Application the green-methodology the production of Curauá Fibers Panels (*Ananás Erectipholius*)

ABSTRACT

The search for new alternatives has provided a new idea for to conserve to environmental issues and sustainable development, as well as the use of renewable option in a new area of civil engineering. This article presents an alternative for use of curaua fibers is the production of a laminated composite reinforced with curauá. The panels were made with fibers curauá perforated, 46.2 mm long, and two types of resins, polyol prepolymer and the base of castor oil. In the mechanical tests bending in three points made in the Materials Laboratory, Federal University of Amazonas - UFAM, according to ABNT-NBR 14810-3, 2003, the plates were bent but not broken and remained intact . This study was compared with the similar study with panels of açaí (Euterpe rogatory), that were produced with 100% açai fiber. The results for this study were promising for application these materials in the construction industry that will be can serve as reinforcement for other materials in new applications.

Keywords: green-materials, curauá fibers, panels, composite, construction industry.

1. INTRODUCTION

Natural fibers are produced in virtually all countries and are usually referred to as lignocellulose materials. In Brazil, there are a variety of plants that can be used to produce fibers, such as sisal, malva and curauá [i]Curauá (Ananas erectifloius) is an Amazonian plant known since pre-Colombian days for its valuable fibers. This fiber, a hydrophilus species, belongs to pineapple or bromelia family. Apparently, the curauá is originated along the low and humid river banks of the Amazon basin.
The composite panels are classified as particulate minerals, fibers and shavings. The term of fibreboard is commonly applied to panels produced in wood fibers or lignocellulosic fibers.

The lignocellulosic fibers have been used in different research to reinforce the polymeric matrix. Great efforts have occurred according to the advantages they offer such as low density and low cost. Moreover, these fibers are not toxic and renewable. Currently, they are used in automotive, construction, furniture industry and other sectors.

The plant fibers have been classified in a group called "green products", which have brought environmental benefits and economic advantages that increase their alternative as new materials in the construction engineering. The materials that which called the "green composite" must have at least one of their components of natural constituents as natural fibers, wood shavings. The many composites may be formed of green materials; usually these materials are obtained from recycling materials because these materials have originated renewable sources.

Among the main fibers used for reinforcement of cementitious matrices, may be cited the curauá fiber, sisal, coconut fiber or husk, crushed sugar cane, bamboo, jute and others.[1] The mixing technique for the curauá fiber composite has one limiting in their utilization as the quantity and fibers length used. How for any fiber, the composite has their workability reduced. The fibers tend to increase the tensile strength and toughness of the hardened composite depending that reason between on their volume fraction and its length of fibers.

Another important point for the manufacture of composite panels is the correct choice of adhesive. The adhesives are very important for the production of wood based panels.[2] The most commonly used types of resin by the industries of wood based panels are urea formaldehyde (UF), phenol formaldehyde (PF), melamine-formaldehyde (MF) and diphenyl methane diisocyanate (MDI). Due to the resin to be the largest cost component of the panel is very important to define the type and amount of resin to be used in their fabrication for seeking to improve the cost-benefit of using these materials.[3] In this study have been used two types of resins for the formation of adhesive of the panels, one prepolymer derived from petroleum and castor oil which is done the one native plant that grows on Northeastern of Brazil. This study presents an alternative for use of curauá fibers in the production of a laminated composite reinforced for applications in construction engineering.

2. METHODOLOGY

If you produce one single panel curauá fiber was used, the amount 816 g of the fibers with a length of 46.2 mm and 144 g of resin. The single panel produced weighed 960 g. A wooden box without a bottom was used as mold with dimensions of 40 cm x 40 cm. The procedure was initially a pre-press to form the mattress. The mattress was placed between two aluminum sheets, spaced by two metal rods, measuring 1.27 cm wide, positioned between the two blades. The pressing temperature was 100 °C with the pressing pressure was 5 MPa and the pressing time was 10 minutes. The edges were trimmed plates for further trimming of the bodies of the test piece. The methodology for mixing procedure that were made for a production of curauá panels is very fast and easy.(Fig.1)

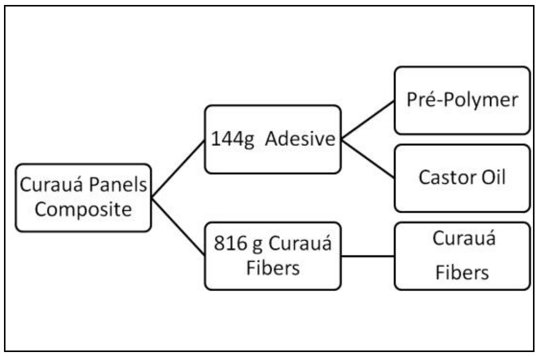

Figure 1: The Curauá Panels Methodology

In curauá panels were tested only static bending tests, according to the ABNT-NBR14810-3.

The methodology for mixing procedure that were made for a production of curauá panels, that know in the Figure 2.

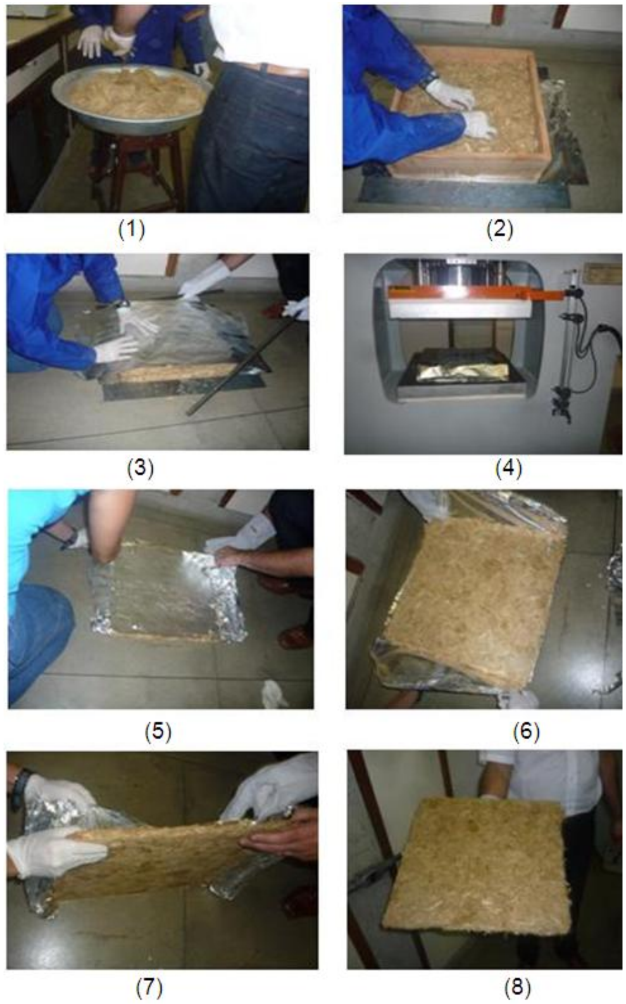

Figure 2: Mixing the fibers with the resin (a) mixing installation of the mattress (2) preparations for pressing (3) positioning of the mattress in a universal machine (4), removal of the mattress (5) removing the aluminium foil (6 and 7) and ready to be cured plate (8) the cure, the plate was kept in a ambient room for 72 h, after the pressing.

The static bending test was conducted to determine the mechanical properties of the two boards produced: Modulus of Rupture - MOR Apparent and Module of Elasticity - MOE. The apparatus necessary for carrying out the test was performed on universal testing machine with speed control. The samples of the test piece for the static bending tests were cut and scanned with the following dimensions 250 mm length and width of 50 mm. The samples of the test piece were obtained in the transverse direction and half in the longitudinal half of the plate. On each body of the test piece was installed a template and scored three points to enable its exact positioning in the press. The speed used for the test was 3 mm / minute.
The calculation of the strength properties and flexural rigidity were performed using the following expressions:

Modulus of Rupture - MOR:

$$MOR = 1{,}5 \times (P \times D) / B \times (E)^2 \qquad (1)$$

Apparent modulus of elasticity - MOE:

$$MOE = P1 \times (D)^3 / d \times 4 \times B \times (E)^3 \qquad (2)$$

3. RESULTS

The results of the bending tests obtained from this research with samples of the test piece from the panel produced with curauá fibers were determined values for the MOE and MOR, which are shown in Table 1. For a single panel produced were made only five (5) static bending tests.(Fig.3)

Table 1 - Values of MOR and MOE determined with the results of static bending tests

CP	MOR (MPa)	MOE (MPa)
CP1	1.36	222.36
CP2	2.28	391.49
CP3	3.05	565.01
CP4	2.39	434.02
CP5	1.95	334.67
Mean	2.20	389.51
Standard Deviation	0.62	126.23

The recommendation of the NBR 14810-2 for chipboard between 14 mm and 20 mm thickness is a minimum value of 16 MPa for the Moment of Rupture - MOR. In tests carried out by Quirino (2010), the açai fiber boards thickness of 10 mm showed a breaking point - MOR with an average of 15.23 MPa. Thus, we concluded that although the test results were slightly below than the standard recommended considering that the thickness of the panel was tested under thickness range recommended by the standard. Based on the results presented in this study for the moment of rupture - MOR and the Modulus of Elasticity - MOE, compared to results obtained by Quirino (2010), we conclude that the panel produced with curauá fiber in this study resulted in values of Moment of Rupture - MOR and Modulus of Elasticity - MOE much lower than those obtained by Quirino (2010), panels made from acai fiber.

Figure 3: Photograph of the body-of-proof

Because the values of Moment of Rupture - MOR and Modulus of Elasticity - MOE obtained in this study, the panel produced with curauá fiber scores were much lower than those obtained for açai fiber unquestionably a significant difference between the composition of the fibers and its natural growth. The two fibers come from the same part of the plant but distinct growth. The dosage of the material was insufficient but the results were promising. As soon as there is material available for repetition of this experiment is expected to repeat it to obtain new results.

4. CONCLUSIONS

The process for manufacturing panels made of curauá fiber is similar to that employed for the production of açai fiber boards and both are very simple. Both panels can be applied in the furniture industry and construction, as well as strengthening of tiles, floors and others, because they showed acceptable results in the bending test, according to ABNT-NBR 14810-2. The contribution to the environment due to the fact that the plant fiber is a renewable resource and its application still requires a proper study that considers all the factors for their use.

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