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DEVELOPMENT OF THERAPEUTIC FACIAL MASK USING BANANA FIBRE

Dr. Rajkumar G, Harini V, Archana V, Madhu Ananya R A

[1] *Associate Professor, Fashion Technology & Kumaraguru College of Technology, Coimbatore*
[2] *B Tech (Scholar) Fashion Technology & Kumaraguru College of Technology, Coimbatore*
[3] *B Tech (Scholar) Fashion Technology & Kumaraguru College of Technology, Coimbatore*
[4] *B Tech (Scholar) Fashion Technology & Kumaraguru College of Technology, Coimbatore*

Abstract -The growing use of synthetic facial sheet masks has raised environmental concerns due to their non-biodegradable nature. This project focuses on developing an eco-friendly facial mask using banana fibre, a natural material derived from agricultural waste with good absorbency and biodegradability. In this study, banana fibres were processed and blended to form sheet structures suitable for facial mask applications. The developed samples were evaluated for properties such as thickness, GSM, absorbency, and wickability. FTIR analysis was also carried out to confirm the cellulose-based composition of the material. The results indicate that the blended banana fibre mask shows good absorbency and is suitable for skin-contact use. The study demonstrates the potential of banana fibre as a sustainable alternative for reducing cosmetic waste.
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1. INTRODUCTION

In recent years, there has been a growing awareness about the environmental impact of single-use cosmetic products, especially facial sheet masks. Most of the masks available in the market are made from synthetic or semi-synthetic materials that are not biodegradable and contribute to increasing waste. This has created a need for more sustainable and eco-friendly alternatives in the cosmetic industry.

Banana fibre is a natural material obtained from the pseudo-stem of the banana plant, which is usually discarded after harvesting. Instead of treating it as waste, this fibre can be effectively utilized for value-added applications. It is biodegradable, lightweight, and has good moisture absorption properties, making it suitable for products that come in direct contact with the skin.

In this project, banana fibres are processed and blended to develop a sheet structure that can be used as a facial mask. The aim is to create a product that not only provides functional benefits like absorbency and comfort but also reduces environmental impact. By using a natural and renewable resource, this study explores a sustainable approach to replace conventional facial sheet mask materials.

2. PROBLEM STATEMENT

1. Most facial sheet masks are made from non-biodegradable synthetic materials, leading to increased environmental pollution and cosmetic waste.
2. Banana plant waste, though rich in natural fibre, is underutilized, creating a need to develop a sustainable and eco-friendly alternative using banana fibre.

3. OBJECTIVES

- To develop a facial sheet mask using blended banana fibre.
- To utilize banana plant waste as a sustainable raw material.
- To evaluate the physical properties such as thickness and GSM of the developed mask.
- To assess functional properties like absorbency and wickability for skin application.
- To analyze the chemical composition using FTIR to confirm its cellulose-based nature.

4. SCOPE AND SIGNIFICANCE

This study explores the potential of banana fibre as a sustainable material for developing eco-friendly facial sheet masks, offering an alternative to conventional synthetic products. By utilizing agricultural waste, the project not only adds value to an underused resource but also supports waste reduction and circular economy practices. The developed mask aims to provide essential functional properties such as absorbency and skin comfort while being biodegradable and environmentally safe. This approach has scope for further development and

commercialization in the cosmetic and textile industries, contributing to the growing demand for sustainable and skin-friendly products.

5. LITERATURE REVIEW

Recent studies have highlighted banana fibre as a promising sustainable material for textile and cosmetic applications. Researchers have reported that banana fibre is biodegradable, has good tensile strength, and shows excellent moisture absorption properties, making it suitable for skin-contact products. Studies on natural fibres in cosmetic applications indicate that they can effectively retain serums and provide better adherence compared to synthetic materials. Additionally, the use of agricultural waste fibres has been encouraged as a way to reduce environmental impact and promote eco-friendly product development.
Further research has focused on improving the usability of banana fibre through processing techniques such as softening and blending to enhance flexibility and comfort. Findings suggest that properly treated banana fibre can be adapted for nonwoven and sheet-based applications with desirable functional properties like absorbency and breathability. Moreover, global awareness regarding sustainability in the cosmetic industry has driven the demand for biodegradable alternatives, reinforcing the importance of developing natural fibre-based facial masks as a viable and responsible solution.

6. METHODOLGY

6.1. FIBER PREPARATION

Banana fibres used in this study were initially sourced and prepared for further processing. The raw fibres obtained from the banana pseudo-stem contained impurities such as dust, residual plant matter, and unwanted particles. Hence, the fibres were first **cleaned thoroughly** to remove these impurities and ensure better quality.
After cleaning, the fibres were subjected to a **softening process** to reduce their natural stiffness and improve flexibility. This step is important to make the fibres suitable for blending and sheet formation, especially for skin-contact applications like facial masks.
Once softened, the fibres were **cut into uniform lengths** to ensure consistency during blending and sheet development. This controlled fibre size helps in achieving a more uniform structure and better performance in the final product. The prepared fibres were then ready for the blending and further fabrication process.

6.2. PULP PREPARATION

The prepared banana fibres were further processed to convert them into pulp suitable for sheet formation. Initially, the fibres were subjected to a pulping process, where they were mechanically treated with water to break down the fibre bundles into finer elements. This step helps in improving fibre dispersion and creates a uniform base for sheet development.
After pulping, the material was passed through a refining process to enhance fibre bonding and flexibility. Refining improves the surface characteristics of the fibres, allowing better interlocking and formation of a stable sheet structure.
To improve the binding and structural integrity of the pulp, alginate was added as a natural binder. The alginate solution was mixed with the banana fibre pulp in appropriate proportions to form a homogeneous mixture. This combination helps in improving the cohesiveness, strength, and smoothness of the final sheet, making it more suitable for facial mask applications.

6.3. SHEET FORMATION

The prepared banana fibre–alginate pulp was first poured and evenly spread to form a uniform wet sheet. The excess water present in the sheet was then removed through a **pressing process**, where gentle pressure was applied to consolidate the fibres and improve bonding between them. This step helps in achieving the required thickness and structural strength.

After pressing, the sheets were subjected to **drying** under controlled conditions to remove the remaining moisture. Proper drying ensures dimensional stability and prevents deformation of the sheet.

Once dried, the sheets underwent **finishing processes** to enhance their usability and appearance. This included smoothing the surface, trimming to the required shape, and improving overall flexibility. The finished sheets were then ready for further testing and evaluation for facial mask applications.

6.4. FINAL OUTPUT

The final product developed in this study is an eco-friendly facial sheet made from blended banana fibre combined with a natural binder. The sheet is biodegradable, lightweight, and suitable for skin-contact applications. It exhibits good absorbency and flexibility, making it effective for holding and delivering skincare formulations.

The use of banana fibre, derived from agricultural waste, makes the product sustainable and environmentally responsible. The developed sheet offers a natural alternative to conventional synthetic facial masks, contributing to the reduction of cosmetic waste while maintaining the required functional properties.

6.5. TESTING AND EVALUATION

PHYSICAL PROPERTIES

Thickness and GSM (gram per square meter) were measured to understand the weight and dimensional characteristics of the sheet. Stiffness and drape tests were conducted to assess flexibility and how well the sheet conforms to facial contours.

MECHANICAL PROPERTIES

Tensile strength and bursting strength were tested to evaluate the durability and resistance of the sheet under stress during handling and usage.

FUNCTIONAL PROPERTIES

Air permeability was analyzed to determine breathability, while thermal conductivity was tested to understand heat transfer properties for user comfort. Absorbency and wickability tests were carried out to measure the sheet's ability to absorb and distribute liquid effectively, which is essential for skincare applications.

CHEMICAL AND STRUCTURAL ANALYSIS

FTIR analysis was performed to identify the chemical composition and confirm the presence of cellulose in the banana fibre sheet. SEM (Scanning Electron Microscopy) was used to study the surface morphology and fibre arrangement, providing insight into the structure and bonding within the sheet.

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7. RESULT AND CONCLUSION

The developed banana fibre sheet was successfully fabricated using a blending and pulp-based approach with alginate as a natural binder. The results from physical testing showed that the sheet possessed acceptable thickness, GSM, and flexibility, making it suitable for facial application. Mechanical tests indicated that the material has adequate strength to withstand handling without damage.

Functional testing revealed good absorbency and wickability, confirming its ability to retain and distribute liquid effectively. Air permeability and thermal conductivity results suggest that the sheet provides sufficient breathability and comfort during use. FTIR analysis confirmed the presence of cellulose, indicating that the natural characteristics of banana fibre were retained, while SEM analysis showed a fairly uniform fibre distribution and bonding.

In conclusion, the study demonstrates that blended banana fibre can be effectively used to develop an eco-friendly and biodegradable facial sheet mask. The product meets essential performance requirements while offering a sustainable alternative to conventional synthetic masks, contributing to reduced environmental impact.

Figure 1. Prepared Banana Fiber

Figure 2. Pulp Preparation

Figure 3. Developed Sheet

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