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# Natural Fibre Reinforced Composite

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***Abstract*: Offering a solution based on a review of the literature on the issue of non-biodegradable composite in textiles, with a natural fibre reinforced composite and also with a highly adaptable and recyclable polymer. The process of extracting banana fibres, followed by the decision to use banana fibres because of their high mechanical strength. Choosing a fabrication technique that is compatible with both the polymer and the fibre. Therefore, for this fabrication, the compression molding technique is adopted. Next, the polypropylene polymer is examined for mechanical strength and other desirable qualities after being selected at its appropriate thickness for sustainability.**

***Keywords*: Fibre, polymer, banana fibre, fabrication, polypropylene, compression molding.**

## 1. Introduction

A composite material is defined as a multiphase material composed of two or more components with specific properties. Reinforcement and matrix are the two main components of any composite material. Reinforcements are the main building blocks of composites and are responsible for most of the loads on composites. The reinforcement has to absorb the load, so it must be hard, brittle and strong. The matrix is the composite component that surrounds the reinforcement. It just protects and supports the reinforcement. There are various factors that affects the properties of composite materials, those are Reinforcement and matrix type, reinforcement placement and distribution, amount of reinforcement, and manufacturing process for composites Light weight, water resistance, chemical resistance, high durability, electrical resistance, fire resistance, and corrosion resistance. They are also used in infrastructure and structural applications. Fibre reinforced composites use different types of fibers such as glass fibres, carbon fibres, natural fibers as reinforcements and polymers i.e., plastics, resins, rubbers or metals as matrices.

## 2. Composites

Previously, only reinforced composite materials based on synthetic fibers were used due to their low cost and good mechanical properties. These composites use glass fiber or carbon fiber as reinforcement for the composite. Sustainability is a major concern of all research today. There is a great need and challenge for all industries to replace unsustainable products with sustainable ones for development. In addition, traditional energy resources are finite and environmental concerns are growing, requiring a switch to renewable raw materials when developing new components. For the reasons mentioned above, this has led to the replacement of synthetic fibers with natural fibers as reinforcements in fiber-reinforced composites. Apart from that, natural fibers also have many other advantages compared to synthetic fibers such as less greenhouse gas emissions, recyclability and CO2 neutrality. In addition, natural fiber composites contain higher fiber content, which gradually reduces the content of harmful base polymers in the composite. Natural fiber reinforced composites are therefore environmentally safe. Natural fiber-based composites are widely used in automotive applications. Because it is lighter, it consumes less fuel and emits less harmful gases. Natural fiber reinforced composites are also widely used in electronics and sporting goods.

Fig. 1.

*Why Natural Fibre?*

Compared with synthetic fiber-based composites, natural fiber-based composites have outstanding properties such as low cost, light weight, biodegradability, high heat and sound insulation, as well as high specific strength and stiffness. In fact, synthetic materials based onsynthetic fibers have serious disadvantages such as high cost, high energy consumption during processing and manufacturing, poor and non-renewable recyclability, development of CO2 emissions and inhalationhealth risks. Natural fibre reinforced composites emerge as a promising alternative to synthetic fiber composites.

Unlike synthetic fibers, natural fibers can be burned at the end of their life with better energy recovery and zero net CO2 emissions, resulting in positive carbon credits and less impact on the environment such as global warming. Natural fiber composites have been used by automotive manufacturers and

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suppliers to replace a large number of synthetic and mineral fillers in many automotive interior and exterior parts. Because of the widening range of uses of NFRC in a number of industrial applications, the machining of these materials should be carefully considered for their different behavior compared to the machining of conventional metallic materials.

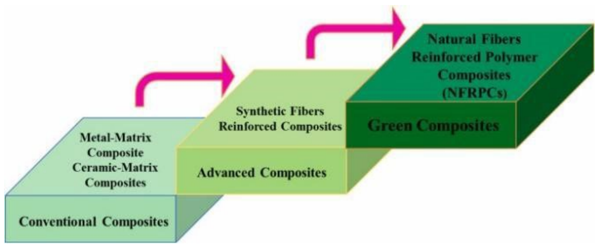


Fig. 2.

### 3. Modification of Natural Fibres

The main drawbacks of natural fibres in related composites are their relatively high moisture absorption and poor compatibility with the matrix. Therefore, it is thought that natural fibre alterations would alter the surface characteristics of the fibres and enhance their ability to adhere to various matrices. Strong interfaces that are extremely brittle and have easy crack propagation across the matrix and fibre can attain outstanding strength and stiffness. A weaker contact could decrease the effectiveness of stress transfer from the matrix to the fibre.

### 4. Processing Techniques

In general, natural fiber reinforced plastic composites are manufactured using conventional manufacturing techniques (designed for conventional fiber reinforced polymer composites and thermoplastics). The processing techniques are compounding, blending, extrusion, injection molding, compression molding, LFT-D, suitable for and studied for natural fiber reinforced thermoplastic composites. Resin Transfer Molding (RTM) and SMC, on the other hand, are implemented with a thermoset matrix. In addition to these processes, thermosetting compression molding and pultrusion using natural fiber composites are currently being investigated. To date, technology above has been well developed and the accumulated experience has proven its ability to successfully produce composites of controllable quality. Innovative technology and process solutions must be focused to acquire composites of high strength for many other applications.

### 5. Performance of Natural Fibre Composites

Tensile, flexural, and impact properties are the most commonly studied mechanical properties of natural fiber reinforced plastic composites. Impact resistance is one of the undesirable weaknesses of these materials in terms of mechanical performance. In addition to these tensile, flexural, and impact properties, the long-term behavior (creep behavior), dynamic mechanical behavior, and pressure properties of natural fiber composites are also investigated.

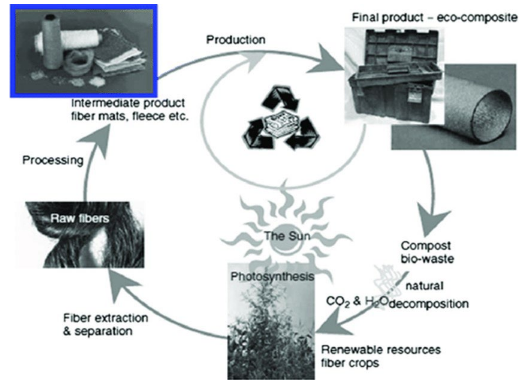


Fig. 3.

### 6. Developments & Applications

Behind the development of natural fiber composites are several that offer the potential economic impact, environmental impact, and ability of natural fiber composites to meet social, economic, and material needs around the world. There are important areas of interest for Advanced Natural Fiber Reinforced Polymer Composites helps improve biocomposite development in terms of performance and sustainability. There is a lot of research being done around the world and reflected in a huge recent review. Overall performance of natural fiber composites, biodegradable polymers and the effects of natural fibers on their biodegradation chemical treatment of natural fibers fibers and performance of chemically treated natural fiber composites, mechanical and physical properties of natural fiber composites, tensile properties, tribological properties, flame retardancy, mechanical behavior of natural fiber textile composites, natural fiber hybrid composites, aspects of fatigue analysis of natural fiber composites, and automotive application.

### 7. Results and Analysis

FIE Make Universal Testing Machine, UNITEK-9450 is used to test and analyze stress, strain properties of the composite. The peak point in graph represents the breaking point of the composite.

*Input Data*

Sample Type -- Rectangular Bar Area: 75.000 mm $^2$

Width = 25 mm Thickness = 3mm

Final Area: 18 mm$^2$: Gauge

Length: 600 mm

Final Gauge Length: 608 mm

Results of: Tension Test

Maximum Force (Fm): 0.400 kN

Disp. at Fm: 6.630 mm

Max. Disp.: 8.130 mm

Tensile Strength (Rm): 0.007 kN/mm$^2$

Elongation: 3.200 %

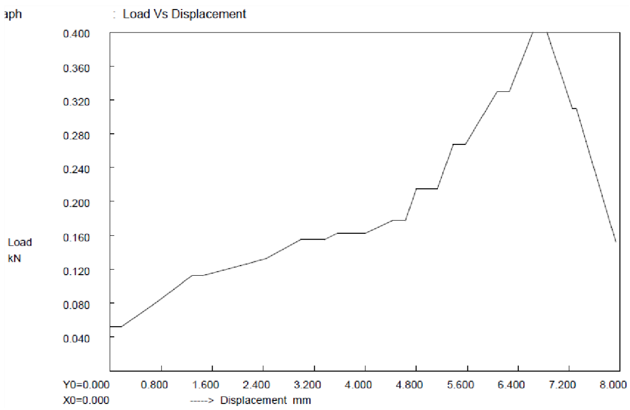


Fig. 4.

## 8. Focusing on Future Research

In the future, natural fiber composite will be used more and more in structural applications. Various other applications rely on further improvements. However, many issues still remain to be resolved before these composites can fully compete with synthetic fiber composites. Natural fiber composites are sustainable and fully recyclable, but fully bio-based and biodegradable can be more expensive and are highly sensitive to moisture and temperature. Natural fiber composites are 100% biodegradable when the proper matrix is used, but controlled biodegradation can be difficult.

Natural fibre composites have good particular qualities, although their characteristics are highly variable. With the development of increasingly sophisticated processing methods for natural fibres and their composites, their disadvantages can and will be overcome. However, due to their comparatively high processing needs, which in turn consume more energy, natural fibre composites' complete environmental superiority to synthetic fibre composites is still debatable. Therefore, the following topics should be the primary focus of future research:

1) To reduce fibre variability, fibre extraction should produce more technical and elemental fibres for incorporation into composite materials;
2) Improve the interfacial properties between the fibre and the matrix; and
3) To find a solution for moisture absorption issue linked to long-term durability (temperature, humidity, and UV radiation), fibre and matrix alterations, fire resistance, characteristics and durability, hybridization, and manufacturing and processing optimization subject to particular final products.
4) Thorough research should be done on biodegradability and life cycle assessment (LCA).
5) It is important to produce composites, matrix (thermoplastics and thermosets), additives, and coupling agents made from renewable resources. To completely achieve future environmental goals, the search for new and superior biopolymers to replace petroleum-based polymers should continue.
6) Multidisciplinary research including agricultural, biotechnology, polymer, and composite manufacturing aspects should be conducted.
7) Composite manufacturing technologies should be developed and utilised with new biobased polymers.
8) The inclusion of cellulosic nanofibers and inorganic nanofillers (such as nano clays) in natural fibre reinforced composite materials is a current trend and area of intense research for nanocomposites.

## 9. Conclusion

The use of natural fibers as reinforcing agents in polymer composites is reviewed in terms of condition, structure, performance, surface treatments, and applications. There is an explosion of interest in the field of natural fiber reinforced composites research, especially with respect to glass fiber-like properties in composites. Green Composites could be his material revolution of this century, focusing on sustainability, cradle-to-grave design, industrial ecology, eco-efficiency and green chemistry, of the new generation of green materials.

The success of natural fiber-reinforced polymer composites depends on appropriate processing techniques, fiber modification to improve adhesion between fibers and biopolymers, matrix modification and post-treatment to improve performance, and long-term It depends on durability and flame retardant.

## References


[1] https://www.researchandmarkets.com/reports/1933235/natural_%20fiber_composites_market_trend

[2] L. Shen, J. Haufe, M. K. Patel, Product Overview and Market Projection of Emerging Bio-based Plastics, PRO-BIP 2009, Final Report, Utrecht, The Netherlands.

[3] Satyanarayana, K.G., Arizaga, G.G.C. and Wypych, F. (2009) Biodegradable Composites Based on Lignocellulosic Fibers—An Overview. Progress in Polymer Science, 34, 982-1021.

[4] Faruk, O., Bledzki, A.K., Fink, H.P. and Sain, M. (2012) Biocomposites Reinforced with Natural Fibers: 2000-2010. Progress in Polymer Science, 37, 1552-1596.

[5] Li, X., Tabil, L.G. and Panigrahi, S. (2007) Chemical Treatments of Natural Fiber for Use in Natural Fiber-Reinforced Composites: A Review. Journal of Polymers and the Environment, 15, 25-33.

[6] John, M.J. and Anandjiwala, R.D. (2008) Recent Developments in Chemical Modification and Characterization of Natural Fiber-Reinforced Composites. Polymer Composites, 29, 187-207.

[7] Andrzej K. Bledzki, Abdullah A. Mamun, Adam Jaszkiewicz, Karsten Erdmann, "Polypropylene composites with enzyme modified abaca fibre," Composites Science and Technology, vol. 70, no. 5, pp. 854-860, 2010.

[8] Yanjun Xie, Callum A.S. Hill, Zefang Xiao, Holger Militz, Carsten Mai, "Silane coupling agents used for natural fiber/polymer composites: A review," Composites Part A: Applied Science and Manufacturing, vol. 41, no. 7, pp. 806-819, 2010.