# An Experimental Review on Mechanical properties of Jute/ Glass and coconut char composite material.

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## Abstract

Currently there are lot of methods and trends are used for making different composite materials for different applications. There is also a high demand for these kind of materials. In this experimental process, the complete effect of the JGCC composite material were made and tested under different conditions. The entire procedure and the full process was made with the method of handlay up and LY556 kind of epoxy resin was used. More over the different properties like impact, tensile, compressive, flexural and finally shear strength for the prepared material was conducted and all the results were tabulated and graphically correlated. All the tests were been conducted based on the ASTM STANDARDS. All the results were carefully studied form the graph for the different combinations of the materials were made. The best results were obtained after several testing for the combination of Jute/Coconut char/flax than the composite material made up of with glass and jute fibers.

**Key words :** Jute Fiber, Coconut char, Hardener, compressive and tensile test, Flax fiber.

## 1. Introduction

The new kind of engineering materials used in current days are reinforced natural fiber are fully made of composite materials for better results. The industrial applications with the help of these materials are keep on improving due to natural composite fibers are renewable, more recyclable and most important thing is they are available in cheap and available all the time. Out of all the different kind of fibers the one and only fiber. The plastic matrix was reinforced and the polymer called jute and glass fiber reinforced material was made. Since these kinds of fibers are having very less weight and very study, they are widely used in the different industrial applications. The one and only the combination gave us best results was the combination of coconut char mixed well with oil palm empty and fruit bunch (CCOPFB) and also this combination have better mechanical properties than any other combination.

The cost effective and the fine combination of the CCOPFB and well combination of Coconut fiber with reinforced with phenol formaldehyde resin was the more better results. Hence they are light in weight also. The following properties like flexural, tensile, compressive and impact and mechanical properties of the above prepared composite material with combination of leaf fiber which was made of pineapple which was also combined with sisal reinforced gave us the best effect.

The inclusion of glass fibre along with palmyra fibre in the matrix enhances the composites' mechanical characteristics and reduces their moisture absorption [4]. With increasing fibre content and the weight ratio of glass/sugar palm fibres, it has been discovered that the tensile, flexural, and

impact properties of glass/sugar palm composites increase [1]. With an increase in glass fibre content, the tensile characteristics of flax/glass fibre reinforced hybrid composites were enhanced. The flax/glass fibre reinforced hybrid composites have greater interlaminar fracture toughness and interlaminar shear strength than GFRP [5]. Experimental research on woven jute fabric-strengthened polyester composites demonstrates the adaptability of this sustainable source of regular fibre for use in a variety of applications.

The availability of more recent biodegradable polymers is changing the market environment for composite applications. In the automotive, aerospace, packaging, and other industrial sectors, composite materials reinforced with natural fibres, such as flax, hemp, kenaf, and jute, are becoming more and more important [6]. In order to improve the mechanical qualities, this study will combine natural fibres like jute fibre, which is widely available in India, with synthetic fibres like glass fibre. This study examines the effects of jute/E-glass fibre reinforced epoxy composite hybridization. The test findings aid in determining the prospective uses of the epoxy composites reinforced with jute and E-glass fibre.

## 2. Experimental Procedure

### 2.1 Materials

The mat fiber for jute had 0.5mm thickness was purchased from SM Composites , Chennai. The other material glass fiber and Coconut Char was directly purchased from JJ Composites, thirumullaivoil, Chennai. The glass fiber was having nearly 295 gsm.

The Epoxy material LY556 and aradur HY951 supplied by the company JJ composites. The following tables 1 and 2 shows the different composite physical properties of Jute and glass fiber.

**Table 1 : Physical Properties of jute fiber**

| Physical Properties | Jute Fiber |
|---|---|
| Density($g/cm^3$) | 1.5 |
| Cellulose content (%) | 52 - 62 |
| Elongation at break (%) | 1.3 |
| Tensile strength (MPa) | 650 -875 |
| Lignin content (%) | 7.5 - 11 |

**Table 2 : Physical Properties of glass fiber**

| Physical Properties | Glass Fiber |
|---|---|
| GSM | 285 |
| Orientation | Plain woven |
| UTS | 55 gpa |
| Modulus | 1.5 gpa |
| Density | 3g/cc |

## 3. Composite Specimen fabrication

The main composite material was fabricated with combination of glass, jute and using epoxy. All the mechanical properties were noted down and tabulated and further they are analyzed.

### 3.1 Harder Epoxy Process

For making laminate about 350 to 450 grams of epoxy mixture was taken in the ration of 1:15. Therefore for 15 grams of epoxy, 1 gram of harder was mixed. Further this mixture is well stirred with the help of stirrer for preparation of laminates.

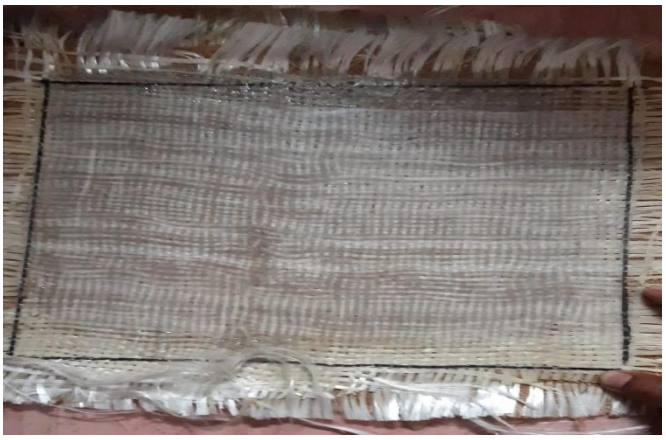
### 3.2 Fabrication procedure

The method was selected as hand layup for preparation of the composite laminates. First and foremost thing is a gel was sprayed on the mould surface in order to avoid sticking of epoxy to the surface. On the top and bottom the plastic sheets are used to make good surface finish and also for look. The hardner is taken as cutting agent. The liquid epoxy was mixed. Once the 1$^{st}$ layer is over the 2$^{nd}$ layer is formed and rolled and the process was continued. All the layers are stacked properly to have better look . The best curing time was taken for about 3 days to 4 days.

## 4. Testing of composite material

All the mechanical properties were carried with the different mechanical instruments. The table 3 indicates the laminates and the sequence of each layers of the composite material and is shown in figure

The mechanical properties are carried out by different instruments for the fabricated composites. Table 3 shows laminates designations and layer sequence of each laminate are as shown in Figures 1.



Figures 1 Composite material by hand layup method.

**Table 3 : Physical Properties of glass fiber**

| Composites | Compositions |
|---|---|
| **L1** | G + G + G + G + G + G + G + G + G |
| **L2** | J + J + G + G + J + J |
| **L3** | J + J + J + J + J |
| **L4** | G + J + J + J + G |

## 5. Tensile test

The tensile test was carried out for the made composite material as per ASTM D638 standard and the specimen dimension was about 215 x 20 x 4 $mm^3$. The Universal testing machine was used for testing the made composite material under the maximum load of 100KN.The tested materials are shown in figure 2. All the readings had been noted and tabulated for analyzing the tested data.

Fig. 2(a)-G/J Tensile Specimen

Fig. 2(b)-Tensile after testing specimen

Fig. 2(a)-G/H/F Tensile Specimen

Fig. 2(b)-G/H/F Tensile after Testing

## 6. Flexural test

Similar to above test and considering the standards the flexural test was carried out for the dimension of 90 x 8 x 4 $mm^3$ and the reading were recorded and shown in figure 3.

Fig-3(a)-G/C flexural specimen

Fig-3(b)-G/C-flexural after testing

## 7. Impact test

Similar to above test and considering the standards the flexural test was carried out for the dimension of 60 x 13 x 4 $mm^3$ and the reading were recorded and shown in figure 4.

Fig-4(a) G/J Impact specimen

Fig-4(b) G/J Impact after testing

## 8. Results and Discission

### 8.1 Tensile Properties

The above prepared composites specimens layers 1,2,3 and 4 were tested for different tensile properties in machine UTM noted all the tensile properties below table 4. The high tensile strength of 285 $N/mm^2$ and L3 jute layers shows a lower tensile strength of 57 $N/mm^2$, combination of jute/glass layers laminates L2 & L4 shows better results more than the layer 3.

| Composites | Break Load (KN) | Tensile Modulus ($N/mm^2$) | UTS ($N/mm^2$) |
|---|---|---|---|
| L1 | 10.54 | 5543.27 | 285 |
| L2 | 2.1 | 412.5 | 95.06 |
| L3 | 17.5 | 2543.25 | 57 |
| L4 | 6.43 | 4021.11 | 129.75 |

### 8.2 Flexural Properties

The flexural properties are tabulated as shown in the table 5 below. For the layer 2 the

flexural strength was more about 300.5N/mm$^2$

| Composites | Flexural Modulus (N/mm$^2$) | UFS (N/mm$^2$) |
|---|---|---|
| L1 | 243.2 | 346.23 |
| L2 | 148.3 | 234.74 |
| L3 | 99.45 | 170.21 |
| L4 | 300.5 | 296.34 |

### 8.3 Impact Properties

The following table gives the impact strength for the different layers.

| Composites | Impact Strength (J) |
|---|---|
| L1 | 12.4 |
| L2 | 4.5 |
| L3 | 1.5 |
| L4 | 3.95 |

The composite hybrid using the materials like jute/glass fiber reinforced epoxy composite by hand layup method. From the tests, the following conclusions are drawn:

The composite layer 3 consisting of jute composition gave very poor results when compared with composite layer 1 of Glass fiber composition.

The hybrid composites layer 2 and 4 of Jute/Glass fiber compositions gave better results than composite layer 3. Laminate layer 4 shows better than layer 2, because it consists of glass in the outer most layer.

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