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*Corresponding author

Roberto Tetsuo Fujiyama, Postgraduate Program in Natural Resource Engineering, Federal University of Pará, Brazil

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Opinion

Green Polymeric Composite: Natural Vegetable Fibers from Northern Brazil

Roberto Tetsuo Fujiyama*

Postgraduate Program in Natural Resource Engineering, Federal University of Pará, Brazil

Abstract

In this work, types of plant fibers that are used in the manufacture of polymeric composite materials are presented. The fibers presented are found in the northern region of Brazil. They are natural fibers that are commonly used for making decorative crafts. There are numerous plant fibers that are still under study, including the fiber extraction process for the manufacture of composite material. The fibers presented here have already been researched through static mechanical tests. This presentation shows vegetable fibers obtained from fruits, roots, stems and leaves. Evaluations in static loading in traction show that the fibers are promising for applications in replacement of synthetic fibers, fiberglass.

Introduction

The northern region of Brazil has a wide vegetation cover and with that an availability of natural resources for use in sustainable materials such as composite materials. In the forest system there are plants that can produce natural fibers from leaves, roots, seeds, stems and flowers. The fiber extraction processes are diversified and most of the fibers are obtained through manual methods. It is worth mentioning that many plant fibers are used for the manufacture of various decoration products, called handicrafts with natural fibers. Institutions and teaching and research centers have developed research involving the use of plant fibers. At the Federal University of Pará, the Research Group on Composite Materials has been developing research involving plant fibers with the intention of producing new sustainable materials, and with that the possibility of adding value to these materials. Advantages and disadvantages can be presented in relation to natural fibers. Among the advantages are low energy consumption, good mechanical properties, non-abrasive and availability and abundance [1]. As for the disadvantages, there is high moisture absorption, low compatibility with conventional resins and high anisotropy, resulting in less homogeneous fibers when compared to glass and carbon fibers [2]. In this context, some plant fibers are presented in Table 1, with the respective parts of the plant from which they are extracted and the shape and distribution they present after extraction. Research has given rise to numerous results that involve undergraduate and graduate students and researchers, thus generating good scientific production. Some composite materials are presented in Table 2, where the uniaxial tensile strength of these composites is presented, as well as the mass fraction for each type of fiber. Bearing in mind that the composites made with vegetable fibers are made of polyester matrix from Table 2 and were produced through manual molding or lamination, that is, the use of artisanal and manual manufacturing methods. Factors such as binding at the interface [3] between fibers and matrix and delamination due to moisture absorption are responsible for limiting the tensile strength of composites.

Variations in mechanical properties are associated with particular characteristics of plant fibers linked to environmental conditions [4] (sun, rain, soil). Factors such as processing and production can also affect the performance of natural fibers.

Table 1: Types of vegetable fibers in the northern region of Brazil.

Type of Vegetable Fiber	Part of the plant where they are extracted	Form / distribution
Tururi (*Manicaria Saccifera Gaertn*)	Between leaf and fruit	medium fibers
Miriti (*Mauritia flexuosa*)	Leaf	long fibers
Piaçava (*Attalea funifera*)	Between leaf and fruit	long fibers
Juta (*Corchorus capsularis*)	stem	long fibers

Table 2: Tensile mechanical properties of polyester matrix polymer composites with plant fibers from the northern region of Brazil.

Type of Vegetable Fiber	Tensile strength (MPa)	fiber mass fraction (%)
Tururi (*Manicaria Saccifera Gaertn*)	35,76	14,39
Miriti (*Mauritia flexuosa*)	12,54	2,63
Piaçava (*Attalea funifera*)	12,05	14,82
Juta (*Corchorus capsularis*)	22,79	5,94

Final Comments

Research involving plant fibers from the northern region of Brazil has shown to be promising and has shown satisfactory results. Factors such as availability and manufacturing methods, mechanical properties have produced research, scientific articles and patent production.

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