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Experimental Investigation of Tensile and Flexural Strength of Banana & Coir Fibers hybrid composite

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***Abstract* -Now a day's researchers are working on various materials that are biodegradable in nature and eco friendly. In the field of engineering, composite material use is increasing continuously. The Composite contains mainly Matrix and Fiber. Jute, Coir, Silk, Banana, Bamboo fibers are utilized to develop composites as it gives good strength. In recent studies, it has been observed that banana fiber showed good chemical and mechanical properties that can be used in various industries like textile and packaging industry as a raw material. The hybrid composite material can be used to produce various products that may helps farmer financially and have a good scope to create a new market for startups. In this proposed work, for preparing the composites epoxy is used as matrix and Banana fibers and coir fibers are used as reinforcement material. Laminate and specimens for testing have been fabricated by using continuous fibers. The banana and coir fibers have been treated with 5% NaOH solutions to remove lignin. The specimens have been prepared by varying coir percentages in laminate i.e 5 %,10 %, and 15 % and maintaining 10% banana fiber constant for all the specimens. The mechanical properties of specimen i.e. tensile strength, flexural strength have been tested on Universal Testing Machine (UTM). The coir/banana hybrid composite with a weight fraction of 5% and 10% respectively shows maximum tensile strength i.e 13.06 Mpa. and Flexural strength of 32.33 Mpa.**

Index Terms - About four, alphabetical order, key words or phrases, separated by commas (e.g., Camera-ready, FIE format, Preparation of papers, Two-column format).

INTRODUCTION

All-natural fibers play a vital role in the emerging green economy. Natural fibers are renewable resources that are abundantly available in nature. It is well known that natural fibers are carbon neutral as they absorb the equal amount of carbon dioxide emitted by natural fiber. Natural fibers like Jute, Banana, Sisal, Coir, etc. are fully renewable, environment friendly, high specific strength, nonabrasive, very low cost, and biodegradable. Natural fibers have recently become attractive for researchers due to these characteristics [1]. Worldwide farmers are cultivating Banana therefore Banana fibers are widely available as agricultural waste. These fibers are biodegradable, environmentally friendly and possess various attributes like low cost, lightweight, low density, high tensile strength. Such waste can be used in various applications [2]. Similarly, coir fiber also possesses good mechanical properties. Coir fiber has a verity of applications in the manufacture of boards, sheets required for roofing, insulation material, and various panels [3]. From the last few decades, research in composites has developed very good engineering materials. The growth of composite applications is too rapid. Many composite materials have been proved their properties and ready to replace other materials. In the automobile sector, composites have acquired big space. Polymer resin matrix materials introduced also gave good contributions as a matrix. Varieties of materials are available in the market with good mechanical and chemical properties. The selection of materials are usually depend on the various factors like working life of product, complicated shapes of product, job, mass or batch production, cost reduction of product, optimum skills or the worker who is producing the product. Natural fiber support in plastics has expanded composite scope from the last few decades. Natural fibers and glass fiber hybrid composites also gives good mechanical properties, As Individual fibers give good properties and it has been proved through research, hybrid composites also give good properties. From the last decade researchers focused on hybrid composites as well [4, 5].

MANUFACTURING OF LAMINATE

For fabrication of laminate, Banana, Coir fiber and coir powder has been used as a reinforcement material. Coir powered is used to fill the gaps between fibers. LY- 556 grade epoxy resin and HY-951 grade hardener has been used as a matrix material. Sodium Hydroxide (NaOH) is an alkaline solution used to enhance the surface morphology of natural fibers. LY-556 resin has been taken as the matrix that belongs to the epoxide family. To prepare the composite plate Epoxy LY556 of density 1.15–1.20 g/cm3, mixed with hardener HY951 of density 0.97–0.99 g/cm3 has been used. As per recommendation, a 10:1 ratio has been selected for mixing epoxy and hardener. Figure 1 (A, B) shows fiber treatment and fabrication of laminate respectively.

(A) (B)

FIGURE 1 (A) NAOH TREATED FIBRE (B) FABRICATION OF SPECIMEN

TESTING OF SAMPLE

Tensile and flexural testing has been done on UTM by following ASTM D638-2014 & ASTM D 790-2003 respectively. Six specimens have been tested for tensile and flexural strength each.

I. Tensile Testing

To get the desired dimension of specimen for tensile testing, fabricated composite laminate has been cut. The specimen size of 150 × 15 mm and the gauge length of 120 mm has been taken for the tensile testing. The specimen with the desired dimension has been fixed in the grips of the machine with a 120 mm gauge length. The experimental set up for the tensile test has been shown in Figure 2. Tensile testing specimen sample before and after test has been shown in Figure 3.

FIGURE 2. TENSILE TESTING SETUP

FIGURE 3. TENSILE TESTING OF SPECIMEN

II. Flexural Testing

As per standards, Specimen dimension for flexural test is 80 mm × 6 mm × 14 mm has been prepared. Figure 4. shows set up of flexural testing. Flexural testing samples before and after test has been shown in figure 5

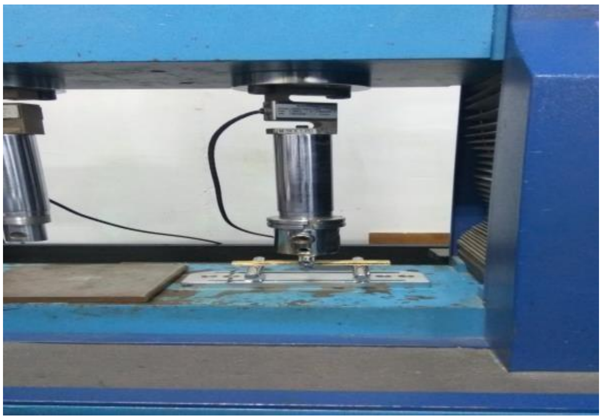

FIGURE 4. FLEXURAL STRENGTH TESTING

FIGURE 5. FLEXURAL TESTING SPECIMEN

RESULT AND DISCUSSION

Tensile and flexural tests have been performed for various samples of composite material having variation of coir fiber percentage of 5%, 10%, and 15% and maintaining banana percentage constant i.e. 10%. Machine-generated Graphical results are shown in figure number 4.1 and 4.2. For each specimen, the test has been performed twice for getting accuracy. From figure number 4.3 it has been seen that 5 % coir and 10 % Banana gives good tensile and flexural strength.

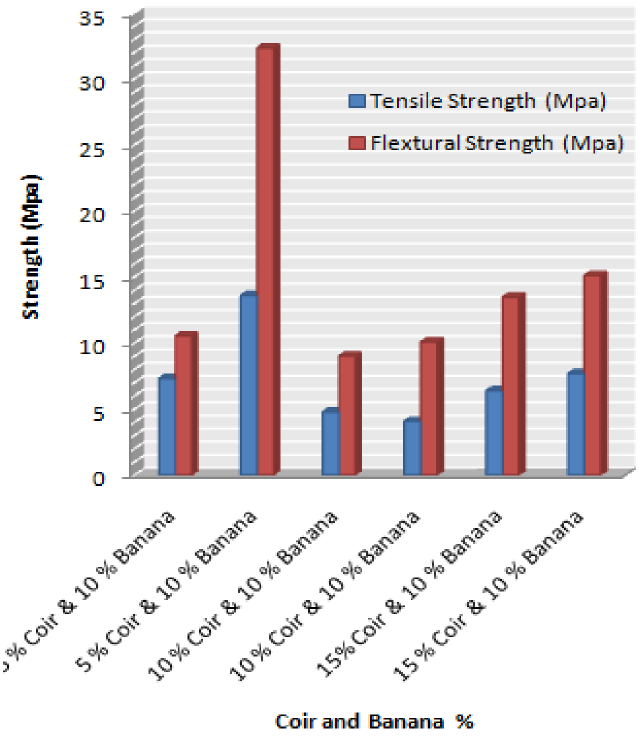

FIGURE 6..TENSILE & FLEXURAL TEST RESULTS

CONCLUSION

The After testing the material properties of coir and banana fiber reinforced composites using three different weight fractions of the materials, the following conclusions has been drawn. The coir/banana hybrid composite with weight fraction of 5% and 10% respectively shows maximum tensile strength i.e 13.06 Mpa. The coir/banana hybrid composite with weight fraction of 5% and 10% respectively shows maximum flexural strength i.e. 32.33Mpa.

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