal mask. The findings are detailed below:

a. **pH Test**

The pH of the Betung bamboo charcoal mask was measured using a pH meter to determine its suitability for acne-prone skin.

Table 1. Results of pH Test on Betung Bamboo Charcoal Mask

pH Range	pH Test Result
4–8	8.4

Based on the data in Table 1, the pH of the Betung bamboo charcoal mask was found to be 8.4, indicating a relatively alkaline nature. While slightly higher pH levels can help with deep cleansing, adjustments may be required to optimize the formulation for sensitive or acne-prone skin.

b. **Antioxidant Test**

The antioxidant capacity of the Betung bamboo charcoal mask was analyzed using a UV-Vis spectrophotometer.

Table 2. Antioxidant Test Results of Betung Bamboo Charcoal Mask

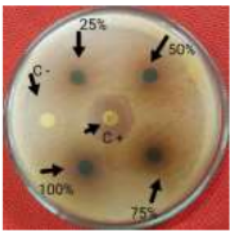
No	Parameter	Analysis Result	Method
1	Antioxidant Concentration	673.96 ppm (0.491%)	UV-Vis Spectrophotometer

Table 2 shows that the antioxidant concentration of the Betung bamboo charcoal mask was 0.491%, which corresponds to 673.96 ppm. This result indicates that the mask contains a notable level of antioxidants, which can help combat free radicals and support skin repair

c. **Antimicrobial Test**

The antimicrobial test was conducted to evaluate the activity of the Betung bamboo charcoal mask against *Staphylococcus aureus*. The test utilized the disc diffusion method with varying concentrations of the mask preparation (25%, 50%, 75%, and 100%), alongside positive and negative controls.

Table 3. Antimicrobial Test Results of Betung Bamboo Charcoal Mask

No.	Parameter	Test Results	Method
1	Antimicrobial		Disc Diffusion

The results revealed that the mask preparation did not exhibit antimicrobial activity against *Staphylococcus aureus*. While the zone of inhibition was smallest at a 25% concentration, the widest inhibition zone was observed at 100% concentration. These findings suggest a trend where higher concentrations of the mask formulation exhibit greater inhibitory effects on microbial growth. However, as indicated in the table, the 100% concentration of the Betung bamboo

charcoal mask preparation demonstrated the most effective antimicrobial activity compared to lower concentrations, though the activity remained insufficient against *Staphylococcus aureus* in this study. Further formulation adjustments or additional active ingredients may be necessary to enhance the antimicrobial properties of the mask.

3. **Results of Organoleptic and Hedonic Tests of Betung Bamboo Charcoal Mask**

The organoleptic and hedonic tests were conducted based on evaluations from a panel of seven individuals. The panel consisted of two lecturers from the Department of Cosmetology and Beauty, one clinical beauty doctor from Dria Beauty Skin Padang, one therapist from Dria Beauty Skin Padang, and three students from the 2020 batch of the Cosmetology and Beauty program at FPP UNP. The results are as follows:

a. Results of the Organoleptic Test on Texture

Table 4. Organoleptic Test Results for Texture

No.	Score	Category	Frequency	Calculation	Percentage (%)
1	1	Very not smooth	0	(0/7) × 100	0%
2	2	Not smooth	0	(0/7) × 100	0%
3	3	Smooth	2	(2/7) × 100	29%
4	4	Very smooth	5	(5/7) × 100	71%

The table above indicates that 29% of the panelists rated the texture of the Betung bamboo charcoal mask as smooth, while 71% rated it as very smooth. These results suggest that the mask preparation has a desirable texture for cosmetic applications, with most panelists favoring the "very smooth" texture. This characteristic is beneficial for enhancing user satisfaction and product acceptance in future formulations or commercial production.

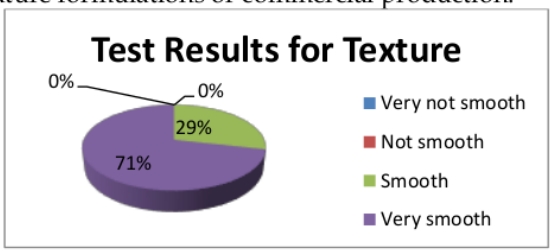


Figure 1. Result of the Texture Organoleptic Test

b. Results of the Organoleptic Test on Aroma

Table 5. Organoleptic Test Results for Aroma

No.	Score	Category	Frequency	Calculation	Percentage (%)
1	1	No aroma	1	(1/7) × 100	14%
2	2	Less aromatic	0	(0/7) × 100	0%

No.	Score	Category	Frequency	Calculation	Percentage (%)
3	3	Aromatic	6	(6/7) × 100	86%
4	4	Very aromatic	0	(0/7) × 100	0%

From the table above, it can be seen that 14% of the panelists stated that the aroma of the Betung bamboo charcoal mask was odorless, while 86% indicated that the mask had a distinct and aromatic scent typical of bamboo charcoal. These results suggest that the product's aroma predominantly carries a unique characteristic of bamboo charcoal, which may appeal to users who prefer natural and distinctive scents. However, the lack of "very aromatic" ratings might indicate a need for further optimization in the formulation to achieve a more balanced and universally appealing fragrance.

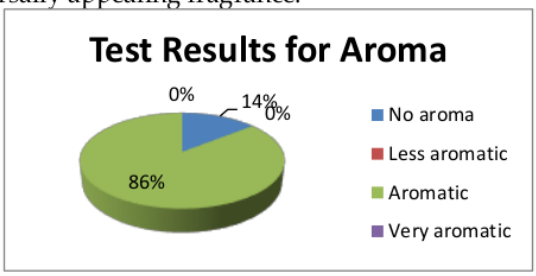


Figure 2. Result of the Aroma Organoleptic Test

c. Results of the Organoleptic Test on Adhesion

Table 6. Organoleptic Test Results for Adhesion

No.	Score	Category	Frequency	Calculation	Percentage (%)
1	1	Not adhesive	0	(0/7) × 100	0%
2	2	Less adhesive	0	(0/7) × 100	0%
3	3	Adhesive	4	(4/7) × 100	57%
4	4	Very adhesive	3	(3/7) × 100	43%

Based on the table above, 57% of the panelists stated that the adhesion of the Betung bamboo charcoal mask was adhesive, while 43% of the panelists found it to be very adhesive.

These findings indicate that the mask demonstrates a good level of adhesion, which is essential for ensuring the mask stays in place during application. The relatively high percentage of "very adhesive" responses further suggests its suitability for effective usage, although slight adjustments might enhance consistency across user experiences.

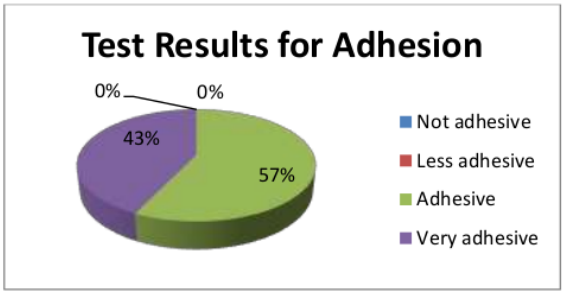


Figure 3. Result of the Adhesion Organoleptic Test

d. Results of Hedonic Test (Panelist Preference)

Table 7. Hedonic Test Results

No.	Score	Category	Frequency	Calculation	Percentage (%)
1	1	Dislike	0	(0/7) × 100	0%
2	2	Less like	0	(0/7) × 100	0%
3	3	Like	4	(4/7) × 100	57%
4	4	Strongly like	3	(3/7) × 100	43%

Based on the table above, 57% of the panelists indicated they liked the Betung bamboo charcoal mask, while 43% stated they strongly liked it. These results demonstrate a high level of panelist satisfaction with the mask, with no negative feedback regarding preference. This suggests the product is well-received in terms of its sensory and functional qualities, aligning with user expectations. Further product refinement may increase the proportion of "strongly like" responses.

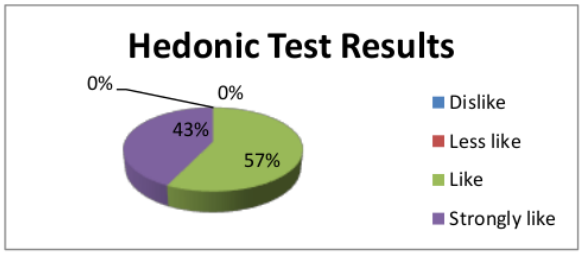


Figure 4. Hedonic Test Result

4. **Discussion of Research Results**

The laboratory tests conducted at the Pharmaceutical Laboratory of the Universitas Perintis Indonesia showed that the pH of the bamboo charcoal mask was higher than the recommended range for facial skin, which is between 4-8 (Komala et al., 2018). The pH of the bamboo charcoal mask, measured using a pH meter, was found to be 8.4, which is considered alkaline. This higher pH can be beneficial for maintaining the skin's pH balance, but it should be used cautiously on sensitive skin.

Furthermore, the antioxidant content of the bamboo charcoal mask was found to be 0.491%. Antioxidants play a crucial role in defending the body against free radicals that can damage skin cells, leading to premature aging and other skin problems (Khairunnisa, 2017). This antioxidant content provides potential benefits for skin care, particularly in combating the harmful effects of environmental exposure. However, in the antimicrobial activity test, the bamboo charcoal mask did not show any activity against *Staphylococcus aureus*. This indicates that although the mask has some benefits, such as its antioxidant content, it is not effective as an antimicrobial agent against this bacterium. Further research with the addition of active antimicrobial ingredients may be needed to enhance the mask's ability to fight acne-causing bacteria or other skin infections.

Based on the results of the organoleptic and hedonic tests conducted by seven panelists, the bamboo charcoal mask received the highest ratings in several areas. 71% of the panelists rated the texture of the mask as very smooth, indicating comfort during use. 86% of the panelists found the aroma to be very characteristic of bamboo charcoal, providing a strong sensory experience. The mask also had a good adhesive quality, with 57% of the panelists stating that it adhered well to the skin. Finally, the hedonic test showed that 57% of the panelists liked the bamboo charcoal mask, while 43% strongly liked it, indicating positive acceptance of the product.

CONCLUSION AND RECOMMENDATIONS

Based on the results of the study, it can be concluded that the bamboo charcoal mask has a pH of 8.4, which is alkaline, and an antioxidant content of 0.491%. Although the mask showed no antimicrobial activity against *Staphylococcus aureus*, the organoleptic and hedonic tests indicated positive results, with a very smooth texture, a characteristic bamboo charcoal aroma, good adhesive quality, and a high level of panelist preference.

For future research, it is recommended to add other active ingredients that can enhance the function and benefits of the bamboo charcoal mask, especially in terms of antimicrobial activity and skin hydration. Adding ingredients such as essential oils or plant extracts with antimicrobial properties could improve the effectiveness of the product.

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