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ABSTRACTS

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Extraction and Characterization of Natural Fibers from Carandá (*Copernicia alba*) and Gravatá (*Bromelia balansae*)

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Natural fiber composites are emerging as an alternative to glass-reinforced composites in many applications. They also claimed to offer environmental advantages such as reduced dependence on non-renewable energy/material sources, end of life biodegradability of components, and lower pollutant emissions [1].

The aims of this work are to extract and characterize fibers of two plant species: carandá (*Copernicia alba*) and gravatá (*Bromelia balansae*). Carandá is a palm tree and gravatá is a kind of bromelia, both used in handcrafts by locals from Pantanal.

Extraction of the fibers was manually processed by a calendaring process in a Makintec calendar, with the species previously rehydrated. Mechanical properties of the fibers were measured according to ASTM standards for tensile properties (ASTM D3379[2]) using an EMIC DL 2000 equipment (500N load cell at a loading rate of 2.0 mm/min). It was determined from stress-strain curve the tensile strength, modulus and the elongation of the fibers. Themogravimetry, TGA, (TA Instruments Q500), was performed in temperature range from 25 to 800 °C with a heating rate of 10 °C/min under synthetic air atmosphere (20 mL/min) and it was determined the initial temperature of degradation (T_i) and ash content. Micrographs were obtained with a scanning electron microscope (Zeiss – DSM 960 SEM). Chemical composition of the fibers was determined according to the Standard TAPPI 222 om-88[3] and proposed methods by Browing[4] and Razera[5].

Table 1 shows the results of thermal, mechanical properties and chemical composition of the fibers, in terms of cellulose, lignin and hemicellulose content.

It was observed that, both carandá and gravatá, show mechanical properties and chemical composition similar to others natural fibers commonly used to reinforcement composites[6]. The T_i was determined about 240 °C for both fibers. It is important to determine T_i to be able to process composites using these fibers without its degradation.

Table 2. *Mechanical and thermal properties of carandá and gravatá fibers, and the main constituents of the fibers.*

Properties	Carandá	Gravatá
Tensile Strength (MPa)	889.1 ± 524.5	580.1 ± 227.1
Modulus (GPa)	36.0 ± 9.3	45.9 ± 15.6
Elongation (%)	3.10 ± 1.52	2.27 ± 1.48
T_i (°C)	243	246
Ash content (%)	1.5	1.0
Celullose (%)	41.7 ± 0.9	57.5 ± 0.7
Lignin (%)	21.0 ± 4.8	14.1 ± 0.7
Hemicellulose (%)	25.3 ± 0.9	28.5 ± 0.7

Figure 1 shows the SEM micrograph of carandá and gravatá fibers (500x). It is possible to observe the presence of smaller fibrils in gravatá and the presence of leaves residues in carandá fibers.

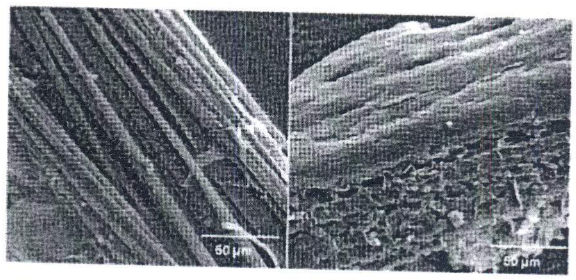

Figure 86. *Scanning electron micrographies of gravatá (left) and carandá (right) fibers (500x).*

The fibers presented different chemical composition and morphologies. The results of thermal and mechanical characterization show a potential of these natural fiber to enhance polymeric matrices. Allying natural fibers to biodegradable polymers, it is possible to obtain biodegradable composites. It is indicative that future studies involving environmental friendly materials must be realized. One great possibility is the use of a hydrophilic matrix, like starch, to be mixed with these hydrophilic fibers[7].

References

[1] Joshi, S.V; Drzal, L.T.; Mohanty, A.K.; Arora, S. *Composites: Part A* **2004** , *35*, 371–376.
[2] ASTM D3379
[3] TAPPI Test Methods. T 222 om-88: *Acid insoluble lignin wood and pulp*; Atlanta, 1999.
[4] Browining, B. L. *Methods of wood chemistr;* Interscience Publishers: New York, 1967; pp. 561-587.
[5] Razera, I. A. T. *Fibras lignocelulósicas como agente de reforço de compósitos de matriz fenólica e lignofenólica.* 2006. 189 p. Tese (Doutorado em Química) - Instituto de Química de São Carlos, Universidade de São Paulo, São Carlos.
[6] Bledzki, A. K.; Gassan, J. *Progress in Polymer Science*, **1999**, *24*, 221–247.
[7] Avérous, L. *J Macrom S Pol*, **2004**, 24, 231-274.

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