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Banana fiber: A sustainable revolution in fashion and textiles

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Abstract

The fashion industry is beginning to recognize the potential of banana fiber. Several prominent fashion houses and designers are planning to employ banana fibers in forthcoming collections. The biodegradability and low environmental impact of this fiber make it ideal. The fiber from the banana plant has been used to make high-quality textiles for a very long time. Banana fiber textiles are eco-friendly garments with market potential for boosting rural employment opportunities. In order to survive in this world, humans need basic necessities such as clothing and furniture. However, the synthetic fibers used in most modern clothing and home furnishings contribute to air pollution, have an adverse effect on ecosystems, and so on. As an alternative to synthetic fibers that are harmful to the environment, natural fibers are making a comeback. Mandana Art is one kind of traditional artwork that is put to use in the reimagining of Mandana motifs via painting on women's clothes and highlighted through Kantha Work, a form of traditional embroidery. Based on the findings of this study, it can be concluded that banana fiber apparel has a high manufacturing value and is thus simple to manufacture and sell in the retail market. By putting it to good use, we can reduce our reliance on virgin resources like agricultural fibers and synthetic, petroleum-based substitutes.

Keywords: Banana yarn, fabric, apparel, home furnishing, Mandan, motifs

Introduction

Bananas are grown on more land in India than anywhere else in the world. It is estimated that production of bananas in 2020 would reach 32 million metric tons, up by around a million metric tons from 2019. Banana fibers are used to create this fabric. Not the soft, delicious center, but the outer and inner peels, which have a lot of fiber. Bananas, like hemp, have a flowering and a stem portion, both of which may be harvested for their fibers. Although this has been done for millennia, it is only lately that the Western fashion industry has realized the banana might be used as a cloth. Banana fibers may be readily intermixed with other fiber types. Our fabric, made from a blend of 80% banana fibers and 20% unbleached cotton, is soft, lightweight, and comfortable to wear. Easily put this fabric to use in making clothes or adorning your house. Fabric with a thick, unique appearance and a shiny sheen may be achieved by blending 50 percent banana fibers with 50 percent bleached cotton fibers. As environmental concerns grow, so does the demand for natural fibers throughout the globe. It has been shown that synthetic fibers derived from petroleum-based substances are hazardous, non-biodegradable, and resource-intensive. Because of their low cost and exceptional mechanical characteristics, natural fibers are being employed more often in composites. The future of agro-based fibers looks bright with these possibilities. Among the many agro-based, natural cellulosic fibers now on the market, banana fibers stand out as having particularly promising applications. There is no doubt about its long-

term sustainability, and it has enormous promise in the textile sector. In India, there is a wide variety of methods available for obtaining banana stem fibers. Many small enterprises in southern India rely on banana fiber to create one-of-a-kind products. Bananas are appropriately called kalpatharu since they are a food fruit crop and because almost every part of the plant may be used to some useful purpose. This ancient plant is often cultivated because of its usefulness as an alternative to citrus fruits. India accounts for around 20% of global banana production. The stem, which may include fibers, is often thrown away after bananas are harvested. Waste management is a major problem for farmers that produce bananas due to the difficulty of discarding pseudostem. Most of them are wasted because their potential uses are not fully appreciated. Banana pseudostem fibre is plentiful, but its prospective uses have not been explored yet.

Literature review

Elayaperumal, Tholkappiyan (2016) ^[1] This study investigates how different alkali and softness treatments affect the physical, chemical, and mechanical qualities of banana and banana: cotton fiber blended yarns and textiles. Aloe vera, castor oil, cotton seed oil, and soap were used to soften the fibers after they had been scoured, bleached, and mercerized with varying percentages of NaOH, H₂O₂, and Na₂CO₃. According to the results of the mechanical characterization, the concentrations of NaOH, H₂O₂, and NaCO₃ all lowered the single yarn strength, tensile strength,

rip strength, and torsion stiffness. Banana fibers have been treated with NaOH, H₂O₂, and Na₂CO₃ to reach the necessary fineness (spinnability), or 5.8 tex. Banana-cotton mix textiles are just as washable and fade-resistant as their pure cotton counterparts, both when dry and wet. The physical, chemical, and mechanical characteristics of banana and banana: cotton fiber blended yarns and textiles are investigated, as are the effects of different alkali and softness treatments. Different quantities of NaOH, H₂O₂, and Na₂CO₃ were used to scour, bleach, and mercerize the fibers, while Aloe Vera, castor oil, cotton seed oil, and soap were used to soften the fibers. As the concentrations of NaOH, H₂O₂, and Na₂CO₃ were increased, the mechanical characterisation showed a reduction in the single yarn strength, tensile strength, rip strength, and torsion stiffness. Fastness qualities of the banana: cotton mixed textiles demonstrate equivalent to the 100% cotton fabrics in dry and wet situations, and the appropriate (spinnability) fineness (5.8 tex) of the banana fibers have been reached using NaOH, H₂O₂, and Na₂CO₂ combined treatments. Ahmad Suhaimi, *et al* (2020) ^[2] There is a plentiful supply of banana stem fibers in Malaysia. Banana pseudo stem fibers were the subject of this investigation into weaving. Banana stem yarn and cotton yarn both made up 100% of the total output. Two distinct retting processes—retting with water and retting with a softening agent—were tested. Using the fibers, a simple weave cloth was woven. Yarn twist, yarn evenness, yarn linear density, and other fabric physical parameters were measured and compared across all samples. The findings revealed that the area density and thickness of the fabric made from softened banana stems were reduced and increased, respectively. Both the bending length and the flexural stiffness of the weft sample retted in softening agent are greater than those of the sample retted in water. This may be because the shedding process is facilitated by the decreased stiffness of the yarn, which facilitates the insertion of yarn. The coarser yarn used in weft samples retted in water results in a shorter bending length and increased fragility. It has been discovered that the yarn's linear density, area density, fabric stiffness characteristics, and flexural rigidity are all influenced by the softening agent used in retting banana stem fibers. Hawas, Hafez (2021) ^[3] The focus of this investigation is on the impact of the mixed ratio of bananas and the weave structure on the comfort characteristics of finished clothing textiles. Nine samples were woven using a variety of weave structures (simple 1/1, twill 2/2, and satin 4) using a mixture of banana/cotton blend and 100% cotton yarns for the weft. The results of the experiment showed that the air permeability, fabric stiffness, and water vapor permeability were all directly related to the amount of banana fibers used in the samples (WVP). Satin 4, regardless of weave structure, scores best in all categories of comfort. Jayakumari, M & Manonmani, G & Sathyam, R. (2018) ^[4] Plant fibers have been very important to humanity. A variety of natural fibers have been used for many purposes since their discovery and use was recorded in antiquity. The banana plant is not only a source of bananas for human consumption, but also of a wide range of other commercially useful items. Cellulose accounts for 43.6% of banana fibers, whereas hemicellulose accounts for 14%, lignin for 11%, and the remaining 31.4% consists of compounds like pectin and wax. The investigation of these

fibers might lead to the creation of a wide range of urgently required technological textiles. The research conducted here is intended to pave the way for the creation of technological textiles with several beneficial properties, such as invulnerability to flame and the ability to inhibit the growth of microorganisms. Chattopadhyay, S. & Pan, N. & Roy, Alok & Samanta, K. (2018) ^[5] Jute is a lignocellulosic bast fibre that is often used in the production of many types of packaging. Banana fibers, on the other hand, are harvested from the underused sheath of the banana trunk and used to make ropes for everyday usage. The 8lb yarn was made from a variety of blends including jute and banana fibers (both natural and bleached), with some of the ratios being 75:25, 50:50, and 25:75. With the same mix ratio, the strength of yarn made from bleached jute and banana fibers is much greater than that of yarn made from grey fibers. Cotton warp and a jute/banana-blend weft have been used to make union textiles.

Banana fiber-An eco-friendly textile

The majority of the world's bananas come from India, which accounts for 22 percent of the world's total banana output. Thousands of farmers in India are able to support their families via the production of banana fiber, which is also used in the textile industry. Banana-based fabric is gaining popularity in the fashion industry because to its numerous useful properties, and many high-profile designers and fashion houses have begun using it. Banana fiber is more sustainable and recyclable than other synthetic fibers. It has been established that the production of synthetic fibers requires a lot of energy and uses harmful and nonbiodegradable materials. The low price and high mechanical properties of natural fibers have led to their widespread usage in composites. This bodes well for the future of agro-based fibers. When compared to other existing agro-based, natural cellulosic fibers, banana fibers stand out as particularly promising. There is no doubt about its long-term sustainability, and it has enormous promise in the textile sector. In India, you may choose from a variety of methods for processing banana stalks into usable fiber. Banana fiber textiles are popular in many banana-producing nations, where they are both manufactured and consumed. Since ancient times, bananas have been used in Japan and Nepal as a great source of fabric for the creation of high-quality textiles. Banana fibers have been utilized to make traditional Japanese garments like kimonos and kamishimo since at least the 13th century. The outer sheath of pseudo stems may be used to generate textiles using well-suited and traditional banana plant varieties in India, where over 1.5 million tonnes of dry banana fibers can be produced yearly. All the households in these areas in southern India now rely on the revenue from banana fiber cultivation. The versatility of banana fiber is shown by the many products made from it. These include saris, pillow covers, tablecloths, currency paper, banana paper, sanitary pads, and even shipping cables, ropes, and cordages.

1. Banana Fiber uses

Banana plants have several applications besides being a great source of fiber, including medicinal, alcoholic, and starch-based ones. Banana fiber was really developed centuries ago, but its potential applications are still largely

unknown in the textile business. Manufacturing of banana fiber began in Japan in the early 13th century. As other fibers like cotton and silk gained popularity, their usage in the textile industry waned. Banana fibre is making a comeback in the fashion industry at the moment. The globe over, this fiber is put to use in a wide variety of items, from tea bags and automobile tires to saris and Japanese currency. This banana fibre is used to make high quality textiles in Japan and Nepal. It finds further use in the paper manufacturing and arts and crafts sectors. Banana fibre has high tensile strength and stiffness, making it a possible fibre. This increases the quantity of yarn that can be produced due to the longer fibers. Banana fiber may be used with other fiber types, whether they are natural or synthetic, due to its better yarn strength. The extraction of fiber from the banana plant's pseudo stem is gaining popularity as the demand for natural fibers rises. Ropes are often made from the fibers in Indian handicrafts. It may also be used in the production of papers, furniture, fishing nets, shipping cables, masonry drilling cables, power transmission ropes and cordage, and much more besides. The textile industry has long relied on this fiber for the production of doormats, ropes, and a variety of other products. In recent years, there has been a rise in the production of polymer composite materials for use as a reinforcement. People choose to wear it throughout the summer because of how light it is and how comfy it is. Banana fibers are used to create fashionable household items including tablecloths, pillow covers, curtains, carpets, neckties, and tote bags. Banana fiber is put to use in many different ways around the globe, from the manufacture of socks in Europe to the production of clothing in the Philippines and Japan. Banana cultivation for use in Japanese textiles has been practiced in much the same way from at least the 13th century. Banana fibers are combined with polypropylene to provide reinforcement for automobile floor panels. It cleans water naturally and may be used as a sorbent to clean up oil spills in refineries. Banana fibers are widely used in the manufacturing of marine cordages, cardboards, tea bags, string thread, fabric material, and rope for tying. Japan's traditional ceremonial clothes are often woven from banana fibers. In Nepal, the outer sheath of the plant is woven into textiles that are used as place mats, floor mats, and sunshades. Banana fiber's market value has been rising in tandem with the proliferation of uses for the material.

2. Banana fibre a more sustainable substitute to Silk

Banana fibre has been around for quite some time, despite the fact that few people know about it. In Japan, banana stem fiber production dates back to the early 13th century. However, the popularity of cotton and silk from China and India led to a fall in the use of banana plants as a source of fiber for textiles. However, recent years have seen a revival of banana fiber's use in the fashion sector. Banana fibre has recently made a resurgence in a variety of sectors and is utilized globally in a wide variety of items, from tea bags and automobile tyres to saris and Japanese yen notes. Banana fibers have several practical uses, including in the production of ropes, mats, woven textiles, and even paper. Green Banana Paper is a firm in Micronesia that uses banana fiber to create vegan wallets, handbags, beads, and paper. The Green Banana Paper, created by Matt Simpson,

uses waste from the island's ubiquitous banana crop in its manufacturing process. The firm buys banana stems from banana growers so that the stems may be processed into something useful, and the farmers don't have to throw them away.

Fabrication of blanket through eco-friendly banana fiber

Synthetic components and chemistry have been rethought in light of industrial advancement in order to better meet the needs of the textile industry. It has joined a growing list of polluting sectors that have a significant impact on the health of our planet, particularly in terms of water and soil. The creation of textiles necessitates the use of and subsequent discharge of chemicals that are toxic to aquatic life and cause soil and water contamination. The use of harmful pesticides and chemical fertilizers is necessary for the management and improvement of the quality during the cultivation of natural fibre, including fibres from plants and animals. Toxic and nonbiodegradable chemicals are employed in production, altering the natural environment. Drought, high temperatures, and increased global warming are all caused by the imbalance of these natural resources. Processes for making textiles are gradually shifting toward an eco-friendlier and more long-term sustainable model. This study proposes using the leftover banana trunks in the textile production process, so introducing a new natural fiber alternative as a byproduct of banana fruit agriculture. Several commercially accessible items have been produced using banana fibre. When it comes to environmental, social, and economic sustainability, organic banana fibre plays a crucial role in the textile industry by delivering higher-quality, more sanitary goods. Natural fibers like cotton, which remains a resource-intensive material, and petroleum-based fibers like acrylic, polyester, nylon, and spandex are highly traded despite the industry's trend toward a future when textile resources are limited. However, because of the long-term environmental harm that the manufacture of these fibers' causes, businesses are looking for eco-friendly substitutes. Sustainable options and new textile technologies are being sought after on a global scale. In this section, we look at a promising use of banana fiber. Banana fibre is a bast fiber with decent mechanical qualities that is extracted from the pseudo-stem of the banana plant (*Musa sapientum*). Natural fibers provide immediate benefits like lower density, precise stiffness and mechanical qualities, higher disposability, and more sustainability. Not only that, but they can be recycled and broken down naturally.

1. Motifs of Mandana Art in Fashion Product

The word mandan, meaning "ornament" or "decoration," is whence the term mandana was originated. Chitra mandana may be both the name of the drawing process and the name of the finished product. Women traditionally use kharia (chalk solution) and geru to design mandalas (red ochre). The surface is first primed with a mixture of cow dung, rati (local clay), and red ochre; then, using a piece of cotton, a tuft of hair, or a simple brush created from a date palm frond, the pattern is drawn with chuna or chalk powder. Floral motifs, cats, tigers, lions, the swastika, Ganesha, working ladies, and symmetric geometric patterns are only some of the designs that are common, although they range

from simple line drawings to intricate iconic representations of gods and goddesses. Look for the Mandana art that decorates the walls and floors of Madhya Pradesh's many buildings. Mandana paintings are among the most ancient kinds of Indian tribal art still in existence today. Khariya (a chalk solution) and Geru (a wooden tool) are used to create this distinctive style of art, which has its roots in the Indian states of Madhya Pradesh and Rajasthan (red ochre). Creating these works of art brings back memories of helping our moms prepare for festivals and the arrival of gods at those times. It's not great for the environment to use and throw away plastic rubbish and shopping bags. Plastic pollutes the environment and takes a millennium to disintegrate, making land unusable for crops. Using a cotton or natural-fiber bag is the first step toward sustainable fashion, and it's also our societal obligation to maintain our world clean and pollution-free. For both financial and ecological reasons, it is preferable to reuse a disposable bag many times before throwing it away.

Conclusion

This research relates to eco-friendly materials. In this research, we speculate on how the banana yarn eco-friendly fibers may be put to use in order to gain a commercial edge. Significant benefits are provided by natural fibers, such as lightweight construction, satisfactory stiffness and mechanical qualities, and easy disposal or recycling. Not only that, but they can be recycled and broken down naturally. Banana fiber might be used as an innovative approach to lowering pollution levels and increasing economic growth for a brighter future. Eco-friendly clothing and materials have a positive impact on both society and the natural world. The banana plant is often considered to be one of the most valuable plants in existence. acknowledged as one of the most prized plants in the horticultural industry. The Mandana culture flourishes in Madhya Pradesh and the neighboring state of Rajasthan. Numerous plant components, including fruit, peel, leaf, pseudostem, stalk, and inflorescence, may be put to good use. Scientists have so began extracting the stem's fibers and other components for use in the manufacture of a wide range of high-value products.

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