Development and Testing of Composite Materials Using Natural Fiber Reinforcements

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Abstract— **World is as of now concentrating on alternate material sources that are environment agreeable and biodegradable in nature. Because of the expanding natural concerns, bio composite produced out of regular fiber and polymeric resin, is one of the late advancements in the business and constitutes the present extent of experimental work. The use of composite materials field is increasing gradually in engineering. The composite consists of mainly two phases i.e. matrix and fiber. The accessibility of characteristic fiber and simplicity of assembling have enticed scientists worldwide to attempt by regional standards accessible inexpensive fiber and to learning their achievability of fortification determinations and to what degree they fulfil the obliged particulars of great strengthened polymer composite aimed at structural requisition.**

Fiber reinforced polymer composites has numerous preferences, for example, generally minimal effort of creation, simple to create and better quality contrast than perfect polymer tars due with this reason fiber strengthened polymer composite utilized within an assortment of provision as class of structure material. This work describe the mechanical behaviour of natural fiber reinforced polymer composite with the extraordinary references to the impact of fiber loading and length of fiber on the properties of composites.

Keywords— Composite Material, Natural Fiber Reinforcement, Hand Layup Process, Mould, Epoxy Resin, Poly-Venyl Alcohol Agent, Bamboo Fiber, Banana Fiber, Jute fiber.

I. INTRODUCTION

A composite material can be defined as a combination of two or more materials that results in better properties than those of the individual components used alone. Each material used retains its separate chemical, physical, and mechanical properties. The main advantages of composite materials are their high strength and stiffness, combined with low density, when compared with bulk materials, allowing for a weight reduction in the finished part. The two constituents are reinforcement and a matrix. The reinforcing phase provides the strength and stiffness. In most cases, the reinforcement is harder, stronger, and stiffer than the matrix. The reinforcement is usually a fiber or a particulate. Applications include aerospace, transportation, construction, marine goods, sporting goods, and more recently infrastructure, with construction and transportation being the largest.

In general, high-performance but more costly continuous-carbon-fiber composites are used where high strength and stiffness along with light weight are required, and much lower-cost fiberglass composites are used in less demanding applications where weight is not as critical. The attraction in utilizing natural fiber, for example, distinctive wood fiber and plant fiber as support in plastics has expanded drastically throughout last few years. Concerning the ecological viewpoints if natural fibers might be utilized rather than glass fibers as fortification in some structural provisions it might be extremely intriguing. Natural fibers have numerous points of interest contrasted with glass fiber, for instance they have low thickness, and they are biodegradable and recyclable. Also they are renewable crude materials and have generally great strength and stiffness.

II. MATERIALS AND PREPARATION OF SPECIMENS

The bamboo fiber is obtained from bamboo plant, which has been collected from local sources. The extracted bamboo fiber were subsequently sun dried for two hours to remove free water present in the fiber then woven in criss cross pattern. The woven fibers were subsequently cut into squares of 190 X 190 mm. The epoxy resins and hardener are procured from Carbon Black Composites, Vasai Ltd. The bamboo fiber based epoxy composite is fabricated using hand lay-up process. The moulds have been prepared with dimensions of 200 X 200 X 1.5 mm. The bamboo fiber sheet has been mixed with epoxy and hardener mixture with their respective values by simple mechanical stirring and mixtures are slowly poured in different moulds, keeping the characterization standards and view on testing condition. The releasing agent has been use on mould sheet which give easy to composites removal from the mould after curing the composites. A sliding roller has been used to remove the trapped air from the uncured composite and mould has been closed at temperature 30° C duration 5 hour. A constant load of about 5-6 Kg is applied on the mould in which the mixture of the bamboo, epoxy resin and hardener has been poured. After curing, the specimen has been taken out from the mould. The composite material has been cut in suitable dimensions with help of zig saw for mechanical tests as per the ASTM standards.

Bamboo was the natural reinforcement used in making this particular plate. It has zero degree (criss-cross) orientation. We used 3 layers of this bamboo sheet. The thickness of each sheet is approximately 1 mm. This is the final product manufactured. Its final thickness is 7 mm. Its total weight is 350 grams. Good surface finish is obtained which gives it an aesthetic appearance

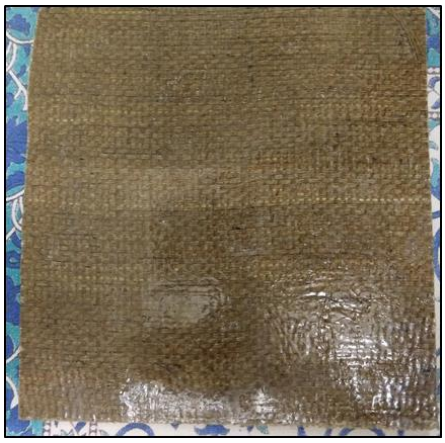


Fig. 1 Composite Specimen

III. MECHANICAL TESTS

Following tests were carried out for the specimens-

A. Tensile Modulus Test (ASTM D 638-2003).

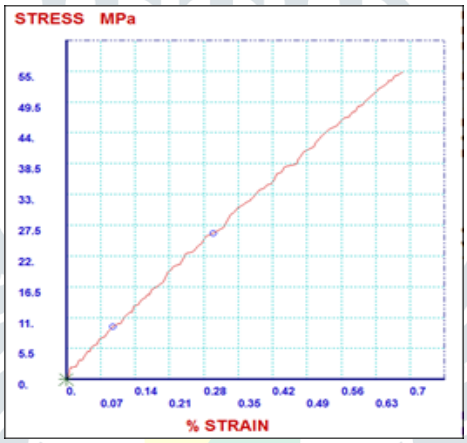


Fig. 2 Tensile Modulus Graph.

Above graph is Stress vs. Strain graph in which we get maximum tensile strength of material which is 128.32 MPa.

B. TensileStrength Test (ATSM D 638-2003).

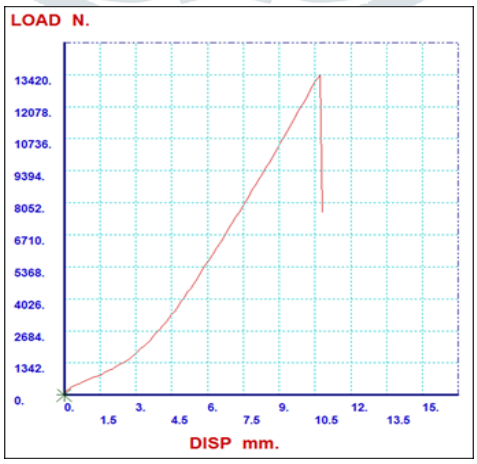
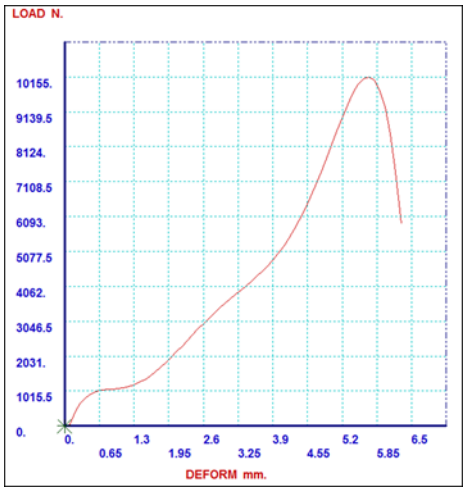


Fig. 3 Tensile Strength Graph.

Above graph is Load vs. Displacement from which we get Tensile modulus equal to 8321 MPa.

C. Compression Test (ASTM D 695-2002)



Fig, 3 Compression Graph.

Above graph is of Load vs. Deformation from which we get compression strength of 101.52.

IV. RESULT

Table 1 Result Table.

Sr. No.	Test Description	Standard	Unit	Observed Values
1	Tensile Strength	ATSM D 638-203	MPa	128.32
2	Tensile Modulus	ATSM D 638-203	MPa	8321
3	Compression Strength	ATSM D 638-203	MPa	101.52

V. APPLICATIONS

In various industries, panels used for partition or panels of machines, protective casings are made up of composite materials made from fibreglass reinforcements. Here instead of this natural fibre composites can be used which have less production cost and light weight.

Natural fibre composites have aesthetic look. Hence it can be used for partition of space in office buildings. They also have good material properties which can be used for roofing. When manufactured properly, these composites can be used for piping in residential and industrial areas. It can be used for production of tanks and vessels in chemical manufacturing.

Automobile body parts can be made from natural fibre composites which have good strength and light weight with reduced class

VI. CONCLUSIONS

This experimental examination of mechanical behavior of natural fiber based epoxy composites indicates to the many conclusions:

1. The fabrication of natural fiber based epoxy composites with different orientation of fiber and different lengths of fiber are possible by hand lay-up process.
2. From the prepared specimen, it has been observed that the composite prepared has mechanical properties like hardness, good surface finish, aesthetic look and light weight.
3. The production cost of composite material using natural reinforcement is less than fiber glass.

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