



Eco-Friendly Practices for Pineapple Horticulture Crop Residue Utilization in Meghalaya

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The use of agro-waste material in the clothing industry will be of great benefit to the environment, the farmers, the wearer, and the makers who make clothes. As a part of the effort to increase the use of agro-waste in sustainable textiles, this study on the use of pineapple leaves in textiles has been conducted. Extraction of fiber from the available pineapple leaf waste, treatment of the extracted fiber, and experiment on spinning of yarn based on the characteristics of the existing yarn used in making the traditional textiles.

Sustainable fashion has become an increasingly important topic in the fashion industry in recent years, as consumers and industry stakeholders become more aware of the environmental and social impacts of fashion production. The concept of sustainable fashion is rooted in the principles of sustainable development, which seeks to balance economic growth, social progress, and environmental protection. In the context of the fashion industry, sustainable fashion aims to minimize the environmental impact of fashion production while promoting social responsibility and ethical practices.

Pineapple leaf fibre as a by-product is one of the largest productive systems in the agro-industry sector. Pineapple leaves can produce competitive and high-quality fibre for textile purposes. Even though pineapple has a very large production of leaf fibre, so far it has not been processed adequately, due to the lack of information among farmers regarding the processing of pineapple leaves as an alternative product. As a result, pineapple leaves are underused and are sometimes thrown away without control by burning them, or allowing them to decompose freely.

Integrating pineapple fiber production into local economies could promote rural entrepreneurship, job creation, and the development of value-added products. The study also explores the challenges in implementing pineapple fiber processing in Northeast India, including limited infrastructure, lack of technical knowledge, and insufficient market linkages. Despite these challenges, there is significant potential for fostering a circular economy through the promotion of pineapple fiber-based textiles.

This research highlights the importance of incorporating pineapple crop residue management and textile innovation into sustainable agricultural and industrial practices in Northeast India. By focusing on capacity-building, research and development, and policy support, the region can unlock the full potential of pineapple fiber, contributing to environmental sustainability, economic growth, and social development.

Keywords: Pineapple fiber, Agro-waste, Textile, Fashion,

Introduction

Pineapple (*Ananas comosus*) belongs to the Bromeliaceae family is one of the most popular tropical fruit. It is popularly known as “queen of fruits” because of excellent flavour, taste and shape of fruit. It is a good source of vitamins A, B and C, calcium, magnesium, potassium and iron (Anonymous, 2012). It is also a source of bromelin, a digestive enzyme. It is mainly used

as dessert fruit and also in processing industry. During post-fruit harvesting, the pineapple leaf bunches are largely discarded as agro-wastes, which are then majorly utilized for textiles, paper and composite materials by extracting the fibre from discarded/abandoned leaves. The leaves of the pineapple yield strong, white silky fibres which can be spun into fine textile grade yarn on jute as well as cotton spinning system. Pineapple leaf fibre (PALF) fabric is marketed as pina fabric in the Philippines. Freshly harvested green leaf bundles are used for fibre extraction. The leaves of Pineapple were considered as agro-waste in the past due to lack of knowledge about the potentiality of Pineapple Leaf Fiber (PALF). But in the era of modern science it is thought as a good source of eco-friendly fibers. Although it was not well known and most useable fiber, now researchers are trying to introduce Pineapple Leaf Fiber as a golden fiber like jute from the commercial point of view. Increase in the living standards of the people as well as in consumption lead to the development of fibers and fabrics focusing on the green environment. Natural fiber has been an important textile material in human civilization. The fabrics of pineapple leaf fiber are easy to print and dye, sweat-absorbent and breathable, hard and not wrinkling and it has good antibacterial and deodorization performances.

Extracting Fibre Using Decorticating Machines

The leaves are fed manually in the decorticating machine for scraping by the revolving blades. Decorticated fibres after washing with water are sun-dried. Extraction methods for pineapple leaf fibre nowadays fall under the waste products of pineapple cultivation. A special purpose machine having metal knife scraper roller and the serrated roller is used to scrap out the waxy layer, and at the same time with retting process, the pineapple leaf fibre is also extracted. Study conducted by Yusof et al. revealed that PALF produced by decorticating machine was more soft, bright and had creamy white colour instead of brown when compared to the conventional method.

Chemical Modification

Alkali treatment or mercerization using sodium hydroxide (NaOH) is the most commonly used treatment for bleaching and cleaning the surface of natural fibers to produce high quality fibers. NaOH reacts with hydroxyl groups of the cementing materials in natural fibers and brings on the destruction of the cellular structure, thereby spitting the fibers into filaments. Hydrogen peroxide (H₂O₂) bleach improves PALF fineness by 5-6% but reduces the tensile strength by 40-45%.

PALF Application

Application of PALF in Textiles:- PALF could be successfully spun in the cotton spinning system with slight modifications to produce 100% PALF yarn and their blends with other natural and synthetic fibers, especially with cotton. The yarn thus produced was used to make fabrics, fancy carpets, mops, curtains etc. The major end use of the pineapple fiber is the Barong Tagalong, wedding dresses and other Philippine formal dresses. Again, table linen, mats, bags, shoes (leather like substance), sports item, baggage, automobiles, cabinets, and other clothing items. Another application is thread and fine casting nets. Pineapple yarn and pineapple-jute-blended yarn are used for fashion fabric development, like fashion bag, curtain and furnishing fabrics and pineapple-acrylic-blended yarns are used to produce fancy apparel products.

Conclusion

This study has clearly revealed the present research condition of PALF. Different physical and mechanical properties such as density, tensile strength, elongation and diameter have been stated. Although the diameter of PALF is higher than other natural fiber, due to its high strength and outstanding physical and mechanical properties it is possible to convert this agro-waste to value added product by simple chemical modification. It is also possible to produce PALF yarn in conventional spinning process without any additional cost that effectively helps to reach zero waste management. It will be helpful for the researcher to conduct better research on PALF.

References

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