PAPER REF: 4662

MECHANICAL ANALYSIS OF NATURAL JUTE FIBRES AND POSSIBLE APPLICATION OF THERMOSETTING RESIN COMPOSITES

João Rocha(*), Luís Queijo

Escola Superior de Tecnologia e de Gestão (ESTiG), Bragança Polytechnic Institute, Bragança, Portugal
(*)*Email:* jrocha@ipb.pt

ABSTRACT

The aim of this study is to analyse the jute fabric and evaluate the possibility of manufacturing composite materials, i.e. using thermosetting resin reinforced with woven jute to use as reinforcing material.

This study began with surface weight determination. Then analysis was performed in order to determine water content in jute fabric. Finally it was determined the yield strength of the fabric and yield strength of specimens of composite thermoset polyester resin made by hand laying process.

Despite the fact of obtained stress being far for the desired results, we believe that this material can be used to give a rustic finishing to parts and increase its resistance.

Keywords: jute, composite, yield strength, thermoset.

INTRODUCTION

The use of natural fibers for the manufacture of polymer matrix composites had a growing interest in recent years.

Fiber-reinforced polymer composites have played a dominant role for a long time in a variety of applications for their high specific strength and modulus. The mechanical properties of a natural fiber-reinforced composite depend on many parameters, such as fiber strength, modulus, fiber length and orientation, in addition to the fiber-matrix interfacial bond strength (Hussien, Abass e Abass 2009) (Queijo e Rocha 2012).

We can expect a broad range of mechanical properties in a natural product like jute. To understand these properties, it must be performed experimental and numeric tests (Esteves, et al. 2012) (Queijo e Rocha 2012).

MATERIALS AND METHODS

For the production of fiber reinforced composite, woven jute fiber fabric was purchased at a small store in a sample with 1x3 m^2. This material is usually used for making Arraiolos carpets. There wasn´t obtained, in addition to this, any other information about the origin or characteristics of the material.

A small sample with 100 x 100 mm was cut to determine the surface weight. It was weighed on an analytical balance, Adam Equipment, Model ADA 210C capacity 210 g, readability 0.1 mg and has been registered 4.410 g. So, this material has a surface weight of 441 g/m^2.
To determine the water sample, it was cut two small portions of material. A *weighting filter* was dried for 2 hours in an oven at 120 ° C. The sample was placed in the recipient and

weighed in the analytical balance. Then the assembly was placed in the oven for 2 hours at the same temperature. It was removed, and once the temperature stabilized, weighed again. The values have been registered and are presented in the table 1.

Fig. 1 - Woven jute fiber fabric

Table 1 - Water content

Sample	wet weight g	dry weight g	water content %
A	145,1696	145,0588	0,076325
B	163,5259	163,4072	0,072641

To produce composite plates by hand lay process, test pieces were produced with a layer of jute fiber in a matrix of polyester resin and the fiber angle was 0º, "L#". Also it was produced specimens without resin, with only the jute fiber and the direction test was 0º, "C#".

The tensile tests were performed according to ASTM D3039 at room temperature. Load-elongation curve, braking load, peak stress were acquired in real time by universal machine, Instron, model 4485 and provided at the end of each test.

RESULTS AND CONCLUSIONS

The results from the tensile tests are shown in Table 2.

Table 2 - Tensile test results Stress (ASTM D3039)

Sample	C1	C2	C3	C4	C5	C6	Average
MPa	22,5	24,0	22,0	22,0	16,0	16,0	20,4
Sample	L1	L2	L3	L4	L5	L6	
MPa	10,5	11,5	9,2	11,0	9,5	12,0	10,6

Contrary to the expectations, the samples without resin, C, obtained stress values much higher than the composite specimens, L, and about half than obtained by Esteves (Esteves, et al. 2012). We think it may have happened due to a bad assembly or when performing the test the first fibers broke, "forcing" the left ones to a *brittle* fracture. This issue will have to be investigated. However, we believe that this material can be used to give a rustic finishing to parts that need to be restoring, and increase the resistance.

REFERENCES

[1]-Esteves, J.L., *et. al*., "Mechanical Behaviour of Composite Materials with Long Jute Fibers" 15th Int. Conf. on Experimental Mechanics. Porto, 2012.

[2]-Hussien, M.A, F.O. Abass, e R.O. Abass. "Synthetic Sacks as Reinforced Fibers in the Thermosetting Composites." Al-Khwarizmi Engineering Journal. 2009.

[3]-Queijo, Luís, and João Rocha. "Mechanical Characterisation of Polyester Resin and Corn Natural Fibers Composite." 15th Int. Conference on Experimental Mechanics. Porto, 2012.