

Fabrication and Evaluation of Mechanical Properties of Kenaf & Coir Hybrid Composite

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ABSTRACT: The focus of the project is the development of natural fiber composites primarily to explore value application avenues. The development of natural fiber composites in India is based on a two pronged strategy of preventing depletion of forest resource as well as ensuring good economic returns for natural fibres. Kenaf & Coir based composite have been developpe as substitutes for plywood & medium density fiber boards. In this project natural fiber composites were fabricated, by combining materials of Kenaf & coir in chopped form by hand lay method. Epoxy resin was used as matrix material. The NFR composite were made in different fiber volume fraction such as 12.5% of Kenaf and 12.5% coir, 15% of Kenaf and 15% coir, 17.5% of Kenaf and 17.5% coir. The mechanical properties of this sample were investigated according to the ASTM standards. From the result it was observed that the 12.5% of Kenaf and 12.5% of coir fiber reinforcement showed the highest flexural strength among the other fiber volume fraction.

KEYWORDS: Natural fibers, coir fiber, kenaf fiber, Epoxy resin.

I. INTRODUCTION

Composite materials consist of two or more constituents with physically separable phases. However, only when the composite phase materials have notably different physical properties it is recognized as being a composite material. Composites are materials that comprise strong load carrying material imbedded in weaker material .Reinforcement provides strength and rigidity, helping to support structural load. The matrix or binder maintains the position and orientation of the reinforcement. Significantly, constituents of the composites retain their individual, physical and chemical properties; yet together they produce a combination of qualities which individual constituents would be incapable of producing alone. When a fiber reinforced composite consists of several layers with different fiber orientations, it is called multilayer composite or laminate composite.

Composite laminates are assemblies of layers of fibrous composite materials which can be joined to provide required engineering properties, including in-plane stiffness, bending stiffness, strength, and coefficient of thermal expansion. The individual layers consist of high-modulus, high-strength fibers in a polymeric, metallic, or ceramic matrix material. Typical fibers used include graphite, glass, boron, and silicon carbide, and some matrix materials are epoxies, polyamides, aluminium, titanium, and alumina.

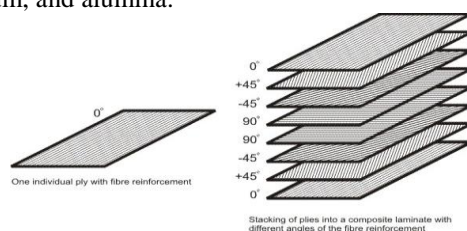


Fig.a.Laminated Composite

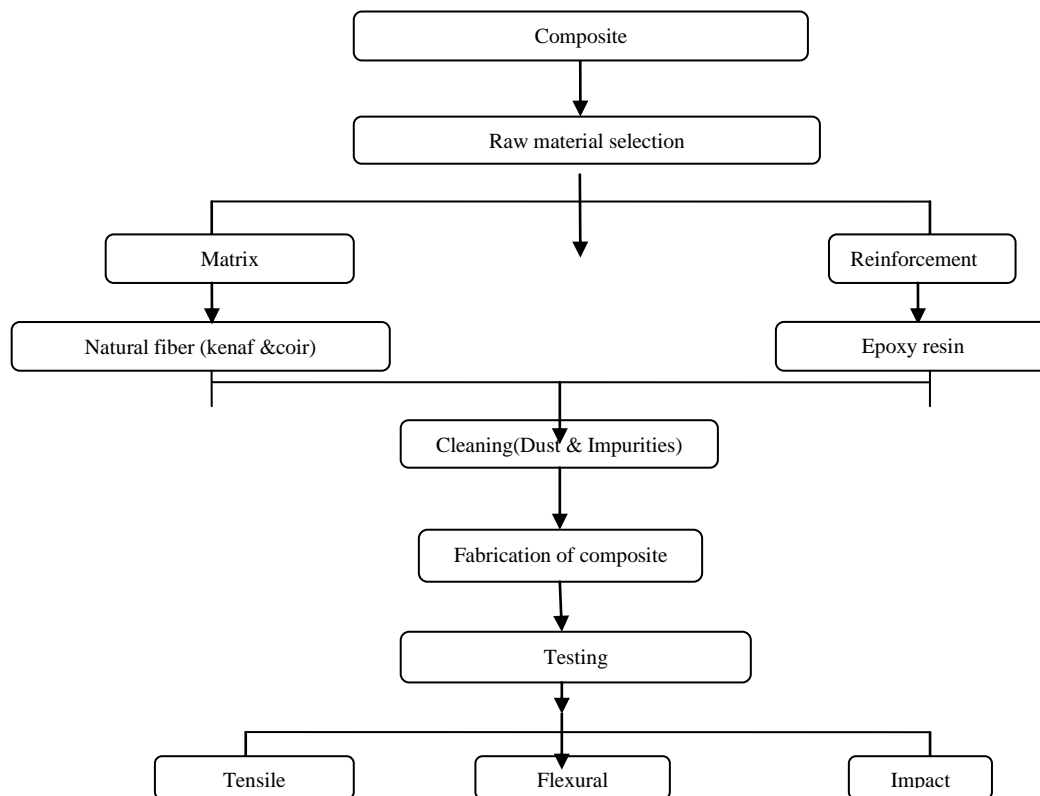
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Layers of different materials may be used, resulting in a hybrid laminate. The individual layers generally are orthotropic (that is, with principal properties in orthogonal directions) or transversely isotropic (with isotropic properties in the transverse plane) with the laminate then exhibiting anisotropic (with variable direction of principal properties), orthotropic, or quasi-isotropic properties. Quasi-isotropic laminates exhibit isotropic (that is, independent of direction) in plane response but are not restricted to isotropic out-of-plane (bending) response. Depending upon the stacking sequence of the individual layers, the laminate may exhibit coupling between in plane and out-of-plane response.

II. METHODOLOGY



FABRICATION OF HYBRID COMPOSITE

Compression moulding is a method of moulding in which the moulding material, generally preheated, is first placed in an open, heated mould cavity. The mould is closed as shown in figure: 1 with a top force or plug member, pressure is applied to force the material into contact with all mould areas, while heat and pressure are maintained until the moulding material has cured.

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Fig. 1 (a) Compression Moulding Machine (b) Kenaf+coir+epoxy resin (17.5%+17.5%+65%) (c) Kenaf+coir+epoxy resin (15%+15%+70%) (d) Kenaf+coir+epoxy resin (12.5%+12.5%+75%)

III. MECHANICAL PROPERTIES TESTING

Tensile Test

The tension test is generally performed on flat specimens. The most commonly used specimen geometries are the dog-bone specimen, straight-sided specimen with end tabs. The standard test method as per ASTM D3039M-93 has been used. The length of the test specimen used is 250×25 mm. The tensile test is performed in universal testing machine (UTM). The tests were performed with a cross head speed of 2mm/min. For each test composite of four samples were tested and average value was taken for analysis.

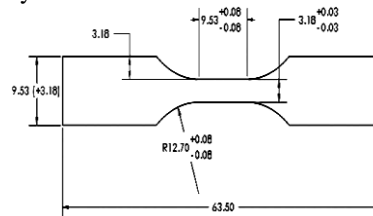
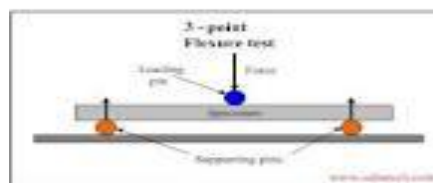


Fig 2 Tensile ASTM D3039M

Flexural test

The three point bend test was carried out in UTM machine in accordance with ASTM D790M-86 to measure the flexural strength of the composites. The entire specimens were of rectangular cross section of (125x15) mm. A span of 125 mm was used for the test specimen. The specimens were tested at a crosshead speed of 2mm/min.



Impact test

Notched Izod impact tests were performed according to ASTM D256 on an impact tester with pendulum energy of 0.4 J and a span of 3 m.

IV. EXPERIMENTAL RESULT AND DISCUSSION

Tensile Test Result

Tensile test is done by applying tensile load on the body using Universal testing machine. The test is conducted for the hybrid composite material of length 125mm and volume fraction of Kenaf& Coir. Tensile strength result of Kenaf& Coir Hybrid composite.

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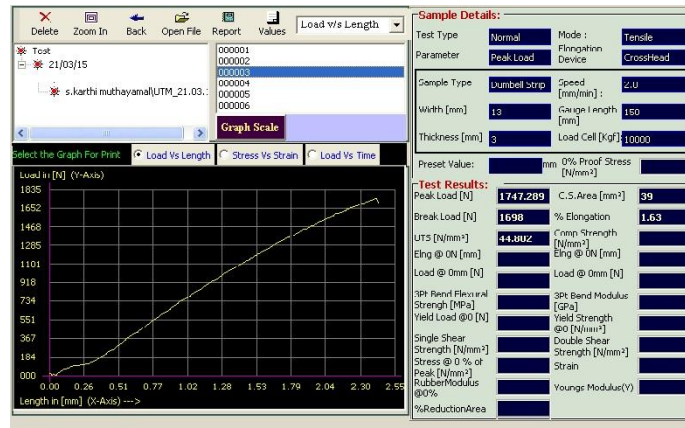


Fig. 3 Tensile Test Result

Flexural Test result

Flexural is also known as bending test .It is done by applying a point load at the center of the composite. It's also carried out using universal testing machine. The Test is conducted for hybrid composite material of Kenaf& Coir epoxy composite.

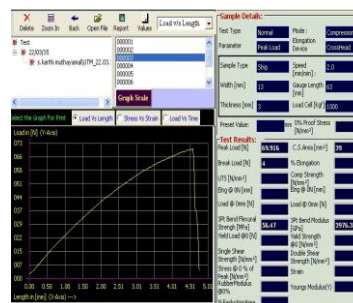


Fig. 4 Flexural Test Result

Impact Test result

The impact test is done on the specimen by applying a sudden load on it. The various test result for the composite material with varying the material composite is tabulated as follows:

Ratio (Kenaf+Coir+Resin)	Sample Number	Izod Impact Value for 3 mm Thick Specimen in J
17.5+17.5+65	1	0.40
	2	0.40
	3	0.30
15+15+70	4	0.25
	5	0.25
	6	0.30
12.5+12.5+75	7	0.35
	8	0.30
	9	0.35

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V. CONCLUSION

From the results it was observed that the flexural strength increased with increasing kenaf & coir fiber volume fraction. This may be due to complete filling of voids in the matrix by the coir particles. Coir powder epoxy composite had lowest flexural strength the most suitable composite has less flexural extension to flexural strength ratio

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