EVALUTION AND COMPARISON OF MECHANICAL PROPERTIES BETWEEN BANYAN FIBRE AND JUTE FIBRE REINFORCED COMPOSITES

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Abstract: In this paper mainly discussed about focuses on the banyan fiber and jute fiber which are known to be very strong and can be processed easily, As the aerial stems of the banyan tree are very strong and children in the villages used to climb the tree using the aerial stems itself the best example for its strength, and from ancient times the banyan had the good medicinal values used to cure many diseases, comparatively jute is termed as golden fiber used for making ropes , storage bags for rice , wheat etc. In the project the laminates of banyan and jute fiber composites were made with 200*200*15mm^3 volumes. The laminates are cut into the dimensions for different tests, and tensile test, impact test ,water absorption test observation of microstructure are performed . Epoxy resin and hardener which has the excellent mechanical properties is used. Comparison between the two fibers is done and the best fiber in each stage is identified

IndexTerms – Banyan fiber, jute fiber, Mechanical Properties.

I. INTRODUCTION

A composite material is a material made from two or more constituent materials with significantly different physical or chemical properties that, when combined, produce a material with characteristics different from the individual components. The individual components remain separate and distinct within the composition of a composite .A composite material is composed primarily of a matrix, i.e. a continuous phase, which is armored with a reinforcement (reinforcement is a secondary phase), which is usually the discontinuous phase. Fibres or particles embedded in matrix of another material are the best example of modern-day composite materials, which are mostly structural. Laminates are composite material where different layers of materials give them the specific character of a composite material having a specific function to perform. Fabrics have no matrix to fall back on, but in them, fibres of different compositions combine to give them a specific character. Reinforcing materials generally withstand maximum load and serve the desirable properties. Further, though composite types are often distinguishable from one another, no clear determination can be really made. To facilitate definition, the accent is often shifted to the levels at which differentiation take place viz., microscopic or macroscopic. In matrix-based structural composites, the matrix serves two paramount purposes viz., binding the reinforcement phases in place and deforming to distribute the stresses among the constituent reinforcement materials under an applied force. The demands on matrices are many. They may need to temperature variations, be conductors or resistors of electricity, have moisture sensitivity etc. This may offer weight advantages, ease of handling and other merits which may also become applicable depending on the purpose for which matrices are chosen. Solids that accommodate stress to incorporate other constituents provide strong bonds for the reinforcing phase are potential matrix materials. A few inorganic materials, polymers and metals have found applications as matrix materials in the designing of structural composites, with commendable success. These materials remain elastic till failure occurs and show decreased failure strain, when loaded in tension and compression. Composites cannot be made from constituents with divergent linear expansion characteristics. The interface is the area of contact between the reinforcement and the matrix materials. In some cases, the region is a distinct added phase. Whenever there is inter phase, there has to be two inter phases between each side of the inter phase and its adjoint constituent. Some composites provide inter phases when surfaces dissimilar constituents interact with each other. Choice of fabrication method depends on matrix properties and the effect of matrix on properties of reinforcements. One of the prime considerations in the selection and fabrication of composites is that the constituents should be chemically inert non-reactive.

II. Types of fibre reinforcement:

(a)Dispersed particle-reinforced,(b)discontinuous fibre-reinforced (aligned), (c) discontinuous fibre-reinforced (randomly oriented), (d) continuous fibre-reinforced (aligned), (e) continuous fibre-reinforced (aligned 0^o –90^o fibre orientation angle), and (f) continuous fibre-reinforced (multidirectional fibre orientation angle) (as shown in fig. 1 &2).

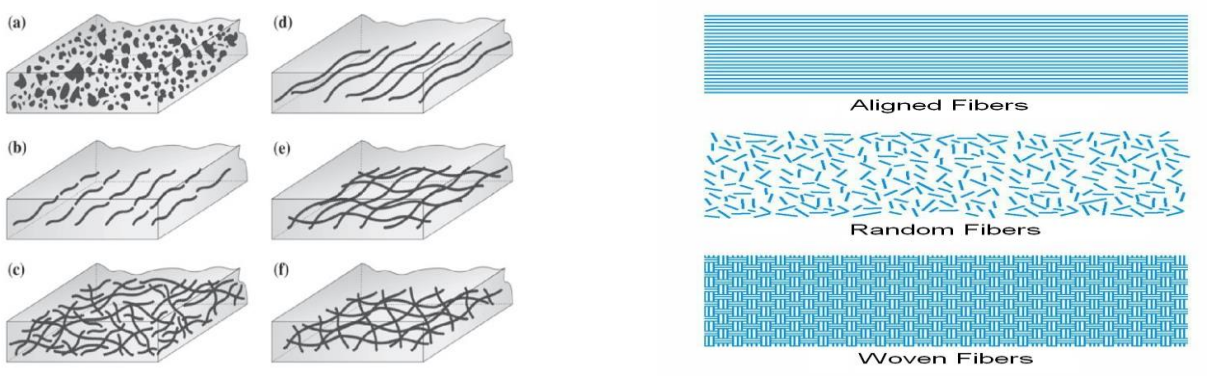

Fig 1.Classification fibre reinforcement

Fig 2. Continuous woven structure

III. MATERIALS AND METHODS

Ficusbenghalensis, commonly known as the banyan, banyan fig and Indian banyan, is a tree native to the Indian Subcontinent. Specimens in India are among the largest trees in the world by canopy coverage.Ficus Benghalensis produces propagating roots which grow downwards as aerial roots. Once these roots reach the ground they grow into woody trunks. Jute is a long, soft, shiny vegetable fibre that can be spun into coarse, strong threads. It is produced primarily from plants in the genus Corchorus, which was once classified with the family Tiliaceae, and more recently with Malvaceae. The primary source of the fibre is Corchorusolitorius, but it is considered inferior to Corchoruscapsularis.[1] "Jute" is the name of the plant or fibre that is used to make burlap, hessian or gunny cloth. The primary reason for epoxy's popularity is its superb mechanical strength. Welding is often the only alternative. Epoxy is nearly always cheaper and faster than welding. Epoxy also has excellent resistance to chemicals. After setting, there is no worry of a chemical reaction that will weaken the seal. It also resists heat. That resistance makes it ideal for electronics and electrical systems and other industrial applications. Those who use epoxy are aware of the superb mechanical strength and low curing contraction. They also know the epoxy resins are well-balanced industrial materials and suited to a broad range of applications. Engineers are faced with concerns about heat dissipation, electrical insulation, adhering dissimilar substrates, light weighting, sound dampening, vibration, and reduction corrosion. Appearance has to be considered, as well as, assembling costs. Epoxy is an adhesive formulation that meets all of those concerns. Its thermal and electrical properties, strength, and durability are what epoxy is noted for. Those properties along with the resistance to immersion and hostile chemical vapour are the reason epoxy often is chosen by engineers.

Banyan Fibre Jute Fibre Epoxy resin Hardener & Accelerator


Fig.3.Raw materials and manufacturing procedure of woven structures

IV.RESULTS AND DISCUSSION:

Impact test - (Charpy) :

Specimen specifications for different tests:(in mm) :

- Impact test :60*10*15 ASTM 256-06
- Tensile test :100*20*15 ASTM E-8M
- Flexural test :200*30*15 ASTM D 790


Fig.4. Impact Test Specimens:

Sl. No	Material	Impact load
1.	Jute	18J
2.	Banyan	20J

Table.1. Impact Test Results

Tensile Test: Before Test Specimens


After Test Specimens


Fig.5. Tensile Test Specimens

Results:

Sl. No	Material	Peak load(N)	UTS(N/mm^2)	%elongation: $\frac{L2-L1}{L1}$*100
1	Jute	16000N	53.3	2.5%
2.	Banyan	8000N	26.6	1%

Table.2.Tensile Test Results.

Water absorption Test:

Fig.6.Water absorption testing procedure

Formula: $\frac{W_2-W_1}{W_1}*100$

Since,

- w_2 is the weight of the sample after test
- w_1 is the weight of the sample before test

RESULT:

Sl.No	Material	Weight of specimen before test(w_1)	Weight of specimen after test(w_2)	%of water absorption
1.	Banyan	28gms	34gms	21.57%
2.	Jute	28gms	32gms	14.2%

Table.3. Water Absorption Test Results

CONCLUSION

Based on the test results it's clear that impact strength of banyan fibre composite is more than the jute fibre composite, tensile stress for jute fibre composite is more than the banyan fibre composite , flexural stress for both the banyan and jute fibre composite were same, water absorption for banyan fibre composite is more than that of jute fibre composite. While ANSYS analysis it is known that the total deformation is more to jute fibre compared to banyan fibre, the max shear stress is more for jute fibre than compared to banyan fibre, max shear elastic strain is more for jute fibre compared to banyan fibre. So, here by declare that both the fibres are competing each other for different mechanical properties, by combining these two fibres there is a possibility for making a different composite which there by gets both the fibre properties. The present project gives the scope for further combining of these two fibres and making a new composite.

Mechanical Test results comparison:

Sl.No	Material	Tensile strength (N/mm^2)	Impact load(J)	% elongation	%of water absorption
1.	Banyan fibre	26.6	20	1	21.57
2.	Jute fibre	53.3	18	2.5	14.2

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