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Study of Properties of Banana Fiber Reinforced with Jute Fiber

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Abstract – *Lot of researches are undertaken and succeeded to replace artificial fibers with natural fiber. Artificial fibers like Glass fiber, Acrylic fiber, Nylon are cost expensive, eco-unfriendly in nature. Hence the replacement of natural fibers which are abundantly available, cheaper in cost, eco-friendly, Bio-degradability is needed and must be used instead of artificial fiber. The use of these natural fibers can be increased by changing its some of parameters like thickness and length etc. By increasing these parameters different mechanical properties can be improved. Banana fiber is used extensively because of its better mechanical properties and availability. Banana fiber can be reinforced with another natural fiber like Jute fiber to improve its mechanical properties further to the next level and can increase its usage and utilization.*

Key Words: Artificial fibres, Natural fibres, eco-unfriendly, Bio-degradability, Mechanical properties,

1.1 INTRODUCTION

Over last thirty years ceramics, plastics, polymer and composites have been dominant emerging materials in engineering field. The composites have been manufactured depending upon volume and weight fractions. And also the composites are very less in weight and easy to use and also cost effective. The commercial applications of these composites can be found out in aerospace industries and also in transportation field. Composites are been extensively used now to replace to strengthen the pre-existing structures. Composites material comprises of at least two physically or artificially particular, reasonably arranged or disseminated stages with an interface isolating them. Commonly composites materials have a bulk phase which is continuous called matrix. And one is chopped in certain length normally discontinuous phase called reinforcement which is usually stronger.

Matrix phase

The primary phase, having a continuous (long form) is called matrix. Matrix is usually less hard and more ductile phase.

Chopped (reinforcing)

The next phase is embedded in matrix in chopped form. This is secondary phase also called dispersed phase.

1.2 TYPES OF COMPOSITES

Composites are classified based on the matrix material.

(a) Metal matrix composites

Metal matrix composites as the name indicates it has metal matrix. Example for this metal matrix is aluminium and magnesium. Metals are mainly reinforced for suitable design.

(b) Ceramic matrix composites

Ceramic matrix composites have alumina, calcium, alumina silicate reinforced by silicon carbide as ceramic matrixes. The merits of CMC are high strength, hardness, high service temperature limits for ceramics and low density. These ceramics offer higher resistance to temperature; ceramic materials have a tendency to become brittle.

(c) Polymer matrix composites

Most commonly polymer in this matrix is materials of polymeric. The reasons for this are two-fold. The disadvantages of these PMC'S are poor mechanical properties like structural purposes. And also the strength and stiffness are low compared to MMC AND CMC.

Fibrous composites

- **Short fibre reinforced composites**

Short-fibre reinforced composites matrix are one in which reinforcement is done by dispersing in the phase form or in discontinuous form generally (length < 100*diameter). They are classified as-

- Composites with random orientation of fibres.
- Composites with preferred orientation of fibres

- **Long-fibre reinforced composites**

Long-fibre strengthened composites comprise of a network fortified by a scattered stage in type of ceaseless strands.

- Unidirectional direction of strands.
- Bidirectional direction of strands

- **Laminate composite**

When a fibre reinforced composite consists of more layers with different fibre placement technique, it is called multilayer composite.

2. METHODLOGY

Steps of preparation of banana fibre composite specimen:

1. Extraction of banana fiber from the plant and its preparation

The banana fiber is obtained from banana plant, which has been collected from local fields. The stems of banana plant are cut in required length and these stems are introduced in machine where rotating part of this machine separates the layers of banana fibers from stem and consecutive drying of these extracted banana fiber will be done. And after completely drying of fiber chemical treatment will be taken place by dipping fibers into NaoH solution and after removing the fiber from this solution oven drying will be done for fiber. Jute fiber will also undergo the same process for complete extraction.

2. Preparation of mold

For the preparation of mould wooden boards are used and these wooden boards are cut into the length and width as per required standards for specimen. By combining the length of wood moulds are prepared.

3. Mixing of banana and jute fibre

The dried banana fibre and jute fibre are mixed by placing them in continuous form or by chopping them into the required proportions i.e. 70% of banana fibre and 30% of jute fibre.

4. Preparation of specimen

The mixed proportion of banana and jute fiber is placed in the mold and epoxy resin and hardener are poured in the mold up to required amount. After pouring these epoxy resin and hardener. As shown in fig 1 the top portion of mold is closed and required amount of load is applied on it say about 20-25 kgs. And let it dry for 2-3 days. After complete drying the required shape of specimen is cutted and further process is carried out.

Fig-1 Preparation of specimen

5. Testing of specimen

a) Tensile test:

For tensile test the universal testing machine is used which is electronic and hydraulically operated. By placing the specimen between two jaws and by tightening they and the load will be applied in two opposite pulls as shown in figure.

Fig-2 Tensile test

b) Flexural Bend Test:

For this test Universal testing machine is used by placing the specimen between two anvils and load will applied from the top side and at the centre of the specimen as shown in fig 2 and the reading are taken from the digital output and graph.

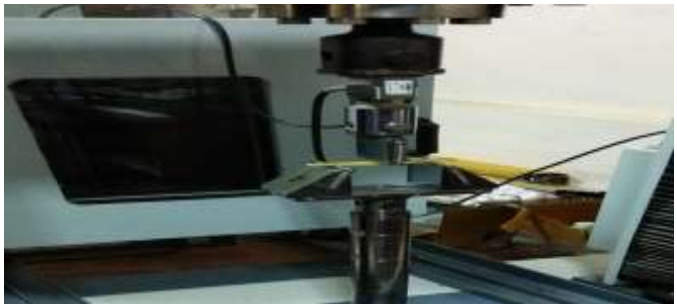

Fig-3 Flexural bend test

c) Izod impact test:

For this test impact testing machine is used by placing the specimen between two anvils and raising the arm of the machine up to certain height and releasing it, the arm swings by down hitting a notched sample by this releasing of arm the breaking of the specimen takes place, further the energy absorbed by the sample is calculated.

Fig-4 Impact testing machine

3. RESULT AND DISCUSSION:-

3.1 Tensile test of the Banana fiber reinforced with jute fiber.

From the graph shown below, we found that the peak tensile load of this reinforced fiber is 18.65KN. At this load the deformation is 16.67mm, so we can compare that as thickness and width are increased. The load absorbing capacity of the reinforced fiber is also increased.

Test Method: ASTM D 3039/D 3039M

Test Conducted: Tensile Test

Machine used: Universal Testing Machine

Maximum capacity: 100 tons

Table 3.1 Tensile test readings

TESTS	RESULTS
Specimen Size	300 X 50 X 10
Width X Thickness	50 X 10
Initial Area mm2	500.00
Ultimate Tensile Load KN	18.65
Ultimate Tensile Strength Mpa	37.3

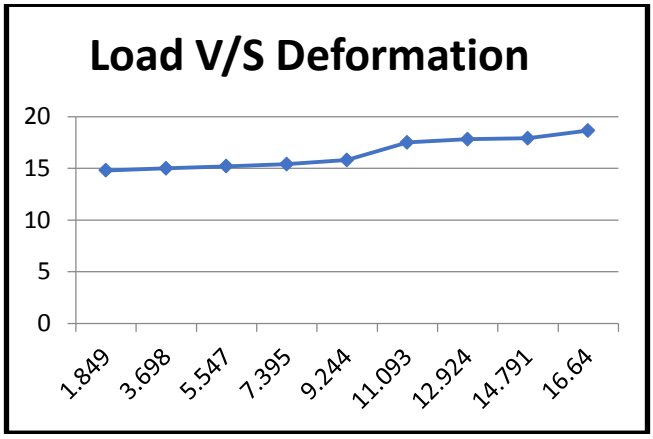

Chart-3.1 Tensile test graph

3.2 Flexural bend test

From the graph shown below, we found that the peak bending load of this reinforced fiber is 2.2KN and ultimate bending strength is 29.333 Mpa. Change in the percentage of the fiber alters the bending load and bending strength of the specimen and it can be increased.

Test Method: ASTM D 790-03

Test Conducted: Flexural Bend Test

Machine used: Universal Testing Machine

Maximum capacity: 100 tons

Table 3.2 Flexural bending test readings

TESTS	RESULTS
Specimen Size	250 X 25 x 3
Width X Thickness	25 X 3
Initial Area mm2	75.00
Ultimate Tensile Load KN	2.2
Ultimate Tensile Strength MPa	29.333

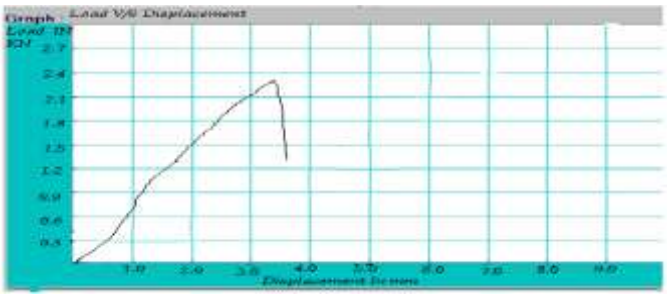

Chart-3.2 Bending test graph

3.3 Izod test

By the conduction of this test we conclude that the impact energy stored by the specimen is up to the 2.2 joules. As the percentage of fibers and resin varies the impact storing energy the specimen will also increases.

Test method: ASTM D 256-04

Test conducted: Izod impact test

Instrument used: Impact Testing Machine

Maximum capacity: 0-20 J

Table-3.3 Izod test readings

Test	Results
Width X Thickness X Length mm	13X 3.0 X 68
Impact load J	2.2

4 ADVANTAGES

1) Both banana and jute fibers are natural sources hence these are eco-friendly.
2) Abundantly available in nature so there is no manufacturing of it
3) No chemical reactions can be occurred while its utilization so it is also user friendly
4) Natural fibers can be recycled easily
5) Finally the cost of these natural fiber is also less compared to the artificial fibers

DISADVANTAGES

1) The load bearing capacity of these are comparatively less than that of the artificial fiber
2) Moisture in this fibers is more the removal of this moisture from the fiber is an problem
3) The elongation of these natural fiber is very less when they are subjected to loading

CONCLUSION

By the above testing of specimen the tensile properties can be increased by increase in the thickness of the composite fiber. And to increase the bending strength the composition of the composite material should be increased and lastly the impact properties if the composite material can be increased by varying the composition of the resin and hardener.

FUTURE SCOPE

So as to reduce the pollution in the environment the usage of this natural fiber should be increased by replacing some of harmful products. The mechanical industries should further think about replacing of some of products of automobile and aircrafts in order to reduce the weight ratio of those products. For easy lifting of some of the products which are presently heavier in weight these composite material can be used. But still further research should be carried out in order to proper utilization of these banana fiber composites.

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