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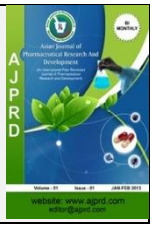

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Review Article

# A Review on Banana Fiber and Its Properties

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## A B S T R A C T

There are many types of natural fiber including hemp, flax, jute, wood fiber, rice husks, straw wheat, oats, bagasse, barley, grass reeds, banana fiber, oil palm empty fruit bunch, coir, sisal, cotton, kenaf, ramie, water pennywort, paper-mulberry, kapok, abaca, pineapple leaf fiber. The production of banana in India is 13.5 million tons per annual. Banana forming generates more quantity of biomass which goes as waste. The above ground parts like pseudo-stem and peduncle are the major source of fiber. Banana fiber used as a raw material in industry for production of papers, tea bags, currency and reinforced as a polymer composite. Natural fiber is used as an alternative resource to synthetic fibers as well as reinforcement for polymer composite materials and the manufacturing is inexpensive, renewable and environment friendly. Natural fibers have low cost, low density and low durability as compare to synthetic fibers but with the help of fiber treatments, mechanical properties of natural fibers are improved. In this paper, banana fibers are compared through their applications, use and properties and thus it is concluded that the banana fibers provide better chemical composition and properties.

**Keywords -** Banana fibers, Composite material, Natural fibers, Synthetic fibers.

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## INTRODUCTION

Banana fiber is a dialect cellulosic fiber, which got from the pseudo-stem of banana plant. Banana fiber is a bast fiber with generally great mechanical properties. Banana fiber has great explicit strength properties similar to those of ordinary material, similar to glass fiber. This material has a lower thickness at that point glass filaments. The pseudo-stem is a barrel shaped, grouped accumulation of leaf tail bases. Banana fiber at is a side-effect of banana development and either not appropriately used or in part done as such. Helpful utilizations of such strands would regularize the interest which would be reflected in a fall of the costs. Banana strands have profoundly strength, lightweight, more modest extension, imperviousness to fire quality, solid dampness ingestion quality, extraordinary possibilities and biodegradability.

Banana fiber has perceived for clothes and home goods Banana fiber has extraordinary possibilities for papermaking uncommon interest of carefully assembled paper. Banana fiber is making items like channel paper, paper sacks, welcoming cards, light stands, and pen stands ornamental papers, rope, mats and composite material and so on Banana fiber is utilized in cash notes in Germany and preliminary attempt in India too. Polypropylene reinforced with banana fiber is utilized via car organizations for making under floor security boards in lavish vehicles like Mercedes. Banana fiber generally utilized in making crafted works and home improving. Composite material of banana fiber utilized in structures sheets and imperviousness to fire sheets. During the examination it was discovered that paper made out of this fiber has long existence of more than 100 years as it is most grounded of the long filaments over discovered other normal strands, which can be collapsed 3,000 times. It tends to be utilized cash and worth capable reports like composition archive preserver.

### Fiber Extraction

PK Das, D Nag, S Debnath & LK Nayak [1] has studied on how vegetable fibers are produced from bast, fruit, seed, leaf, and sheath of plants. They are discrete of single entities as in cotton; ligno-cellulosic meshy as in jute and mesta; long as in jute, mesta, flax, sisal, ramie, pineapple

leaf fiber (PALF); and short as in areca nut, kapok. Some of them like cotton and ramie are strong and fine with high length to breadth aspect ratio for good spin ability into yarn for fabric. Primarily, cotton is used for apparel; jute and mesta for packaging; ramie for fabrics, ropes and currency paper blanks; sisal for rope; flax for linen; sun hemp for rope and tissue paper, etc. Ramie is the strongest amongst all the vegetable fibers and, therefore, it has great promises for specialized applications. The traditional uses of some vegetable fibers are in packaging of food grains, sugar, potato, onion, etc. Emphasis has, therefore, been given to crops like jute, mesta, sisal and PALF right from their extraction to finished products like yarns, fabric, sacking, hessian, ropes, twines, soil-savers, craft papers, etc. through mechanical processing and intervention of a host of machinery. The need for production of fine yarn/blended yarn has become acute in the context of manufacture/export of fabrics and ready-made garments. Therefore, it becomes essential to explore all spinning technologies for production of market friendly yarn. K.

Sunita Chauhan and Sharma AK[2] stated that today, biotechnology is perceived as a revolution throughout the world. With biotechnology, certain crops have been developed that can withstand the brutalities of weather changes, helping poor farmers of the developing countries to retain their yield and increase their output manifold. Biotechnology has also made agriculture more competitive and sustainable by creating new non-food markets for crops. To exploit the vast potential of biotechnology involved in non-food plant-products, the present study was taken up to explore the possibilities of improving the fiber extraction process of banana plant with the help of commercially available pectinase enzyme. Waste biomass of banana plant is widely available in many countries and the fiber extracted from its pseudo stem has utility for diversified range of applications including the manufacture of good quality handmade paper. The enzymatic treatment of green stem and trunk of banana plant before extracting fiber with the Raspador machine has resulted into an improvement in the yield as well as the quality of fiber obtained. This may not only result into a better utilization of the waste biomass of banana plant but may also increase profitability of the banana cultivators besides providing a source of good raw material for making handmade paper.

Vadivel K, Vijaya kumar A, Solomon S, Santhosh kumar R[3] has done paper on design and fabrication of banana fiber extraction machine to develop high quality banana fiber from banana pseudo stems. Banana fiber is a best fiber with good mechanical properties. Manually extraction of the banana fiber better quality of fiber but it much time consuming. Labor expense is high. Now day's machines exist for extracting banana fiber with mass production. The number of machines are available in current scenario in India. But quality obtained from that the local machine is not impressive. This paper explains the newmodel of machine and its working. The new machine will over coming like breakage in fiber, knot formation and discontinuous length of fibers.

**Application of Banana Fiber**

M. Y. Arafat and et all.[4]has studied that banana fiber is a natural fiber with high strength, which can be blended easily with cotton fiber or synthetic fiber to produce composite material. In the fiber extraction process, a substantial amount of lignocellulosic wastes are generated, disposal of which creates problem in the adjacent area. In this paper, extracted banana fiber (EBF) and waste banana fiber (WBF) were characterized in terms of chemical and morphological properties to produce handmade paper. WBF was characterized with lower α–cellulose, lignin content and longer fiber length. Pulping of EBF and WBF was carried out with varying active alkali and cooking time at boiling temperature. Pulp yield of WBF was 35.9%after 120 min of cooking with 8% alkali charge. In the unbeaten state the degrees of drainage resistance i.e. SR values were 65 and 71 for EBF and WBF, respectively. The tensile, burst and tear indices of WBF were 23.7 N.m/g, 2.2 kPa.m2/g and 5.0 mN.m2/g, respectively; these were much lower as compared to EBF. These values however, meet the requirement for handmade paper.

Ms. Ankita Shroff and et all.[5] has studied that India is the world's largest producer of banana. The fiber has limited application in textiles due to its high stiffness and less cohesive properties. The aim of the study was to remove noncellulosic gummy materials from banana fiber thus softening it and prepare nonwovens through needle punch method. Grey banana fibers were treated with hemicellulase, pectinase and cellulase enzyme individually by varying its concentration and time. This optimized treatment was treated with different combination of enzymes, and then standardized. The effect of the enzymes on the fibers was measured in weight loss, strength loss and whiteness index of the fiber. Subjective analyses by touch and feel method, SEM analyses were also done. The best softened fibers were then processed for preparation of nonwovens through needle punch method at NIRJAFT Kolkata.

**Properties of Banana Fiber**

D. Jagadeesh, R. Venkatachalam, G. Nallakumarasamy [6]has found that today engineering industries are seeking to produce eco-friendly materials. Natural fibers havedistinct properties like high strength, low weight, low cost processing and bio degradability than synthetic fibers such as glass fiber and carbon fiber. Some of the annual natural fibers are banana, jute,coir, bamboo, hemp, etc.. ,among these fiber banana fibers have high strength and plenty in availability. Present work divulges extraction of banana fibers, study of mechanical, chemical, physical behaviour of banana fibers. Chemical treatments, processing techniques, surface morphology, hybridized characterization of banana fiber has been reviewed.

P.Dilleswara Rao, D.Venkata Rao, A. Lakshumu Naidu, MVA Raju Bahubalendruni[7] reviewed that natural fiber based composites are drawing in numerous researchers and scientists due to their eco-incommoding nature and specific properties. They are of ease and to a great extent accessible

in nature. Their handling isn't hard correlation with the ordinary filament's generation. Bio-degradability is another preferred standpoint from characteristic fiber composites that draw in numerous scientists for condition concern jump at the chance to lessen nursery impact etc. Natural filaments are promptly accessible in stringy shape and can be separated from stem and leaves at low expenses. Banana fiber is one of the characteristic fibers with better mechanical properties. This audit paper inspects the mechanical properties of banana fiber. Mechanical properties of some banana strengthened composites and most regularly utilized assembling methods generation of banana fortified composites are considered. Key Words: Banana fiber, Bio-degradability, Mechanical properties, strengthened composites, composite fibers.

R. Bhoopathi, M. Ramesh, R. Rajaprasanna, G. Sasikala and C. Deepa[8] In there experimental work the effect of mechanical properties on incorporation of glass fiber with treated banana-hemp fibers has been studied. Methods/Statistical analysis: Banana and hemp fibers are extracted by enzymatic processes for successfully removing lignin. The alkaline solution was used to treat the fibers since it is increasing their mechanical strength. The banana, hemp and glass fibers were reinforced with the epoxy matrix and the hybrid composites were fabricated by using hand layup process. Alternative orientations of fibers were used for the fabrication of the laminates in order to improve their strength. Findings: As per the ASTM standards, test specimens were prepared from the laminates with the stacking sequence of glass/banana fiber, glass/hemp fiber and glass/banana/hemp fiber. The mechanical characteristics were obtained by impact test, tensile test and flexural test for the fabricated samples. The interfacial analysis was conducted using scanning electron microscope to estimate voids, fractures and fiber pull out. The experimental result shows that the glass/banana/hemp fiber composite exhibits maximum tensile strength than the other two combinations. The hemp-glass fiber composite holds the maximum flexural strength followed by glass/hemp/banana fiber composites. The glass/banana fiber composites hold maximum impact energy and the value of the composites varies from 7.33 to 9.33 Joules. Application/Improvements: These composites are performing well in all kind of mechanical loadings. It is suggested that these materials can be used in the relevant fields.

Ricardo Mello Di Benedettoa, Maria Virginia Gelfusoa, Daniel Thomazinia[9] presented paper on surface treatments done in banana fibers (BFs) can generate significant superficial structural changes enabling the production of mechanically stronger composites. In this way, the objective of this study was to evaluate the physicochemical and mechanical properties of banana fibers of Prata specie from inner and outer leaf sheaths, when irradiated with UV light (λmax = 400 nm) during 7 (UV7) and 15 (UV15) days. Structural and microstructural characterizations for non-and irradiated fibers were performed by, FT-IR spectroscopy and Scanning Electron Microscopy (SEM), which showed the influence of UV irradiation on BFs surface and chemical structure. The EA involved in the thermal degradation process of In Natura fiber (188.2 kJ.mol–1) was obtained using Differential Thermal Analysis (DTA/TG). The results obtained from mechanical characterization showed that the UV7 fibers presented significant improvement in tensile strength (89.77 MPa) and elastic modulus (238.94 MPa) as compared to tensile strength (69.99 MPa) and elastic modulus (87.40 MPa) of In Natura fibers. Statistical analysis using two-way ANOVA has showed that there were no differences between mechanical properties of BFs from inner to outer leaf sheaths. UV radiation has proved to be a clean method for BF surface treatment, which can improve the mechanical properties of composites based on these fibers.

Bhuvneshwar Rai1, Gulshan Kumar, R. K. Diwan and R. K. Khandal[10] studied on the utilization of coagulum of euphorbia as binder in polyester banana fiber composite. Euphorbia coagulum (dried latex) is rich in resinous mass (60-80%), which are terpenes and polyisoprene (10-20%). Effect of varying percentage of coagulum content on various physico-mechanical and fire properties of polyester banana fiber composites has been studied. Since banana fiber is sensitive to water due to presence of polar group, banana composite undergoes delamination and deterioration under humid condition. Alkali treated banana fiber in the polyester banana fiber composite results in improvement in overall mechanical properties and reduction in water absorption. The best physico-mechanical properties have been achieved on replacing 40% of polyester resin by coagulum. An increase of 50% in bending strength, 30% bending modulus and 45% impact strength as well as 68% decrease in water absorption was observed. Incorporation of coagulum in polyester banana fiber composite enhanced limiting oxygen index from 18 to 21% with the reduction of smoke density. The developed composite material can beutilized for the partition board, particle board etc. This study presents the possibility of utilization of renewable materials for environmentally friendly composite development as well as to find out alternative feedstock for petroleum products.

## CONCLUSION

The current paper investigates the possibility of banana fiber stresses both mechanical and actual properties furthermore, their substance arrangement. Properties of banana strands are better as look at than other regular filaments. The uses also, utilization of the less expensive products in superior machine is conceivable with the assistance of this composite innovation. Joining the valuable properties of two unique materials, less expensive assembling cost, adaptability and so on, makes them helpful in different fields of designing, elite applications like recreation and outdoor supplies, transporting ventures, Aviation and so forth On the off chance that we talk about the eventual fate of banana filaments, are exceptionally brilliant on the grounds that they are less expensive, lighter and earth better than glass fiber or other manufactured strands composites as a rule. When contrasted with other

fiber banana strands are generally helpful for materials, strength,moisture ingestion, hardness and fineness. Subsequently, with this back ground, it is reasoned that, the composites stand the most needed innovation in the quickly developing latest thing.

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