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Utilization of Banana Leaf Fiber as a Material for Making False Eyelashes

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Abstract. *False eyelashes are essential tools used to enhance the appearance of the eyes in makeup application. However, most variants of false eyelashes currently available on the market are made from human hair and synthetic materials, which do not guarantee halal quality for Muslim consumers. This study aims to develop a new variant of false eyelashes made from halal-certified natural fibers. The false eyelashes are produced using natural fibers derived from the leaf sheaths of Musa paradisiaca (kepok banana), Musa textilis (abaca banana), and Musa sapientum (ambon banana), which are mechanically processed and crafted using a hanging netting technique, with designs adjusted to fit the shape of the eyes. Based on laboratory tests for tensile strength and modulus of elasticity, abaca banana fibers achieved the highest values at 72.49 g/tex and 1.85 g/tex, respectively. For fiber smoothness testing, kepok banana fibers scored the highest at 10.44 g/tex. In organoleptic tests, abaca banana fibers received the highest score for curliness at 66.7%; for lightness, both kepok and abaca banana fibers shared the highest score at 44.4%; and for neatness, kepok and abaca banana fibers again shared the highest score at 66.7%. In hedonic preference tests, kepok banana fibers scored 44.4%, abaca 50%, and ambon 60%. It can be concluded that false eyelashes made from the leaf sheath fibers of kepok, abaca, and ambon bananas are considered visually suitable for use in makeup based on organoleptic and hedonic evaluations. The results of this study contribute to the development of new variants of halal-certified false eyelashes in the cosmetic industry.*
Keywords: *utilization; banana pseudostem fiber; false eyelashes; makeup.*

Type of the Paper: Regular Article.

1. Introduction

The beauty industry has experienced rapid growth in line with the development of the makeup and cosmetics field [1]. The world of beauty and makeup is closely associated with women, playing a meaningful role in their lives, especially for those whose activities involve appearance enhancement, such as dancers performing on stage who require false eyelashes to support their overall look. Beauty has become an essential aspect of women's lifestyles, as it significantly influences their appearance and boosts self-confidence [2].

Facial makeup is the art of enhancing facial features by highlighting attractive areas and concealing imperfections with cosmetics [3]. Among facial features, the eyes are a focal point, as

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they convey emotions and support non-verbal communication. Eye makeup, including the use of false eyelashes, can modify the eye's appearance to make it look larger, more expressive, and attractive [4–5].

Different types of makeup exist, ranging from basic to fantasy makeup, with the latter emphasizing creativity and transformation [6]. False eyelashes play an essential role in complementing eye shape. Commercial products are available in various models, such as thick, round, or fashion/fantasy lashes, and ideally should be lightweight, curly, and comfortable [7–8]. However, most false eyelashes on the market are made from synthetic fibers, human hair, or animal hair [9–10]. Synthetic materials are non-biodegradable and raise environmental concerns, while animal-based sources may present halal-related issues for Muslim consumers.

This study addresses the need for alternative raw materials that are sustainable, environmentally friendly, and socially acceptable. Plant-based natural fibers offer promising properties, including light weight, abundance, affordability, and biodegradability [11–13]. Indonesia has rich biodiversity, particularly in banana species such as kepok (Musa paradisiaca), abaca (Musa textilis), and ambon (Musa sapientum) which hold significant potential as a source of high-quality fibers [13–14].

The novelty of this research lies in the utilization of banana pseudostem fibers for the production of false eyelashes. While banana fibers have been widely studied for applications in textiles, paper, and composites [15–20], their use in cosmetic products, especially decorative beauty items such as false eyelashes, remains largely unexplored [21–26]. Therefore, this study proposes bio-based, biodegradable false eyelashes that not only support environmental sustainability but also align with cultural and religious values.

Previous studies highlight the gap that this research aims to fill; they analyzed eco-friendly fibers for wearable cosmetic applications. However, the studies did not specifically explore banana pseudostems [27]. This research demonstrates the potential of lignocellulosic fibers in biocomposites, indicating value for the cosmetic sector [28]. The development of natural fibers has primarily focused on fashion and textiles, without addressing decorative cosmetics [29]. Recent innovations in green cosmetic ingredients further reinforce the urgency for bio-based, ethical materials, particularly for environmentally conscious consumers [30–35].

The purpose of this study is to develop and analyze false eyelashes made from natural banana pseudostem fibers as an alternative to synthetic materials by evaluating their physical characteristics and potential as environmentally friendly cosmetic products.

2. Materials and Methods

This research employed an experimental design. It is a trial-based study aimed at assessing the feasibility of false eyelashes made from the pseudostem fibers of kepok, abaca, and ambon

banana plants. The object of this research is false eyelashes made from the pseudostem fibers of kepok, abaca, and ambon bananas. The variables in this study are: X1: False Eyelashes from Kepok Banana Pseudostem Fiber, X2: False Eyelashes from Abaca Banana Pseudostem Fiber, and X3: False Eyelashes from Ambon Banana Pseudostem Fiber. The procedure of this research begins with manual (biological) fiber extraction. Data collection techniques include observation, interviews, and questionnaires. The research indicators consist of laboratory tests (tensile strength, modulus of elasticity, and fiber smoothness), organoleptic tests (curliness, lightness, and neatness), and hedonic tests (panelist preference and aesthetic value). In the data analysis, descriptive analysis and analytical methods were used. The primary data is obtained directly from the research subjects.

2.1. Steps in the Production of False Eyelashes from Kepok, Abaca, and Ambon Banana Pseudostem Fibers for Makeup Applications

In this process, the researcher manually (biologically) extracted fibers from the pseudostems of kepok, abaca, and ambon banana plants. Once the fibers were obtained, a coloring process was carried out using natural dyes. Finally, the false eyelashes were produced from the fibers of the kepok, abaca, and ambon banana pseudostems. The tools, materials, and production process of the false eyelashes are as follows:

2.1.1. Equipment Preparation

The tools used for making false eyelashes from the pseudostem fibers of kepok, abaca, and ambon banana plants for makeup purposes include: a knife, round stone mortar, hanger, wooden cutting board, scale, eyelash-making tool, eyelash box, eyelash scissors, iron, spoon, and wire brush.

2.1.2. Preparation of Materials

The materials used in the process of making false eyelashes from banana stem fibers, abaca, and ambon bananas for make-up consist of: banana stem fibers, abaca, and ambon bananas, water, eyelash glue, glitter eyeshadow, diamonds, natural dyes, string, toni paper.

2.1.3. Implementation Stage

The implementation stages in the production of false eyelashes from banana stem fibers, abaca, and ambon for cosmetic use include the following: preparing the banana stem fibers, abaca, and ambon; weighing 300 grams of each material; separating the stem fibers individually; grinding the banana stem fibers, abaca, and ambon using a round stone mortar; scraping the fibers with a wire brush until they are fully separated; further scraping the banana stem fibers, abaca, and ambon with a spoon; washing the obtained fibers with water; and drying the fibers under direct sunlight for one day. Upon completion of these stages, the resulting banana stem fibers, abaca, and ambon will be as illustrated in Fig. 1.

Kepok Banana Stem Fiber | Abaca Banana Stem Fiber | Ambon Banana Stem Fiber

Fig. 1. Results of Kepok, Abaca, and Ambon Banana Stem Fibers

2.1.4. Fiber Dyeing Process and Making False Eyelashes from Kepok, Abaca, and Ambon Banana Stem Fibers

The implementation stages in the production of false eyelashes from banana stem fibers, abaca, and ambon for cosmetic use are as follows: 1) Preparing 2 grams each of banana stem fibers, abaca, and ambon; 2) Coloring the banana stem fibers, abaca, and ambon using a natural black dye for 2 hours; 3) Washing the colored fibers with running water and drying them; 4) Tying the banana stem fibers, abaca, and ambon using an eyelash maker; 5) Ironing the fibers coated with toni paper to ensure they remain straight and neat; 6) Applying false eyelash glue to the fiber knot line to strengthen the knot and prevent breakage; 7) Rolling the fibers coated with toni paper using a rolling tube; 8) Ironing the rolled fibers coated with toni paper to enhance flexibility; 9) Cutting and shaping the knotted fibers of banana stem, abaca, and ambon according to the desired design; 10) Decorating the eyelashes with glitter and diamonds; 11) Presenting the final results of the false eyelashes made from banana stem fibers of kepok, abaca, and ambon.

3. Results and Discussion

3.1. Laboratory Test of Feasibility Data of False Eyelashes from Kepok, Abaca, and Ambon Banana Stem Fibers

Table 1 illustrates the descriptive results of the laboratory test assessing the feasibility of false eyelashes made from the pseudostem fibers of kepok banana (X1), abaca banana (X2), and ambon banana (X3), based on the indicators of Tensile Strength, Young's Modulus, and Fiber Fineness [25]. Previous studies have shown that natural fibers such as pineapple leaves possess good elasticity and strength, as well as smooth and soft textures, making them suitable for cosmetic applications [35]. Similarly, the findings in this study indicate that banana pseudostem fibers also exhibit promising mechanical and textural properties, with abaca showing superior strength and stiffness, while kepok demonstrates greater flexibility and smoothness, thus supporting their potential as alternative raw materials for false eyelashes.

The mean value for the Tensile Strength indicator of false eyelashes made from kepok banana pseudostem fibers (X1) was 55.78, with a standard deviation of 7.4977351 and a coefficient of variation (CV) of 0.13%. For abaca banana pseudostem fibers (X2), the mean was also 55.78,

with a standard deviation of 8.1408200 and a CV of 0.18%. In contrast, the false eyelashes made from ambon banana pseudostem fibers (X3) had a mean of 44.94, a standard deviation of 6.6697147, and a CV of 0.15% [25]. These findings are comparable to those of pineapple leaf fiber, which has demonstrated high suitability as an eyelash material in a similar test [35].

Table 1. Results of Laboratory Test

Assessment Indicator	Variable	Average (g/tex)	Standard Deviation (S)	Coefficient of Variation (CV) %
Tensile Strength	X1 (Kepok)	55.78	7.4977351	0.13
	X2 (Abaca)	72.49	8.1408200	0.18
	X3 (Ambon)	44.94	6.6697147	0.15
Young Modulus	X1 (Kepok)	1.52	0.2120124	0.14
	X2 (Abaca)	1.85	0.240755	0.17
	X3 (Ambon)	1.72	0.1966122	0.11
Fiber Fineness	X1 (Kepok)	10.44	1.400915574	13.42
	X2 (Abaca)	1.70	0.287864	0.16
	X3 (Ambon)	**8.66**	**0.752737227**	**8.69**

Description: False Eyelashes made from Kepok Banana Stem Fiber (X1), False Eyelashes Made from Abaca Banana Stem Fiber (X2), and False Eyelashes Made from Ambon Banana Stem Fiber (X3).

Regarding the Young's Modulus indicator, the false eyelashes made from kepok banana fibers (X1) showed a mean of 1.52, a standard deviation of 0.2120124, and a CV of 0.14%. The abaca banana fibers (X2) had a mean of 1.55, a standard deviation of 0.240755, and a CV of 0.17%. Meanwhile, the ambon banana fibers (X3) produced a mean of 1.72, with a standard deviation of 0.752737227, and a CV of 0.11%. Previous research also showed that natural fibers such as pineapple leaves have good elasticity and strength, making them suitable for cosmetic applications [35].

Based on the Fiber Fineness indicator, false eyelashes made from Kepok banana fiber (X1) had a mean value of 10.44, a standard deviation of 1.400915574, and a CV of 13.42%. For Abaca banana fiber (X2), the mean was 9.55, with a standard deviation of 0.287864 and a CV of 0.16%. Ambon banana fiber (X3) recorded a mean of 8.66, a standard deviation of 0.1966122, and a CV of 8.69%. The smooth texture is also consistent with the findings of pineapple leaf fiber, which is reported to have smooth and soft characteristics suitable for eyelashes [35].

3.2. Organoleptic Test of the Suitability of False Eyelashes from Kepok, Abaca, and Ambon Banana Stem Fibers

Table 2 describes the descriptive results of the organoleptic test evaluating the feasibility of false eyelashes made from the pseudostem fibers of kepok banana (X1), abaca banana (X2), and ambon banana (X3), based on the indicators of Curliness (%), Lightness (%), and Neatness (%).

The average score for the Curliness indicator of false eyelashes made from kepok banana pseudostem fibers (X1) was 55.5%. The eyelashes made from abaca banana fibers (X2) had a higher average of 66.7%, while those made from ambon banana fibers (X3) had an average score of 60.0%. It can be concluded that in terms of curliness, the false eyelashes made from abaca

banana fibers (X2) achieved the highest score, indicating that abaca fibers produce false eyelashes with better curliness compared to those made from kepok and ambon banana fibers.

Table 2. Organoleptic Test of the Suitability of False Eyelashes

Assessment Indicator	Variable	Average value (%)
Curl (%)	X1	55.5
	X2	66.7
	X3	60.0
Lightness (%)	X1	44.4
	X2	44.4
	X3	40.0
Neatness (%)	X1	66.7
	X2	66.7
	X3	40.0

Description: False Eyelashes Made from Kepok Banana Stem Fiber (X1), False Eyelashes Made from Abaca Banana Stem Fiber (X2), and False Eyelashes Made from Ambon Banana Stem Fiber (X3). Similar organoleptic evaluation of pineapple leaf fiber products showed attractive, light, and neat curls, which strengthens the potential of natural fibers.

For the Lightness indicator, the false eyelashes made from both kepok (X1) and abaca (X2) banana fibers showed the same average score of 44.4%, while the eyelashes made from ambon banana fibers (X3) had a slightly lower average of 40.0%. This suggests that the false eyelashes made from kepok and abaca banana pseudostem fibers are lighter than those made from ambon banana fibers.

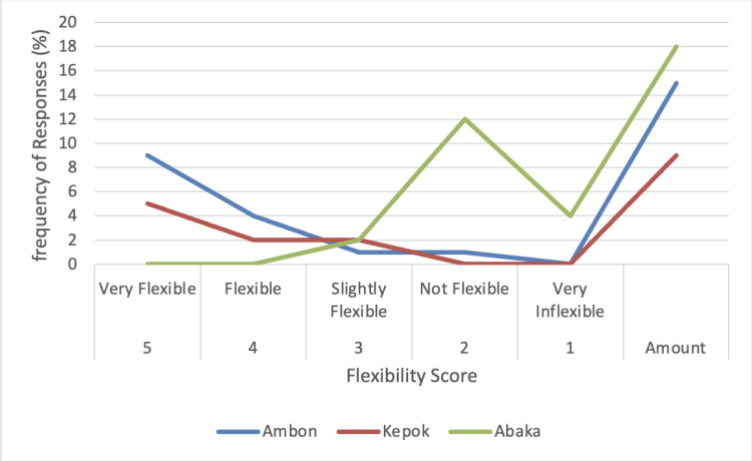

Fig. 2. Bar chart of the eyelash curling oganoleptic test from Kepok, Abaca and Ambon banana stem fibers.

Regarding the Neatness indicator, the false eyelashes made from kepok banana fibers (X1) and abaca banana fibers (X2) again shared the same average score of 66.7%, while those from ambon banana fibers (X3) scored 40.0%. This indicates that the neatness of false eyelashes made from kepok and abaca banana fibers is higher than that of eyelashes made from ambon banana fibers [25].

The bar chart illustrating the organoleptic test results for the curliness of false eyelashes made from kepok, abaca, and ambon banana pseudostem fibers is presented in Fig. 2.

Fig. 2 indicates that Ambon banana is the material with the highest flexibility, Kepok banana

has medium flexibility with balanced characteristics, while Abaca banana shows the least flexible (stiff) properties among the three materials. These results indicate that the selection of materials can be adjusted to specific needs: Ambon banana for applications that require high flexibility, Abaca banana for strength needs, and Kepok banana as a medium choice [25].

The bar diagram for the organoleptic test of the lightness of eyelashes from banana stem fibers from kepok, abaca, and ambon can be seen in Fig. 3.

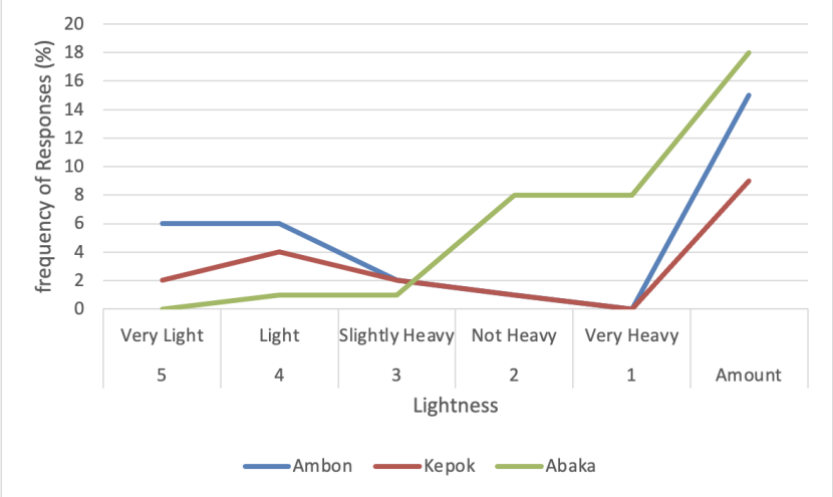

Fig. 3. Lightness organoleptic test of eyelashes from Kepok, Abaca and Ambon banana stem fibers.

Fig. 3 above explains that Ambon banana is the material with the highest lightness, Kepok banana has moderate lightness with balanced characteristics, while Abaca shows the least light (heavy) properties among the three materials. These results indicate that the selection of materials can be adjusted to specific needs: Ambon banana for applications that require light weight, Abaca banana for heavier weight needs, and Kepok banana as a medium choice [25].

The bar diagram for organoleptic test of neatness of eyelashes from banana stem fibers from kepok, abaca, and ambon can be seen in Fig. 4.

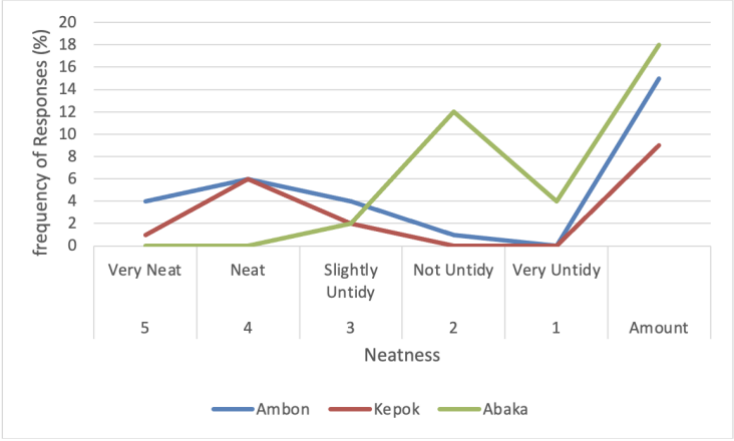

Fig. 4. Neatness oganoleptic test of eyelashes from Kepok, Abaca and Ambon banana stem fibers.

Fig. 4 shows that kepok banana is the material with the highest neatness, ambon banana has medium neatness with balanced characteristics, while abaca banana shows the least neat nature among the three materials. These results indicate that the selection of materials can be adjusted to specific needs: kepok banana for applications that require high neatness, abaca banana for needs that do not prioritize neatness, and ambon banana as a fairly versatile middle choice.

3.3. Hedonic Test of the Feasibility of False Eyelashes Made from Kepok, Abaca, and Ambon Banana Stem Fibers.

Table 3 describes the results of the Hedonic Test of the Feasibility of False Eyelashes Made from Kepok Banana Stem Fiber (X1), False Eyelashes Made from Abaca Banana Stem Fiber (X2), and False Eyelashes Made from Ambon Banana Stem Fiber (X3) with panelist preference indicators (%) and Aesthetics (%) [25]. This is in line with the results of the hedonic test of pineapple leaf fiber which was assessed as very feasible with a high preference score [35]. A total of 20 panellists participated in the organoleptic and hedonic evaluations. Each panellist was asked to rate the samples based on preferences and aesthetic indicators using a structured questionnaire. The scores presented are the average of all collected responses.

Table 3. Hedonic test results of false eyelashes

Assessment Indicator	Variable	Average value (%)
Panellist's Favorite	X1	44.4
	X2	50.0
	X3	60.0
Aesthetics	X1	45
	X2	55
	X3	73.3

Description: made from kepok banana pseudostem fiber (X1), abaca banana pseudostem fiber (X2), and ambon banana pseudostem fiber (X3). The values represent the mean percentage scores of panelists' preferences and aesthetic assessments. For comparison, previous studies on pineapple leaf fiber also reported high feasibility as eyelash material.

The average value of the panelist preference indicator for false eyelashes from Kepok Banana Stem Fiber (X1) was 44.4%, while the average value of the panelist preference for false eyelashes from abaca Banana Stem Fiber (X2) was 50.0%, and the average value of the panelist preference for false eyelashes from Ambon Banana Stem Fiber (X3) was 60.0%. The average value of the aesthetic indicator for false eyelashes from Kepok Banana Stem Fiber (X1) was 45%, while the average value of the panelist preference for false eyelashes from abaca Banana Stem Fiber (X2) was 55%, and the average value of the panelist preference for false eyelashes from Ambon Banana Stem Fiber (X3) was 73.3%. It can be concluded that in terms of the panelists' preference and aesthetic indicators for false eyelashes made from banana stem fiber, variable X3, namely False Eyelashes Made from Ambon Banana Stem Fiber, obtained the highest preference value, which is 73.3% [25].

4. Conclusions

Based on laboratory and organoleptic assessments, fibers extracted from the stem sheaths of Musa varieties, specifically abaca and kapok, emerged as the most suitable raw materials for the production of false eyelashes. This study highlights the potential of banana pseudostem fibers, particularly abaca and kepok, as sustainable raw materials for false eyelashes. Abaca demonstrates superior mechanical strength, while kepok contributes favorable texture and aesthetic qualities, making them complementary for cosmetic applications. These findings confirm the feasibility of developing bio-based, biodegradable alternatives to synthetic false eyelashes that better align with environmental and cultural considerations. Future research should focus on durability testing under repeated use, comprehensive safety evaluations to ensure consumer health, and exploration of scalability and commercialization potential to enable wider adoption of banana fiber–based materials in the cosmetic industry. The combination of abaca and kepok fibers presents a strategic alternative for developing high-quality, halal, and competitive false eyelash products based on natural materials. This innovation also holds great potential as a creative industry product by transforming agricultural waste into high-value cosmetic goods.

Abbreviations

X1	refers to false eyelashes made from kepok banana pseudostem fiber
X2	refers to false eyelashes made from abaca banana pseudostem fiber
X3	refers to false eyelashes made from ambon banana pseudostem fiber
CV	stands for Coefficient of Variation
SEM	refers to Scanning Electron Microscope
FTIR	stands for Fourier Transform Infrared
Tex	is the unit of linear mass density of fiber (g/km)

Data availability statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Credit authorship contribution statement

Vivi Efrianova: conceptualization, methodology, writing of the original draft, and supervision of the research. **Samul Martin Pradana**: was responsible for data curation, investigation, and formal analysis. **Nabilla Yasmin**: conducted the laboratory testing, visualization, and validation. **Aulia Khairani**: writing – review and editing, provided resources, and managed the project administration. **Edi Syafri**: developed the fiber processing technique, contributed to the methodology, and acquired funding for the research**.**

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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