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COMPOSITE MATERIAL USING BAMBOO FIBER WITH EPOXY RESIN

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Abstract - *The high cost of synthetic fibers such as glass, carbon, kevars etc, results in high cost of production and products derived from these materials which has necessitated alternative means of materials development. This has also informed the utilization of locally available bamboo fiber for composite materials development. Natural fiber has emerged as a renewable and cheaper substitute to synthetic materials such as glass, carbon and afraid, which are used as reinforcements. In this work, the objective was to develop, investigate and analyze the mechanical properties of a composite material using bamboo fiber polymer. The long bamboo fiber was extracted using chemical digestion and maceration methods. The fabrication of the composite was carried out using epoxy resin as the matrix and the bamboo fiber as reinforcement. Tests were carried out to determine the mechanical properties such as tensile, hardness and compressive strengths. The results were studied and compared with the conventional materials and it process that the material developed can be used in structural applications with strong dependence on its mechanical properties.*

Key Words: **Bamboo Fiber, Epoxy resin, Hardener, Laminate cover, Relieve oil.**

1. INTRODUCTION

In addition to these naturally occurring composite, there are many other engineering materials that are composite in general ways and have been in use for a long time. They include carbon black in rubber, Portland cement or asphalt mixed with sand, and glass fibers in resin etc. Since the early 1960's, there have been increasing demands for materials that are stiffer and stronger yet higher in fields as diverse as aerospace, energy, civil and mechanical constructions. The demand placed on materials for better overall performance is so great and diverse that no one material can satisfy them. This limitation has led to a resurgence of the ancient concept of combining different materials in an integrate-composite materials to satisfy the user requirement, this composite material system result in a performance that cannot be attained by individual constituent which offer a great advantage of a flexible design. Natural fibers are now regarded as a serious alternative to glass fiber for use as reinforcements in composite materials. Their advantages include low-cost, low density, high strength-to-weight ratio, and resistance to breakage during processing, low energy content and recyclability. The properties of natural fiber-based composites can be affected or modified by a number of factors such as fiber combinations, processing method, fiber volume fraction, aspect ratio, water absorption, etc. The process parameters and their influence on the final properties vary with different fiber-matrix combinations. The fabrication method has a significant impact on the resulting properties. Various processing methods, e.g. compression molding, injection molding, extrusion molding, and hand lay-up, are available for natural fiber composite materials. Injection molding improves the fiber dispersion, hence increasing the tensile and flexural properties. However, extrusion and injection molding have detrimental effects on the properties of natural fibers. Bamboo fibers have emerged as a renewable and cheaper substitute for synthetic fibers such as glass and carbon, which are used as reinforcement in making structural components. They have high specific properties such as stiffness, impact resistance, flexibility and modulus, and are comparable to those of glass fiber. Bamboo can be used for reinforcement such as the whole bamboo, section, strips and the fibers. These various forms of bamboo have been used in applications such as low rise construction to resist earthquake and wind loads, bamboo mats composite in combination with wood for beam, and shear wall in low rise construction in addition bamboo fiber can be used as reinforcement with various thermoplastic and thermo set polymer.

1.1 LITERATURE REVIEW

A] Literature survey

[1] Pankaj Tripathi, Kuldeep Yadav (May -2017)
that the tensile and flexural properties of bamboo/glass fiber hybrid composite is suitable for highly flexibility & it can be concluded by finding such a value of tensile & flexural strength that the mechanical properties significantly influenced while using bamboo & glass fiber in such layer manner.

[2]Dipika Devi, Boken Jempen (Aug-2016) the shear parameters of soil with and without bamboo fiber are compared. The length of fiber also cause increase in shear strength of the soil.

[3] S. A. H. Roslan, Z. A. Rasid and M. Z. Hassan (Aug-2015) the tensile properties of laminated composite, while the mechanical properties are compared with the mechanical properties of natural fiber.

[4] Hingujam Jackson Sing, Sutanu Samanta (May- 2014) the natural fiber reinforced composites got high potential of replacing the conventional material used in the electrical appliances. Research works regarding the use of natural fiber composites as the electrical resistance are also reported. Only very few research works on the machining optimizations of the natural composite materials have been reported.

B] Points to remember while taking design.

- ✓ Bamboo fiber (Renewable Source).
- ✓ Epoxy Resin and Hardener additive.
- ✓ Laminating Film to prevent air bubbles.

Bamboo fiber has enormous flexural strength.

2. OBJECTIVE AND METHODOLOGY

2.1 Objective

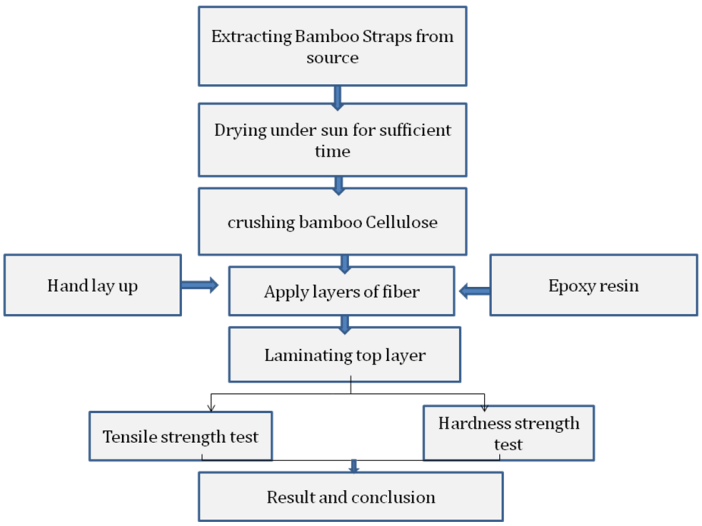
To Investigate and analyze the mechanical properties of a composite material using bamboo fiber. To explore the processing feasibility of bamboo fiber composites by different techniques and to study the resulting fiber and composite properties. To carry out a systematic study of the influence of processing parameters on the mechanical properties of bamboo fibers.

The long bamboo fiber was extracted using chemical digestion method. The fabrication of the composite was carried out using epoxy resin as the matrix and the bamboo fiber as reinforcement. Tests were carried out to determine the mechanical properties such as tensile, hardness and compressive strengths.

The results were studied and compared with the conventional materials and it process that the material developed can be used in structural applications with strong dependence on its mechanical properties.

The mechanical properties of bamboo such as stiffness, impact strength and flexibility are high and are comparable to the synthetic fibers such as glass fiber. The hardness of the column of bamboo depends on the number of fiber bundles and the manner of their scattering.

2.2 Methodology



3. CONSTRUCTIONAL DETAILS

3.1 Bamboo Fiber

Fig.-3.1 Bamboo Straps

Bamboo fiber is a cellulose fiber extracted or fabricated from natural bamboo. These are collected from local sources. Bamboo belongs to grass family Bambusoideae. It is a natural Lignocelluloses composite, in which cellulose fibers are embedded in the lignin matrix.

3.2 Epoxy Resin

Fig- 3.2 Epoxy Resin

Epoxy resins, also known as poly epoxies, are a class of reactive polymer high mechanical properties, temperature and chemical resistance. Epoxy has a wide range of applications, including metal coatings, use in electronics/ electrical components, high tension electrical insulators, fiber-reinforced plastic materials and structural adhesives.

4. BAMBOO FIBER COMPOSITE

Fig -4 Bamboo fiber composite

4.1 TENSILE STRENGTH TEST RESULTS

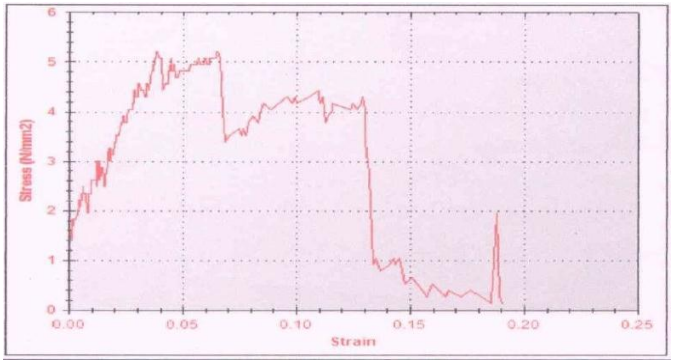
Test File Name : CL C73.Utm.
Test Type : Tensile Test
Test Standard : ASTM
A370 : 2017

Table -1

INPUT DATA	
Specimen C S Area	153.51 mm2
Specimen type	Bamboo fiber with Epoxy resin
Specimen width	10.02 mm
Final Gauge Length	50.56 mm

OUTPUT DATA	
Load At Yield	0.54 KN
Yield Stress	3.158 N/mm2
Yield Stress	0.800 KN
Tensile Strength	5.212N/mm2
Elongation	1.12 %

Stress vs. strain



Chat -4.1 stress vs. strain

4.2 BRINELL HARDNESS TEST RESULTS

SAMPLE DESCRIPTION:

Specification: BAMBOO FIBER WITH EPOXY RESIN
Test method: ASTM D 2240

DETAILS OF TESTING FACILITY:

Table -2

Machine no	CL/ME/SHRD 40
Model	SHORE-D GOLD
Ambient temperature, °C	25.2

Table -3

S. No	Sample Id	Observed values, HRA			Average, HR15N
		1	2	3	
1	Bamboo fiber with epoxy resin	75	74	75	75

5. CONCLUSION

In this project we have done a mechanical character analysis on bamboo fiber with epoxy composite. By doing this project we have gained good knowledge about natural fibers and the mechanical tests were conducted in the materials and the results were included with this project report. By seeing the test results we here by conclude that the bamboo fiber with epoxy resin composite has good mechanical characteristics.

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