

# **Mechanical Properties of Natural Composite Fibre Balanites Aegyptiacs**

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**ABSTRACT:** The present study effort is more enthusiastic in the enlargement of more and more likely fiber composites. The perseverance of industrial and domestic requirement with the use of biodegradable products. The likely fibers such as coconut, husk are naturally available are not harmful to nature. In this paper an attempt is made to prepare to composite materials using **BALANITES AEGYPTIACS** as reinforcement and **Epoxy** as the matrix material respectively. Composites were prepared by increasing the weight of fibers like 5,10,15,20 grams for reinforcement respectively by Hand Layup technique.

**KEYWORDS:** composite, Natural Fibers, epoxy, hand layup, chemical

## **I. INTRODUCTION**

Natural polymer are more in concern in research work as they are naturally and abundantly available and cheap compare to synthetic fiber. Composite consisting of two or more materials that have different physiognomies, where one assists as a binder material and the other as a fiber. The possessions of the composites are strong, lightweight, corrosion resistant, wear resistant, and attractive in arrival. Many composites have been conventional with various types of synthetic fibers in authoritative to improve the mechanical properties. Now, the type of composite tends to modification from composite with synthetic fibers to natural fibers. This is because the composite with synthetic fibers such as glass fibers are not environmentally friendly, lead to problems of waste glass fiber, which cannot be decomposed by nature. Composites with natural fibers have many significant advantages over composites with synthetic fibers such as low cost, lighter weight, available in the form of plants or waste, non-toxicity, and does not cause skin irritation. Natural fibers can be sophisticated so that its accessibility is justifiable. However, natural fibers also have many weaknesses such as asymmetrical dimensions, stiff, susceptible to temperature, easy to absorb water, and quickly obsolete. In an ideal world composite materials used in structures where strength to weight ratio into consideration. Efforts have been finished to use natural fiber composites in non-structural application. Presently a total of locomotive components previously made with glass fiber composites are currently actuality manufactured using globally friendly composites. The use of natural fibers in locomotive has two advantages, namely vehicles become lighter, which means improved fuel efficiency, and better-quality the sustainability of manufacture because it can be cultivated.

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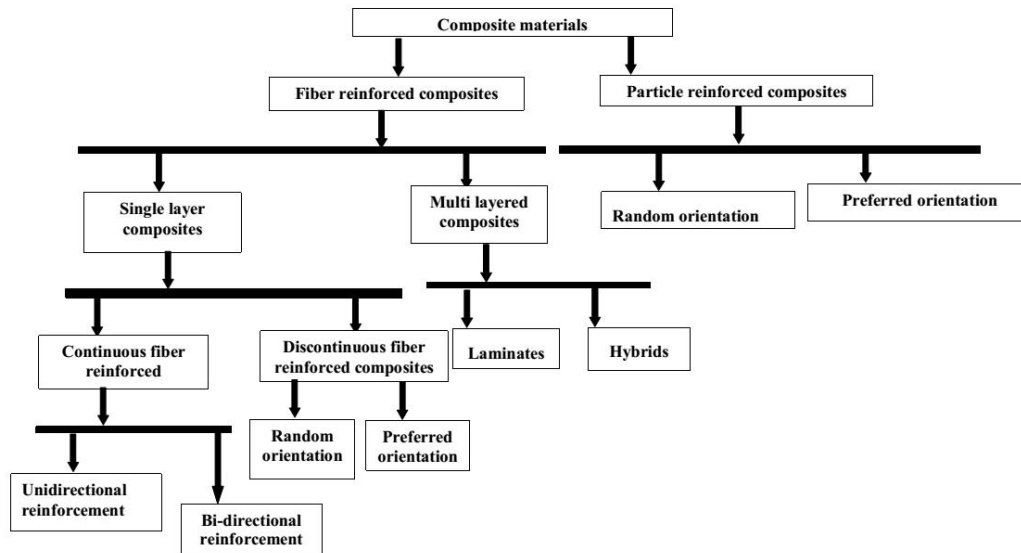


Fig.1 classification of composites

Composites are classified into different types namely fibrous and particulate composites. The classification of composites is as shown in fig 1. Natural fiber composites include coir, jute, baggase, cotton, bamboo, hemp. Natural fibers come from plants. There are many features of Natural fibers such as eco-friendly; lightweight, strong, renewable, cheap and biodegradable which make them to attract researchers to invent new composites. In general, many composites consist of a bulk material and a reinforcement of some kind added primarily to increase the strength and stiffness of the matrix. The natural fibers can be used to reinforce both thermosetting and thermoplastic matrices. Thermosetting resins such as epoxy, polyester, polyurethane, phenolic are commonly used composites requiring higher performance applications. They provide sufficient mechanical properties in particular stiffness and strength at acceptably low price levels. These composites are gaining importance due to their non-carcinogenic and bio-degradable nature. Natural fiber composites are very cost effective material especially in building and construction, packaging, automobile and railway coach interiors and storage devices. However, the main disadvantages of natural fiber composite are the relative high moisture absorption. Therefore, chemical treatments are done so as to modify the fiber surface properties.

## II.MATERIAL

Balanities aegyptics fibers were peeled off from the barks collected from their respective trees which are present in Nallamalla forest at Bailrooty area in Andhra Pradesh. Fibers are cut to a length equal to the length of the mould. Epoxy mixed with hardener was used as matrix material. Epoxy and hardener were mixed at a ratio of 20:1 respectively. Glass mould with the dimensions 200mm x 200mm x 3mm (length x width x thickness) was used for the preparation of the composite. Other ingredients which were helpful in preparing the composite are releasing agent, OHP paper and a roller.

## III.EXPERIMENTAL SETUP

The releasing agent used is hard wax which is applied over the mould such that the wax is equally spread and it is dried for about half an hour. Epoxy and hardener are thoroughly mixed in a separate beaker. The composite material is prepared by using Hand Layup Technique and the mould was covered with an OHP paper and weights were kept on it. While performing hand layup technique care should be taken to avoid formation of voids within the composite.

After that mould was kept for about 24 hours to get hardened. After 24 hours the mould was kept in an oven for 20  
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minutes such that the releasing agent gets melted and it will be easy to remove the composite material from the glass mould. And then the composite material was kept in the oven for about one hour for curing purpose. After curing the material is kept under weights so that the material gets a uniform shape like the shape of the mould cavity.

## IV. PREPARATION OF TEST SPECIMENS

### (a) Tensile testing

The ductility of a sample is determined by conducting a tensile strength test on a Universal Testing Machine (UTM). During the stretching process, the machine measures the load, or the force applied to the sample, and the displacement of the sample along with the original cross sectional area of the sample and the original length, an engineering Stress-Strain Curve can be generated.

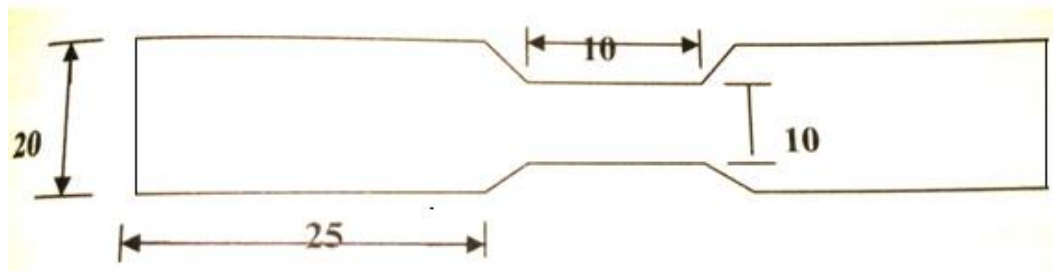


Fig .2 Specifications of Tensile Test Specimen

<b>Balanites aegyptiacs</b>			
Weight of Fiber	Max Load (N)	Tensile Stress (MPa)	Young's Modulus (MPa)
05 grams	197.10	6.57	1922.87
10 grams	295.48	9.85	2560.60
15 grams	688.79	22.96	1645.59
20 grams	799.56	26.65	2321.31

Table 1. Tensile test results of Balanities aegyptiacs

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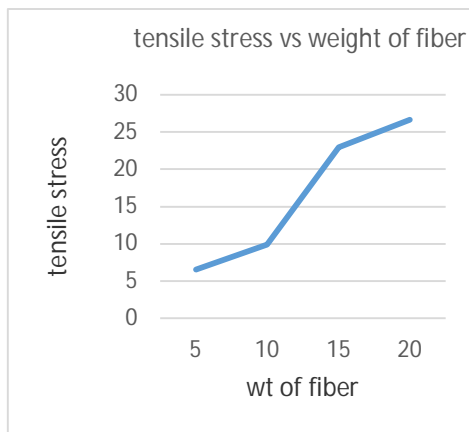


Fig 3. Tensile test vs. weight of fiber

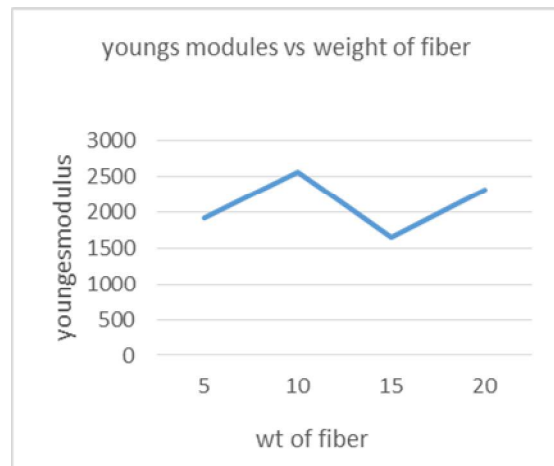


Fig 4. Young's modulus vs. weight of fiber

### (b) Flexural testing

Flexural test is performed using 3-point bending method according to ASTM D790-03 procedure. The specimens are tested at a cross head of 10 mm/min, at a temperature 18 degree centigrade and humidity 50%. In each case two or three samples are taken and average values are recorded. This test is employed to compute the flexural (bending) stress of the specimen at their maximum load. The Flexural method measures behaviour of materials subjected to simple beam loading. It is also called as transverse beam

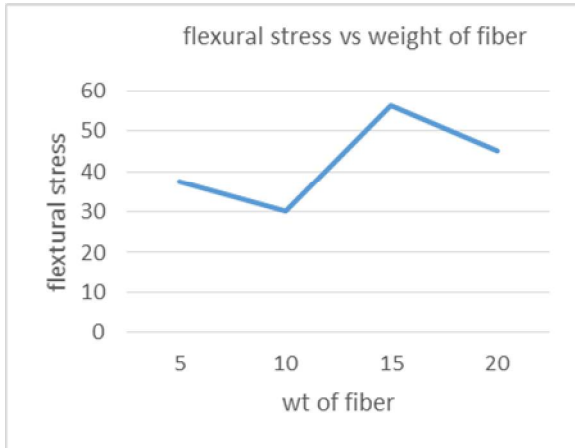
<b>Balanities aegyptiacs</b>			
Weight of Fiber	Max Load (N)	Max Stress (MPa)	Flex Modulus (MPa)
05 grams	184.2	102.2	9341.86
10 grams	189.1	105.41	9635.28
15 grams	199.89	113.29	10355.57
20 grams	220	124.92	11418.64

Table 2. Flexural test results of Balanities aegyptiacs

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5.flextural stress vs. weight of fiber

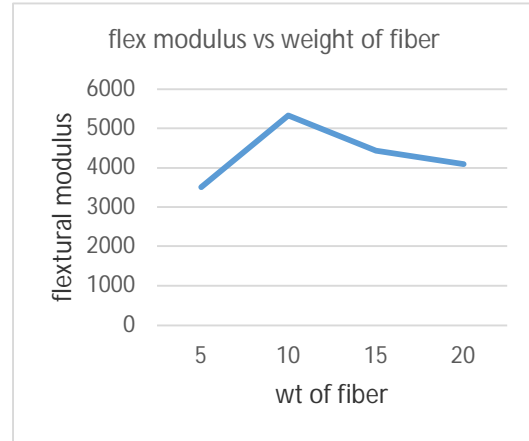


Fig 6.flextural modulus vs. weight of fiber

Fig

### (c) Chemical Test

The chemical resistance test of the composites was studied as per ASTM D 543-87 Method.

$$W = \frac{W_2 - W_1}{W_1}$$

W = weight of final sample

W<sub>2</sub> = weight of treated sample

W<sub>1</sub> = weight of untreated sample.

#### Values of chemical resistance test

Chemicals	W <sub>1</sub>	W <sub>2</sub>	$W = \frac{W_2 - W_1}{W_1}$
40% nitric acid	0.18	0.21	0.1667
10% Hydrochloric acid	0.18	0.24	0.3333
8% Acetic acid	0.21	0.28	0.3333
10% Sodium Hydroxide	0.28	0.32	0.1429
20% Sodium Carbonate	0.25	0.29	0.1600
Benzene	0.20	0.24	0.2000
Carbon Tetrachloride	0.29	0.33	0.1379
water	0.28	0.30	0.0714

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## V. CONCLUSION

From the results achieved it was experimental that the treatment of composite fibers with chemicals shows difference in the weights of composites. As the weights increase after chemical treatment, density also increases which indicates better strength for the fibers. Thus proper chemicals must be selected while using composites in application according to the need. Proper precautions must be taken while preparing composites in mould so that errors will become minimum which leads to better results. Further experiments are needed for better understanding of balanites aegyptiacs fiber composites.

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