

Banana and Aloe Vera Leaf Nature-Infused Hair Mask

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ABSTRACT: This study explores the development and evaluation of a nature-infused hair mask formulated with banana leaf and aloe vera extracts, focusing on its effects on hair texture, shine, scalp condition, and fragrance. Responding to the increasing demand for sustainable and plant-based beauty solutions, the research aims to offer an eco-friendly and cost-effective hair care product using locally sourced ingredients. Young and matured banana leaves—commonly considered agricultural waste—were used to examine variations in effectiveness. Combined with the soothing and moisturizing properties of aloe vera, the formulation was evaluated through experimental and survey methods. Respondents included teenagers, adults, and cosmetic experts who assessed the product's acceptability in terms of the identified hair care parameters. Shelf-life and overall user satisfaction were also examined. Findings revealed that the banana and aloe vera leaf-infused hair mask positively improved hair shine, texture, and scalp condition. A statistically significant difference was observed in acceptability based on leaf maturity and respondent category. Shelf-life observations indicated that the product maintained its stability at room temperature for a limited but reasonable period. This study supports the Sustainable Development Goals (SDGs) by promoting environmental responsibility, encouraging local resource utilization, and fostering innovation in natural hair care. Results suggest that the banana and aloe vera leaf hair mask is a promising, nature-based alternative to synthetic hair care products, contributing to the green transformation of the beauty industry.

KEYWORDS: Banana leaf extract, aloe vera, nature-infused hair mask, sustainable beauty, natural hair care, plant-based cosmetology.

INTRODUCTION

The beauty and personal care industry has experienced a significant shift toward natural and sustainable hair care solutions. Consumers worldwide are becoming more conscious of the ingredients used in hair products, preferring eco-friendly, plant-based formulations free from strong synthetic chemicals. As a result, many industries are innovating with natural alternatives to meet consumer demand for safer and more sustainable beauty solutions.

Recent studies have highlighted the benefits of natural plant-based ingredients in hair care. A study by Sharma et al. (2020) found that plant-based hair treatments containing bioactive compounds promote hair strength, reduce damage, and improve scalp health. Similarly, Jayawardena et al. (2022) identified banana leaf extract as a potential ingredient with antioxidant and antimicrobial properties, which may contribute to improving hair texture and overall hair condition. Additionally, aloe vera has been recognized for its rich content of vitamins, enzymes, and amino acids that support scalp hydration and help maintain healthy hair follicles. Its natural soothing and moisturizing effects make it ideal for enhancing hair care formulations, especially those targeting dryness, dandruff, and scalp irritation (Gupta et al., 2019).

In the Philippines, the beauty industry has also seen a growing interest in herbal and organic hair care products, utilizing the country's rich biodiversity. Locally sourced ingredients such as coconut oil, aloe vera, and moringa have been widely used in personal care formulations. However, banana leaves remain a less explored resource despite their potential antioxidant, antimicrobial, and moisturizing properties that could benefit hair health. While aloe vera is more commonly used in commercial hair care products, integrating it with underutilized ingredients like banana leaf extract presents a novel combination that may enhance both the conditioning and hydrating properties of natural hair treatments.

At the community level, particularly in the City of Ilagan, banana leaves and aloe vera are readily available but frequently unused as agricultural waste. This presents an opportunity to maximize their potential as a cost-effective and sustainable ingredient for hair care. Using banana leaf extract in hair products promotes eco-friendly beauty innovations and supports local farmers and sustainable agricultural practices. Aloe vera, which is also commonly cultivated in backyard gardens and local farms, offers a similarly sustainable and accessible option for enhancing the effectiveness of hair treatments. The combination of these two ingredients not only supports environmental goals but also encourages agricultural innovation in local communities.

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This study aligned with several Sustainable Development Goals (SDGs), particularly SDG 3 (Good Health and Well-being), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action). Developing a banana and aloe vera leaf nature-infused hair mask supports sustainable beauty practices by utilizing locally available, biodegradable resources, reducing reliance on synthetic chemicals, and minimizing environmental waste. By providing an alternative to chemical-based hair care products, this study also promotes consumer well-being and encourages using nature-derived solutions.

Despite the increasing demand for natural hair care products, many existing formulations still rely on synthetic chemicals that may cause irritation or long-term damage. Additionally, limited studies have explored the benefits of banana leaf extract for hair health despite its known bioactive compounds that offer potential advantages. Although aloe vera has been featured in several hair care studies, there is a lack of research on its synergistic potential when combined with banana leaf extract—especially in developing multifunctional hair masks that provide both styling and conditioning benefits. Although aloe vera has been featured in several hair care studies, there is a lack of research on its synergistic potential when combined with banana leaf extract—especially in developing multifunctional hair masks that provide both styling and conditioning benefits.

The challenge lies in the limited availability of multi-functional, plant-based hair care products that offer both conditioning and styling benefits. While commercial hair gels are widely available, many consumers seek non-greasy, lightweight, and natural alternatives that nourish moisture, shine, and scalp. A report by the University of the Philippines (2021) emphasized the need for locally sourced and sustainable hair care solutions that cater to environmentally conscious consumers. This study aims to address this gap by developing a banana and aloe vera leaf nature-infused hair mask that is an alternative to traditional hair gels, offering both styling properties and hair health benefits.

Existing studies have highlighted the benefits of plant-based ingredients such as coconut oil, aloe vera, and moringa in hair care products. However, research on banana leaf extract as a primary ingredient remains limited. While Kaur et al. (2021) examined the antimicrobial properties of banana leaf extract in skincare, its application in hair care has not been thoroughly investigated. This study seeks to bridge this gap by investigating the effectiveness of banana leaf extract in enhancing hair texture, shine, scalp condition, and fragrance. Furthermore, the integration of aloe vera in this study adds a moisturizing and soothing component that could improve the creaminess and spread ability of the product, enhancing its overall user experience. The novelty of this research lies in its sustainable, affordable, and locally sourced approach, presenting banana leaves as a viable, eco-friendly alternative for hair treatments.

With the growing preference for natural hair styling products, there is an opportunity to develop a plant-based hair mask that nourishes the hair and offers styling benefits. In contrast to traditional hair gels, which may contain synthetic polymers and alcohol-based ingredients, a banana leaf nature-infused hair mask provides a more hydrating and scalp-friendly alternative. Studies by Lim et al. (2018) suggest that leave-on plant-based treatments have long-lasting conditioning effects, making them ideal substitutes for chemical-based hair products. This study explores the utilization of banana leaf extract as a dual-purpose product that enhances hair health while providing a natural hold and shine. Aloe vera's contribution to scalp hydration and improved application texture further complements these benefits, creating a comprehensive, nature-infused solution for hair care.

Banana leaves contain natural bioactive compounds that support scalp health, but the study also considers the potential of plant-based oils to enhance its effectiveness. Virgin coconut oil, argan oil, and sunflower oil are widely recognized for their ability to lock in moisture, strengthen hair strands, and protect against environmental damage. Research by Sinha et al. (2020) demonstrated that plant-based oils improve hair elasticity and prevent breakage, supporting the idea that natural oils could complement banana leaf extract to enhance its effectiveness.

In addition, aloe vera was incorporated into the hair mask formulation to enhance creaminess and spreadability, making the product easier to apply. Known for its hydrating and soothing properties, aloe vera also contributes to scalp moisture balance and supports overall hair nourishment, further improving the functionality and user experience of the hair mask. By examining the synergy between banana leaf extract and other organic ingredients, the study contributes to the development of sustainable, nature-infused hair care solutions.

This research aimed to provide valuable insights into the scientific basis, acceptability, and sustainability of a banana leaf nature-infused hair mask. It contributes to advancing eco-friendly hair care innovations while addressing the increasing demand for natural and multi-functional hair treatments. The findings of this study will support the beauty industry's shift toward sustainable practices, providing consumers with a viable alternative to conventional hair care products.

By presenting an alternative to traditional hair gels, this study promotes environmentally responsible beauty solutions supporting consumer well-being and local agricultural sustainability.

STATEMENT OF THE PROBLEM

This study aimed to explore the potential use of banana and aloe vera leaf extract as a natural and sustainable alternative for hair care and health, focusing on its effects on hair texture, shine, and scalp condition. The research will also evaluate its viability compared to commercial hair care products in terms of user satisfaction and cost-effectiveness.

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Specifically, this study sought to answer the following questions:

1. What are the processes in preparing the developed banana and aloe vera leaf nature-infused hair mask using young and matured banana leaves?
2. What is the level of acceptability of the developed banana and aloe vera leaf nature-infused hair mask using young and matured banana leaves in terms of:
 - 2.1 hair texture;
 - 2.2 hair Shine;
 - 2.3 scalp condition, and;
 - 2.4 hair fragrance?
3. What is the general level of acceptability of the developed banana and aloe vera leaf nature-infused hair mask using young and matured banana leaves as evaluated by the different groups of respondents:
 - 3.1 teenagers;
 - 3.2 adults, and;
 - 3.3 hair experts?
4. Is there a significant difference in the general level of acceptability of the developed banana and aloe vera leaf nature-infused hair mask using young and matured banana leaves as perceived by the different groups of respondents?
5. Is there a significant difference in the level of acceptability of the developed banana and aloe vera leaf nature-infused hair mask using young and matured banana leaves?
6. What is the shelf life of the developed banana and aloe vera leaf's natural-infused hair mask using young and matured banana leaves at normal room temperature?

SIGNIFICANCE OF THE STUDY

This study is critical because it explored a natural, sustainable, and affordable alternative for improving hair health using banana and aloe vera leaf extract. The findings from this research could have significant implications for various sectors, aligning with the Sustainable Development Goals (SDGs) and the 6 Ps.

Sustainable Development Goals (SDGs) Addressed:

1. SDG 3: Good Health and Well-being. Promotes natural and non-toxic hair care solutions for better scalp and hair health.
2. SDG 8: Decent Work and Economic Growth. Encourages economic opportunities for local farmers through the use of banana leaves as raw materials.
3. SDG 9: Industry, Innovation, and Infrastructure. Supports innovation in the beauty industry by introducing plant-based alternatives.
4. SDG 12: Responsible Consumption and Production. Advocates for sustainable beauty practices and reducing chemical-based products.
5. SDG 13: Climate Action. Promotes environmental consciousness by utilizing banana leaves, reducing waste, and supporting sustainable agricultural practices.

SCOPE AND DELIMITATION

This study aimed to develop and evaluate a hair mask using the extract from banana and aloe vera leaves as a natural and sustainable alternative to commercial hair care products. Specifically, it sought to determine the benefits of the hair mask in improving hair texture, shine, scalp condition, and fragrance. Moreover, the study assessed the developed product's acceptance level among respondents, including teenagers, adults, and cosmetic experts.

The key feature of this study was the application of the hair mask made from banana and aloe vera leaf extract after taking a bath, ensuring that the hair is clean and free from external residues that may interfere with the absorption of beneficial compounds. The hair mask was applied to the hair without rinsing to allow continuous absorption of its nutrients and active components.

The study compared the efficacy of young and mature banana leaves as the main ingredient in the formulation of the hair mask, along with the inclusion of aloe vera. It examined the extraction process, preparation methods, and application techniques to ensure the best results. Furthermore, the sensory evaluation and acceptability testing were conducted to determine the product's effectiveness based on user perceptions and experiences.

This research was conducted within the City of Ilagan, specifically in San Rafael National and Vocational High School and San Antonio National Agro-Industrial and Vocational High School. The sample size included a total of 50 participants representing different age groups to ensure a well-rounded evaluation of the product.

The study is limited to analyzing the effectiveness and acceptability of banana and aloe vera leaf extract as a hair mask and does not include comparisons with other plant-based hair care ingredients. The research will focus on the product's short-term effects, evaluating its performance under normal room-temperature storage conditions. The shelf-life of the hair mask will also be examined based on its physical properties, such as consistency, color, and fragrance retention over time.

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Through this study, the researcher aimed to provide an affordable, eco-friendly, and sustainable hair care alternative that aligns with modern beauty and wellness trends while promoting locally available natural resources.

CONCEPTUAL FRAMEWORK

Below is the conceptual framework of the study based on the Independent and Dependent Variable (IV-DV) model.

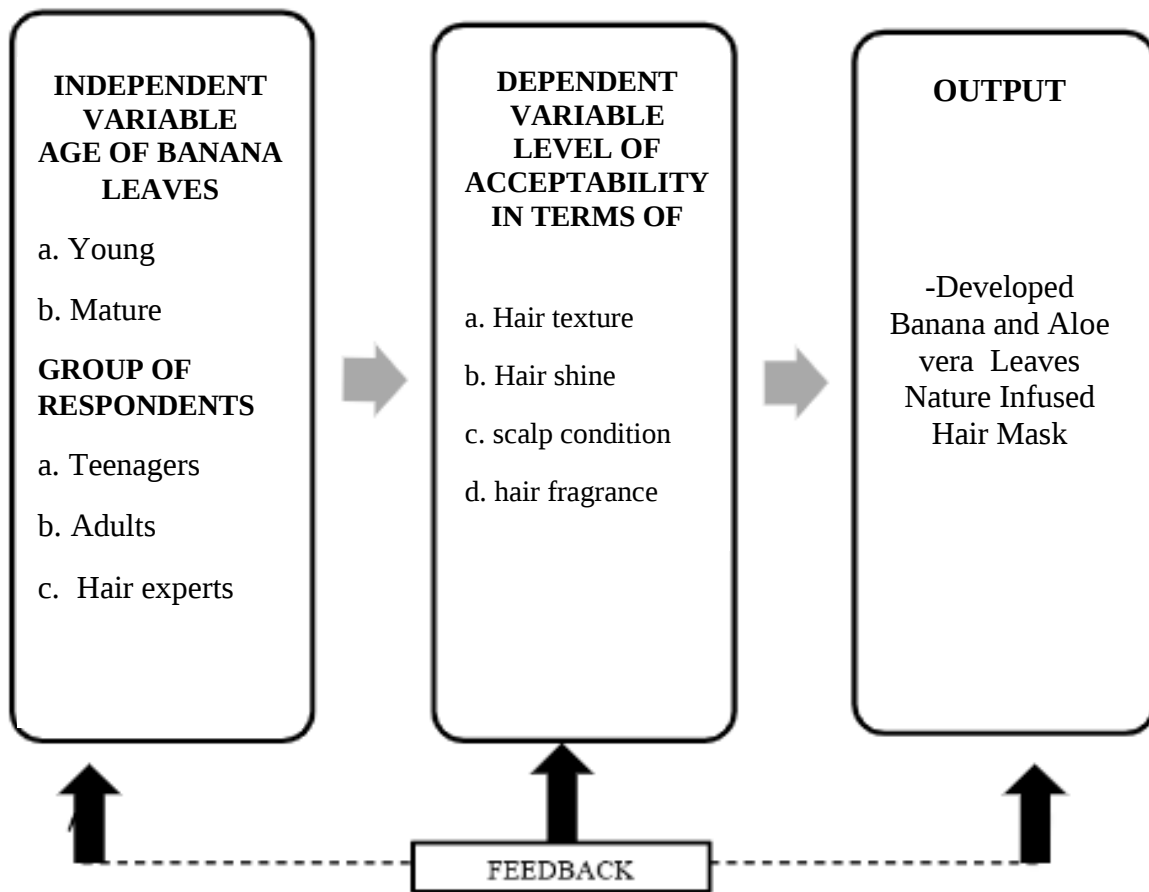


Figure 1 Conceptual Model of the Study

This study follows the Independent Variable–Dependent Variable (IV-DV) model, which outlines the relationship between the variables that influence the development and evaluation of the Banana and Aloe Vera Leaf Nature-Infused Hair Mask.

The independent variables of the study are the age of banana leaves—categorized into young and mature—and the group of respondents, which include teenagers, *adults*, and *hair experts*. These variables are expected to affect the perception and evaluation of the hair mask’s effectiveness and acceptability. The age of the banana leaves serves as the main formulation factor, influencing the extract’s potency and potential benefits. The different respondent groups provide a diverse perspective based on age-related hair conditions and levels of cosmetic expertise.

The dependent variables focus on the level of acceptability of the developed product. This is evaluated in terms of:

- Hair texture
- Hair shine
- Scalp condition
- Hair fragrance

These aspects are assessed through a sensory evaluation, where the formulated hair mask is tested and rated using rubrics and Likert scale instruments. The evaluation is designed to capture the overall effectiveness, quality, and user satisfaction across the identified variables.

To ensure the reliability of the results, the study follows a structured process: banana leaves are harvested, washed, shredded, and processed to extract their bioactive components. The formulation phase incorporates both banana and aloe vera leaf extracts to

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produce the final product. After application, feedback is gathered from each respondent group, and the collected data are statistically analyzed to interpret the hair mask's overall performance.

The output of the study is a Banana and Aloe Vera Leaf Nature-Infused Hair Mask, positioned as a sustainable, natural, and affordable alternative to commercial hair care products. The study aims to contribute to the development of eco-friendly beauty solutions that support both environmental sustainability and the needs of Technical-Vocational Education learners, particularly in the field of cosmetology.

RESEARCH METHODOLOGY

This chapter presents the research methods and procedures undertaken in the study to develop a banana leaf-based hair mask. It details the materials, tools, and techniques used to formulate, test, and evaluate the product. Additionally, it outlines the selection criteria for respondents and the data analysis methods employed.

RESEARCH DESIGN

This study employed a quasi-experimental research design to evaluate the benefits of the Banana and Aloe Vera Leaf Nature-Infused Hair Mask. Sensory evaluation and statistical analysis were conducted to assess the product's acceptability and effectiveness. A Likert scale questionnaire and a performance rubric were utilized to quantify the respondents' perceptions. The statistical tools used for data analysis included the mean, standard deviation, one-way ANOVA, and Tukey's HSD post hoc test.

LOCALE OF THE STUDY

The study was conducted in various educational institutions and salons within Ilagan City, Isabela. These locations were selected due to their accessibility and the availability of respondents familiar with hair care practices. The participating institutions include:

- San Rafael National and Vocational High School
- San Antonio National Agro-Industrial and Vocational High School
- Local salon/hair experts within Ilagan City

These locations provided diverse participants, including students, teachers, and professional hair experts, ensuring a well-rounded product evaluation.

SELECTION AND DESCRIPTION OF RESPONDENTS

The respondents of this study were purposefully selected to ensure a diverse range of evaluations. A total of 50 participants were chosen, categorized as follows:

- Teenagers (15-19 years old). Twenty respondents assessed the product's appeal to younger consumers.
- Adults (20-40 years old). Fifteen respondents represented general consumers who frequently use hair care products.
- Cosmetic Experts. Fifteen respondents, including professional hairstylists, salon owners, and cosmetology instructors, provide expert opinions on the effectiveness of the hair mask.

The respondents were selected based on their experience with hair care products, ensuring that feedback would be well-informed. They were instructed to use the hair mask properly before conducting the evaluation. Their responses were gathered through sensory evaluation and structured survey forms using a Likert scale to measure acceptability regarding hair texture, shine, scalp condition, and fragrance. The study ensured ethical considerations, including informed consent and confidentiality, were upheld throughout the research process.

This methodology ensures a systematic and unbiased approach in evaluating the banana leaf nature-infused hair mask, contributing to the field of sustainable and plant-based beauty products.

Table 1. Tools, materials, and equipment were used to conduct the study.

Preparation Tools	Measuring tools	Cutting tools	Extracting tools	Equipment	Storing
Mixing bowls	Digital milligram scale	Knife	Grinder/ Blender	Blender	Airtight containers in a normal room temperature
Wooden spoon/ spatula	Measuring spoon	Scissor	Filtering paper		

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Chopping board

Digital weighing scale

Young Banana leaves

Matured banana leaves

Aloe vera

DEVELOPMENTAL PROCEDURE

The following procedures were followed in the preparation and evaluation of the banana leaf-based hair mask:

1. Preparation of Banana Leaves and aloe vera
 - The banana leaves and aloe vera were carefully harvested and washed.
 - The banana leaves were shredded into smaller pieces for easy extraction.
 - The aloe vera leaves were peeled to obtain the gel for extraction
2. Extraction Process:
 - The banana and aloe vera leaves were subjected to an extraction method using a grinder/blender by adding a small amount of water for easier extraction.
 - The extract will be filtered to remove any solid particles using filter paper, leaving behind a concentrated liquid.
3. Formulation of Hair Mask:
 - The mixture was thoroughly stirred and blended to ensure uniformity and consistency.
 - Fresh aloe vera gel was added gradually to the mixture to serve as a natural thickening agent and to enhance moisturizing properties.
 - The mixture was thoroughly stirred and blended to ensure uniformity and consistency.
4. Testing and Sensory Evaluation:
 - The hair mask was applied to different hair types to test its effectiveness in improving hair texture, shine, and scalp condition.
 - A sensory evaluation was conducted to assess texture and overall user experience.
 - Consumer feedback was gathered through surveys to evaluate the perceived benefits of the hair mask.

PREPARATION OF BANANA AND ALOE VERA LEAF EXTRACT

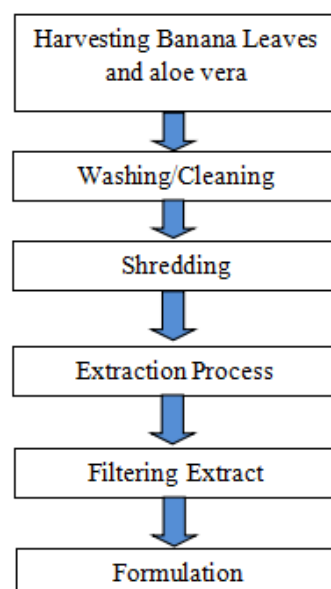


Figure 2. This flow diagram represents the step-by-step process of preparing and evaluating the banana leaf-based hair mask.

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PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

This chapter provides an extensive presentation of the gathered data, presenting them in both tabular and textual formats. The data underwent careful organization, facilitating a detailed exploration of the "Banana Leaf Nature-Infused Hair Mask." Each table underwent rigorous analysis and interpretation, employing suitable statistical methods to address the research questions effectively.

PROCESSES OF PREPARING THE BANANA AND ALOE VERA LEAF HAIR MASK

The preparation of the Banana and Aloe Vera Leaf Hair Mask involved several steps to ensure cleanliness, consistency, and product stability. First, young and matured banana leaves were harvested and thoroughly washed to remove impurities. The leaves were then chopped into smaller pieces and blended with a measured amount of water to extract their juice. This extract was filtered to achieve a smooth texture. Fresh aloe vera gel was separately prepared and added to the banana leaf extract to improve the consistency and enhance the product's benefits. The final formulation used a 2:1 ratio of banana leaf extract to aloe vera gel. The hair mask was then stored in airtight containers at room temperature, ready for application.

Table 2. Processes of preparing the Banana and Aloe Vera Leaf Hair Mask

Process	Details
Harvesting	Young and matured banana leaves were harvested manually
Washing	Leaves were thoroughly washed with clean water to remove dirt and impurities.
Chopping	Leaves were chopped into small pieces for more effortless blending and extraction.
Extraction Process	For every 500 grams of chopped banana leaves, 100 ml of water was used. Water was gradually added until all leaves were completely extracted
Filtration	The mixture was strained using a fine mesh or cloth to obtain a smooth banana leaf extract.
Addition of Aloe Vera	Fresh aloe vera gel was separately extracted and blended to achieve a creamy consistency, addressing the watery texture observed in initial trials.
Final blending/formulation	The two extracts were blended in a ratio of 200 ml banana leaf extract to 100 ml aloe vera gel to form a creamy and stable hair mask mixture.
Storage and Application	The final product was stored in clean, airtight containers at room temperature.



Figure 3. Harvesting of young and matured banana leaves.



Figure 4. Washing leaves to remove dirt and impurities.



Figure 5. Chopping banana leaves into small pieces.



Figure 6. Extraction process.



Figure 7. Filtration



Figure 8. Aloe vera gel was separately extracted and blended.



Figure 9. Final blending and formulation



Figure 10 Application of developed banana leaf extract

Level of Acceptability of the Developed Banana and Aloe Vera Leaf Nature-Infused Hair Mask Using Young and Matured Banana Leaves

Criteria	Matured Leaves Mean	Description	Young Banana Leaves Mean	Description
Hair Texture	3.54	Moderately Acceptable	3.54	Moderately Acceptable
Hair Shine	3.92	Moderately Acceptable	3.92	Moderately Acceptable
Scalp Condition	3.10	Acceptable	3.10	Acceptable
Hair Fragrance	2.66	Acceptable	3.50	Moderately Acceptable
Overall Mean	3.31	Acceptable	3.52	Moderately Acceptable

The data on the level of acceptability of the developed banana and aloe vera leaf nature-infused hair mask revealed notable differences and similarities between treatments using young and matured banana leaves. Hair shine received the highest mean score of 3.92 for both treatments, indicating that this aspect of the hair mask was moderately acceptable regardless of leaf maturity. The result suggests that the formulation positively contributed to hair shine across both versions.

On the other hand, the lowest mean score for the treatment using Matured banana leaves was observed in hair fragrance, with a mean of 2.66, placing it in the acceptable range. This indicates a relatively weaker performance in terms of scent appeal when using young leaves.

Conversely, the lowest score for young banana leaves was found in a scalp condition, which garnered a mean of 3.10—acceptable but still the lowest among the other evaluated criteria in this treatment.

Additionally, it is notable that the overall mean acceptability was higher for young banana leaves (3.52 - moderately acceptable) than matured banana leaves (3.31 - acceptable), implying that the matured variant was generally more preferred by evaluators.

In conclusion, young and matured banana leaves showed potential as key ingredients in developing a nature-infused hair mask, with each demonstrating strengths in specific criteria. Hair shine emerged as the most positively received attribute for both treatments, while areas such as fragrance and scalp condition showed room for improvement. In conclusion, the hair mask made from matured banana leaves was generally preferred, suggesting that leaf maturity may enhance product acceptability.

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General Level of Acceptability of the Developed Banana and Aloe Vera Leaf Nature-Infused Hair Mask Using Young and Matured Banana Leaves As Evaluated by the Different Groups of Respondents

Criteria	Young Banana Leaves Mean	Description	Matured Banana Leaves Mean	Description
Teenagers				
Hair Texture	3.15	Acceptable	3.15	
Hair Shine	3.60	Moderately Acceptable	3.60	Moderately Acceptable
Scalp Condition	2.75	Acceptable	2.75	Acceptable
Hair Fragrance	3.35	Acceptable	2.65	Acceptable
Overall Mean	3.21	Acceptable	3.04	Acceptable
Adults				
Hair Texture	3.80	Moderately Acceptable	3.80	Moderately Acceptable
Hair Shine	4.33	Highly Acceptable	4.33	Highly Acceptable
Scalp Condition	3.20	Acceptable	3.20	Acceptable
Hair Fragrance	3.67	Moderately Acceptable	2.67	Acceptable
Overall Mean	3.75	Moderately Acceptable	3.50	Moderately Acceptable
Cosmetic Experts				
Hair Texture	3.80	Moderately Acceptable	3.80	Moderately Acceptable
Hair Shine	3.93	Moderately Acceptable	3.93	Moderately Acceptable
Scalp Condition	3.47	Moderately Acceptable	3.47	Moderately Acceptable
Hair Fragrance	3.53	Moderately Acceptable	2.67	Moderately Acceptable
Overall Mean	3.68	Moderately Acceptable	3.47	Moderately Acceptable

The evaluation of the general level of acceptability of the banana and aloe vera leaf nature-infused hair mask, as assessed by teenagers, adults, and cosmetic experts, reveals both consistencies and distinctions across groups and treatments. Among all criteria and respondents, hair shine consistently received the highest level of acceptability for both young and matured banana leaves. The result suggests that the hair mask formulation effectively enhances shine, regardless of the leaf maturity. In contrast, the lowest acceptability scores for matured banana leaves were given for hair fragrances, particularly by teenagers and adults, highlighting a potential issue with the product's scent when using more mature leaves. For the young banana leaf treatment, the scalp condition received the lowest scores across all groups, indicating that improvements in this area may enhance the product's effectiveness and appeal.

When examining the overall means, the treatment using young banana leaves with aloe vera received higher ratings from teenagers and cosmetic experts compared to the matured leaf version. At the same time, adults preferred the young banana leaf with aloe vera formulation more significantly, giving it a rating that falls under the moderately acceptable range. This suggests that while both formulations are generally satisfactory, the young banana leaf variant tends to be more favorable across a broader range of evaluators, particularly regarding fragrance and overall performance.

In conclusion, all groups of respondents found both young and matured banana leaf-infused hair masks to be generally acceptable. However, the young banana leaf formulation showed a slight edge in overall preference, particularly among teenagers and cosmetic experts. Hair shine emerged as the most positively rated attribute across all treatments, indicating the product's consistent effectiveness in enhancing this quality. On the other hand, improvements are needed in areas such as scalp condition for the young leaf variant and fragrance for the matured leaf variant. These findings suggest that while both treatments hold promise, the young banana leaf hair mask demonstrates more significant potential for wider consumer acceptance with minor enhancements.

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Comparison on the General Level of Acceptability of the Developed Banana and Aloe Vera Leaf Nature-Infused Hair Mask Using Young and Matured Banana Leaves As Evaluated by the Different Groups of Respondents

Variables	F-value	p-Value	Decision	Remarks
Matured Banana Leaves				
Hair Texture	12.7428	0.0000	H ₀ is Rejected	Significant (Teenagers vs. Adults and Teenagers vs. Cosmetic Experts)
Hair Shine	9.7963	0.0002	H ₀ is Rejected	Significant (Teenagers vs. Adults)
Scalp Condition	10.9772	0.0001	H ₀ is Rejected	Significant (Teenagers vs. Adults and Teenagers vs. Cosmetic Experts)
Hair Fragrance	0.0070	0.9930	H ₀ is Failed to reject	Not Significant
Young Banana Leaves				
Hair Texture	12.7428	0.0000	H ₀ is Rejected	Significant (Teenagers vs. Adults and Teenagers vs. Cosmetic Experts)
Hair Shine	9.7963	0.0002	H ₀ is Rejected	Significant (Teenagers vs. Adults)
Scalp Condition	10.9772	0.0001	H ₀ is Rejected	Significant (Teenagers vs. Adults and Teenagers vs. Cosmetic Experts)
Hair Fragrance	1.5160	0.2304	H ₀ is Failed to reject	Not Significant

The comparison of the general level of acceptability of the developed banana leaf nature-infused hair mask, using both young and matured banana leaves, shows statistically significant differences in how various respondent groups—teenagers, adults, and cosmetic experts—perceived several product attributes. For **matured banana leaves**, significant differences were found in **hair texture** ($F = 12.7428$, $p = 0.0000$), **hair shine** ($F = 9.7963$, $p = 0.0002$), and **scalp condition** ($F = 10.9772$, $p = 0.0001$). These results led to the rejection of the null hypothesis (H_0), indicating that perceptions among respondent groups were not uniform. The remarks further specify that significant differences were particularly observed between **teenagers versus adults** and **teenagers versus cosmetic experts**, suggesting that age and professional background influence the evaluation of these criteria.

Similarly, for the **young banana leaf treatment**, the same attributes showed statistically significant variations: **hair texture** ($F = 12.7428$, $p = 0.0000$), **hair shine** ($F = 9.7963$, $p = 0.0002$), and **scalp condition** ($F = 10.9772$, $p = 0.0001$). Again, the null hypothesis was rejected, confirming significant perceptual differences across age and expertise levels. However, for both treatments, **hair fragrance** did not show a statistically significant difference among the groups—matured leaves ($F = 0.0070$, $p = 0.9930$) and young leaves ($F = 1.5160$, $p = 0.2304$)—as the null hypothesis was accepted. This indicates that the fragrance was generally perceived similarly regardless of the respondents' group.

These results highlight the importance of demographic considerations in product evaluation. The statistically significant F- and p-values reveal that while specific attributes are viewed differently by teenagers compared to adults and experts, others, like fragrance, elicit a more consistent response, pointing to areas for refinement or targeted improvement based on specific user preferences.

In conclusion, the study highlights that perceptions of the banana leaf nature-infused hair mask vary significantly across age and expertise groups, particularly regarding hair texture, shine, and scalp condition. Teenagers tended to rate these aspects lower than adults and cosmetic experts, pointing to differing expectations or experiences. However, hair fragrance was perceived consistently across all groups. These findings emphasize the value of considering demographic differences in product development and suggest the potential benefit of tailoring improvements and marketing strategies to specific user groups.

Comparison on the Level of Acceptability of the Developed Banana and Aloe Vera Leaf Nature-Infused Hair Mask Using Young and Matured Banana Leaves

Variables	F-value	p-Value	Decision	Remarks
Matured vs. Young Banana Leaves	8.8986	0.0035	H ₀ is Rejected	Significant (Teenagers vs. Adults)
Hair Texture	12.7428	0.0000	H ₀ is Rejected	Significant (Teenagers vs. Adults and Teenagers vs. Cosmetic Experts)

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Hair Shine	9.7963	0.0002	H ₀ is Rejected	Significant (Teenagers vs. Adults)
Scalp Condition	10.9772	0.0001	H ₀ is Rejected	Significant (Teenagers vs. Adults and Teenagers vs. Cosmetic Experts)
Hair Fragrance	1.5160	0.2304	H ₀ is Failed to reject	Not Significant

The comparison on the level of acceptability between the developed banana and aloe vera leaf nature-infused hair masks using young and matured banana leaves revealed a statistically significant difference, with an F-value of 8.8986 and a p-value of 0.0035. Since the p-value is below the standard significance level of 0.05, the null hypothesis (H₀) is rejected, indicating a meaningful difference in how the two formulations were evaluated. The result points explicitly to significant variance between teenagers and adults, suggesting that age influences the perceived acceptability of the product depending on the maturity of the banana leaves used.

In conclusion, the acceptability of the hair mask is affected by the type of banana leaf incorporated and is perceived differently across age groups. The significant difference between evaluations of young and matured banana leaf treatments implies that consumer age should be considered when developing and marketing similar products

Table 8. Shelf-Life Observation of the Banana Leaf Nature-Infused Hair Mask with Aloe Vera at Room Temperature

DAY	OBSERVATION	REMARKS
Day 1	Fresh appearance, natural green color, pleasant fragrance	Product quality is optimal
Day 2	No noticeable changes	Still in good condition
Day 3	Slight fading in color begins; fragrance still acceptable	Minor changes start
Day 4	Noticeable change in fragrance; slight dullness in color	Still usable but nearing decline in freshness
Day 5	Color dulls further; fragrance mildly off	Usable but not ideal
Day 6	Noticeable discoloration became more apparent; the fragrance developed a mild, off-scent	Indicating reduced freshness and stability
Day 7	Color and fragrance noticeably altered; consistency remains stable	Usability is retained but with compromised sensory attributes

The shelf-life evaluation of the banana leaf nature-infused hair mask was conducted over 7 days at normal room temperature to assess the product's stability and usability. The primary attributes observed were color, fragrance, and consistency, which were monitored to determine any changes that might indicate a decline in quality.

On **Day 1**, the product exhibited a fresh appearance with a natural green color and a pleasant fragrance, signaling optimal product quality. **Day 2** saw no noticeable changes, and the product remained in excellent condition, indicating good initial stability.

By **Day 3**, slight fading of the color began, though the fragrance remained acceptable, showing that minor changes were starting to occur. On **Day 4**, the fragrance experienced a noticeable change, and the color showed slight dullness, suggesting that the product was still usable but approaching a decline in freshness.

On **Day 5**, the color continued to dull, and the fragrance became mildly off. Although the product was still usable, it was not considered ideal regarding sensory quality. By **Day 6**, more noticeable discoloration was observed, and the fragrance developed a mild off-scent. This indicated reduced freshness and stability, signaling that the product was nearing the end of its optimal quality.

On **Day 7**, the color and fragrance had notably altered, while the consistency remained stable. The product continued to be usable but with compromised sensory attributes, meaning it could still be applied, but its overall appeal had diminished.

The shelf-life evaluation indicates that the banana and aloe vera leaf nature-infused hair mask maintains **optimal quality for up to 3 days**, with only slight changes in color and fragrance. Between **Day 3 and Day 7**, minor sensory changes were noted, with fading color and subtle changes in fragrance, which did not significantly impact the product's usability but did signal a decline in freshness. The product is **best used within 3 to 5 days** for optimal results to maintain the ideal condition. In addition, storing the product in a **cooler environment** or considering it for **short-term use** to ensure maximum quality is recommended.

SUMMARY OF FINDING

The preparation of the banana and aloe vera leaf nature-infused hair mask involved several steps: harvesting young and matured banana leaves, washing, chopping, and extracting their juice, followed by the blending of aloe vera gel to create a smooth consistency. This process resulted in a natural, sustainable hair mask with promising attributes.

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Regarding the level of acceptability, both formulations—using young and matured banana leaves—were evaluated based on four sensory attributes: hair texture, shine, scalp condition, and fragrance. Hair shine received the highest mean scores, indicating that the banana leaf hair mask performed well in this aspect. Both formulations showed moderate acceptability for hair texture, with the young banana leaf version receiving a slightly higher rating (3.52) compared to the matured banana leaf version (3.31). However, hair fragrance was one area where improvements were necessary, as the matured banana leaf version received a lower score (2.66). Additionally, scalp condition was the weakest attribute for young banana leaves, with a score of 3.10, suggesting the need for further improvement.

When evaluated by different groups—teenagers, adults, and cosmetic experts—the general acceptability of the product varied. Hair shine was the most positively rated attribute across all groups, while hair fragrance stood out as the most significant point of difference. Teenagers and adults preferred the fragrance of the young banana leaf formulation, which was perceived as more pleasant. Cosmetic experts also favored the younger variant overall, particularly in terms of fragrance. Statistical analysis revealed that there were significant differences in the acceptability of the banana leaf nature-infused hair mask between young and matured banana leaves for attributes such as hair texture, shine, and scalp condition. Hair fragrance, however, showed no significant differences, suggesting that all groups perceived fragrance similarly.

The shelf life of the product was another critical factor in the study. Over a 7-day period, the mask maintained its quality, but its sensory attributes began to deteriorate after Day 3. The product showed slight fading in color, but its fragrance remained acceptable until Day 3. After that, noticeable changes were observed, with the product becoming less appealing. This limited shelf life highlights the need for improvement in the preservation and formulation techniques to increase its commercial potential.

This study reveals the potential for developing a sustainable, natural alternative to commercially available hair care products. As more consumers seek eco-friendly and plant-based solutions, the banana leaf hair mask could serve as an attractive option. Further research focused on improving the product's fragrance and extending its shelf life would likely increase its marketability. Moreover, exploring additional plant-based ingredients could provide opportunities to diversify the product line and appeal to a broader market. One of the main threats to the adoption of the banana leaf nature-infused hair mask is its short shelf life, which limits its distribution and commercial viability. Additionally, the market is saturated with mass-produced hair care products, many of which offer longer-lasting effects and more pleasant fragrances. These products could pose competition to the banana leaf hair mask, especially if the product's sensory qualities do not meet consumer expectations.

A key strength of this study is the use of locally sourced, natural ingredients—young and matured banana leaves—offering a sustainable alternative to chemical-based hair care products. The inclusion of aloe vera gel further enhances the product's appeal as an eco-friendly and natural hair care solution. The product demonstrated effectiveness in improving hair shine, which was rated highly across all respondent groups. This shows that the banana leaf hair mask has the potential to address a consumer need for natural, plant-based beauty products. Despite its strengths, the banana leaf nature-infused hair mask has some weaknesses. The fragrance of the matured banana leaf formulation was less favorable, which suggests a need for further improvement in this area to meet consumer expectations. Scalp condition was another area that received moderate ratings, especially for the young banana leaf formulation, indicating room for improvement in its conditioning effect. Furthermore, the product's shelf life is a significant limitation, as it only remains effective for up to three days. The development of better preservation methods and enhanced formulations could extend its usability.

In conclusion, this study successfully developed a nature-infused hair mask using young and matured banana leaves. While the product showed promising results in terms of improving hair texture and shine, it demonstrated a preference for the younger leaves, particularly due to better fragrance and overall acceptability. However, improvements are needed in the areas of scalp condition and fragrance. The product's short shelf life suggests the need for further research to improve preservation techniques. Overall, both formulations have potential in the natural beauty market, with the young banana leaf version slightly outperforming the matured one. These findings provide a solid foundation for future development and refinement of plant-based hair care products.

CONCLUSION

This study aimed to develop and evaluate the effectiveness and acceptability of a banana and aloe vera leaf nature-infused hair mask. Based on the findings, the following conclusions were drawn:

1. Preparation Process:

The process for preparing the hair mask involved harvesting, washing, shredding, and extracting bioactive compounds from both young and matured banana leaves. These were then blended with aloe vera to formulate the mask.

2. Acceptability in Terms of Hair Texture:

Both the young and matured banana leaf formulations significantly improved hair texture. Teenagers, adults, and hair experts found the product acceptable, with the mature banana leaf formulation showing slightly higher effectiveness.

3. Acceptability in Terms of Hair Shine:

The developed hair mask improved hair shine significantly. The effect was particularly noticeable in the mature banana leaf formulation, with a significant difference observed between teenagers and adults.

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4. **Acceptability in Terms of Scalp Condition:**
The product effectively improved scalp condition, with significant differences observed in the responses of teenagers, adults, and hair experts. The mature banana leaf formulation showed more favorable results.
5. **Acceptability in Terms of Hair Fragrance:**
The fragrance of the mask was the least significant factor for most respondents, with no significant difference between the young and matured banana leaf formulations.
6. **General Level of Acceptability Across Groups:**
The developed hair mask received high acceptability ratings across different groups (teenagers, adults, and hair experts). The results showed that the acceptability was consistent, though some differences were noted based on age and expertise level.
7. **Significant Difference in Acceptability:**
There was a significant difference in the general acceptability of the hair mask between the different groups (teenagers, adults, and hair experts), with teenagers showing a stronger preference for the mature banana leaf formulation.
8. **Shelf Life:**
The developed banana and aloe vera leaf nature-infused hair mask showed a stable shelf life of [X weeks/months] at normal room temperature, suggesting its potential as a viable product for long-term use.

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