

Anaology of Jute Fiber with Mud Crab Shell and Mussels Shell Powder Filler Reinforced Isophthalic Polyester Resin Based Composites



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Abstract: Jute fibers are totally biodegradable and recyclable substances, i.e., environmentally friendly substances. The contemporary annual global production of jute fiber is ready 3.2 million tons and used for diverse packages. Various research is being accomplished to discover a suitable substitute for the non-bio degradable plastic strengthened composites, which has a negative effect at the environment. The mercerization technique is executed the use of 8% of sodium in water to form the sodium hydroxide (NaOH). The property of the fabric is similarly promoted with the aid of adding mud crab shell powder and mussels shell powder all through the hand moulding process. The composite fabric is evolved with the assist of isophthalic polyester resin with 2% of accelerator and hardener used at the side of it. Experiments are executed as according to ASTM requirements to discover the mechanical properties. In addition to mechanical properties HDT (Heat Deflection Test) and rate of burning test are done. With help of the studies and study, Jute fabric mat can be used as an alternate for plastic components (non bio degradable).

Keywords: Jute, Isophthalic, hand moulding process, Mercerization, Reinforcement.

I. INTRODUCTION

The nature of natural fiber such as it is less weight, reuseable, eco-friendly and offers a high overall performance in relation to its mechanical properties makes this material an best alternative for the presently used components in the manufacture of automobile components[1]. More than 100 years natural fibers are used in the world. As the automobile market and its supportive industries were increases massive quantity of natural composite material fed on as more automobile components. However at the given up of the product life; products begin every other life cycle, both by recycling or disposal in a variety of manners[2].

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The developments in the direction of utilization of natural fibers in the automobile zone started out in the 1990s in Europe and reached North America some years later.

The demand for strengthened plastics in the United States is projected to grow 2.5% yearly to over four billion (1.81 billion kg) pounds in 2007, valued at US\$6.5 billion. This will create a market for 2.8 billion (1.27 billion kg) pounds of resin and 1.3 billion (0.59 billion kg) pounds of reinforcements. The automobile and construction industries will continue to be the main markets for reinforced plastics, together accounting for 63% of the whole in 2007[3]. Jute is the common natural fiber which has high productivity in India. Jute fiber reinforced polymer composites have proved to be higher than few structural materials previously made up of wood and steel. Most types of jute fibers are light brown, but some off-white varieties are also obtained. Since it is sturdy and flexible, the fiber is generally easy to work with and is long and gleaming in its raw state. [4].

II. FABRICATION

A. Materials used

The Jute fabric is ordered and bought from the Anakaputhur Jute Weavers Association. The Isophthalic polyester resin, and corresponding hardener (Methyl Ethyl Ketone Peroxide) and accelerator (Cobalt Octoate) supplied with the aid of Sakthi fiber glass, which have been used to prepare the composites. The Jute fabric is now obtained in mat form.



Fig. 1. Jute Fabric





Fig. 2. Isophthalic Polyester Resin



Fig. 3. Methyl Ethyl Ketone Peroxide



Fig. 4. Cobalt Octoate

In order to expand the properties of the Jute fabrics, it is chemically treated with water solution containing 8% sodium salts (NaOH) dissolved in it, this process is called

as mercerization process.



Jute fabric is soaked in 8% of sodium hydroxide (NaOH) solution for 11 hour. Dried at room

Temperature (28-32) for 48 hour. Then heat dried for few minutes. This makes the Hydrophilic nature of the mat into Hydrophobic nature. Then the Jute fabrics were cut into uniform shape.

III. COMPOSITE FABRICATION

The isophthalic polyester resin and its corresponding accelerator and hardener were mixed as 2% of resin. Then add the filler (A-mud crab shell powder, B-mussels shell powder) as 5% according to the weight. In order to enhance elevated interior bonding and to expand crosslink density of the composites, the fillers are used in the isophthalic resin solution[5]. Take 750ml of resin in a beaker which is added with the hardener and accelerator and then apply the solution layer by layer in the jute faibre. The process is carried out by hand moulding process[6] and the outcome of the composite is shown in the Fig.5 and Fig.6.



Fig. 5. Jute fiber with mud crab shell powder



Fig. 6. Jute fiber with mussels shell powder

IV. METHODOLGY

Various mechanical test is carried out in order to recognize and examine the mechanical property of the isophthalic based Jute. All the mechanical test is carried out according to the ASTM D standards. The following are mechanical test carried out:

A. Tensile Test

Tensile testing, additionally known as tension testing, is a indispensable materials science and engineering check in which a sample is subjected to a managed tension until failure. Properties that are directly measured by a tensile test are last tensile strength, breaking strength, maximum elongation and reduction in area. From these measurements the following properties can additionally be determined: Young's modulus, Poisson's ratio, yield strength, and strain-hardening characteristics. Uniaxial tensile testing is the most typically used for obtaining the mechanical characteristics of isotropic materials. Five samples were tested in each set and average is tabulated for each specimen.[7]



Fig. 7. Universal Testing Machine (UTM)

Tensile assessments are usually conducted on electromechanical or Universal Testing Machine (UTM) at a crosshead velocity of 50 mm/min and a gauge length of 50 mm. The Tensile test used to be performed in accordance to the ASTM D 638 standards. The test specimens used were rectangular in form with dimensions 120 mm x 12.5 mm x 3 mm. Five samples have been tested in every set and the average. Fig.7 represents the anatomy of the Universal Testing Machine (UTM).

B. Flexural Test

The most common motive of a flexure test is to measure flexural power and flexural modulus. Flexural strength is described as the most stress at the outermost fiber on both the compression or tension facet of the specimen. The material is laid horizontally over two factors of contact (lower support span) and then a pressure is applied to the top of the material through either one or two points of contact (upper loading span) till the sample fails. The most recorded force is the flexural strength of that sample. The flexural modulus of the fabric increases with increase in fiber loading[8].



Fig. 8. 3-point Flexural Testing Machine

Flexural properties of the composites have been measured by using a three-point loading device as per ASTM D 790 the usage of a universal testing machine with rectangular samples of dimension 120 mm x 12.5 mm x 3 mm. A minimum of 5 samples had been examined in each case and average of these results are tabulated for future calculation.

C. Compression Test

A compression test is any test in which a material experiences opposing forces that push inward upon the specimen from opposite sides or is otherwise compressed, "squashed", crushed, or flattened. The test sample is usually positioned in between two plates that distribute the utilized load throughout the whole floor area of two opposite faces of the test pattern and then the plates are pushed collectively by means of a universal test machine causing the sample to flatten[9]. Both the samples are taken as the measurement of 120 mm x 12.5 mm x 3 mm thickness. The compression test is also carried out in the universal testing machine. The samples are loaded in the machine and results are tabulated.

D. Impact Test

Impact tests are used in analyzing the toughness of material. A material's toughness is a element of its capacity to soak up energy all through plastic deformation. Charpy impact test, additionally recog-nized as the Charpy V-notch test, is a standardized excessive strain-rate test which determines the quantity of energy absorbed through a material for the duration of fracture. Absorbed energy is a measure of the material's notch toughness[10].



Fig. 9. Impact Testng Meachine

The Fig.9 shows the impact testing used for the experimental work. For each case, a sample of 5 is taken and tested and the average value is tabulated.

E. HDT(Heat Deflection Temperature)

The heat deflection temperature is the temperature at which a polymer plastic sample deforms underneath a specifies load. The property of a given plastic material is utilized in many components og production design, engineering and manufacture of merchandise using thermoplastic components[11].

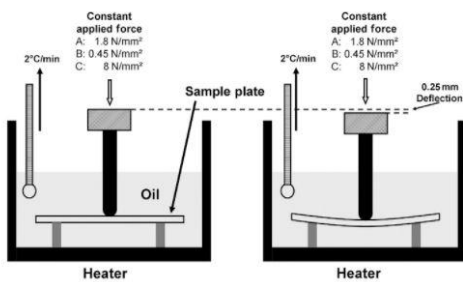


Fig. 10. HDT Test

.The heat distortion temperature is determined by the following test procedure outlined in ASTM D648.

F. Rate of Burning Test

In this test, the end result is the measurement of a material's flammability and rate of combustibility of that material. Initially the test specimen is supported horizontally at one end, and the free end is uncovered to a gas flame for 30 seconds. After elimination of the flame, the test specimen is discovered for time and extent of burning.

V. RESULT AND DISSUCION

The results are received from the common value recived from the following tests mentioned. Five sample were tested in it for each test. The mean value is calculated and tabulated.

The sample is give tag as A and B

- A- Jute fiber with mud crab shell powder
- B- Jute fiber with mussels shell powder

Similarly, in graphical representation Jute fabric with mud crab shell powder composite is indicated using blue

color and Jute fabric with mussels shell powder composite is indicated using red color.

A. Mechanical Property

The main mechanical properties such as Tensile, Flexural, Compression and Impact were tabulated below. In this specimen the tensile strength of sample A is grater than the sample B. when compare to other test research flexural strength of the sample B is grater thn the sample A. In compression strength also the value od sample B is greater than the sample B. At laste the impact strength also the strength of Sample B is gtrater than the sample A.

Table.1 . Mechanical Property Readings

Speciman	Tensile	Flexural	Compression	Impact
Unit	MPa	MPa	MPa	MPa
A	24.58	41.33	47.8	20
B	22.34	43.36	66.1	40

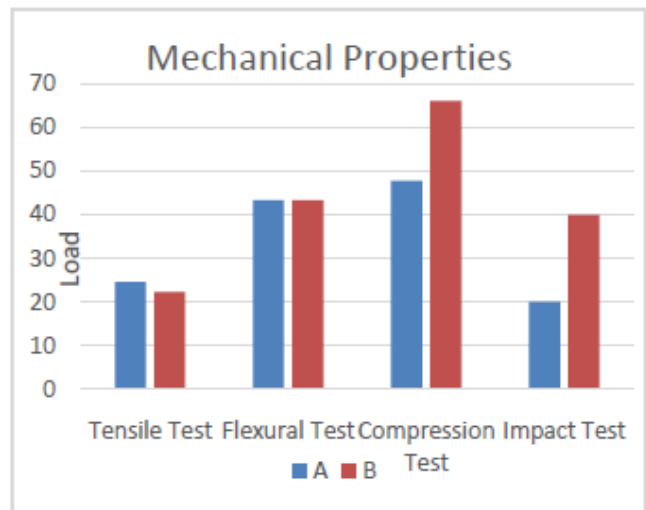


Fig. 11. Mechanical Properties

B. Heat Deflection Temperature (HDT)

HDT test is carried out in ASTM D790. Test parameter is HDT: 1.82 MPa. In HDT test the sanple B is grater than the sample A.

Table. 2. HDT Test

S.No	Sample	Unit	Test method	Test result
1	A	°C	ASTM D648	59.7
2	B	°C	ASTM D648	60.9

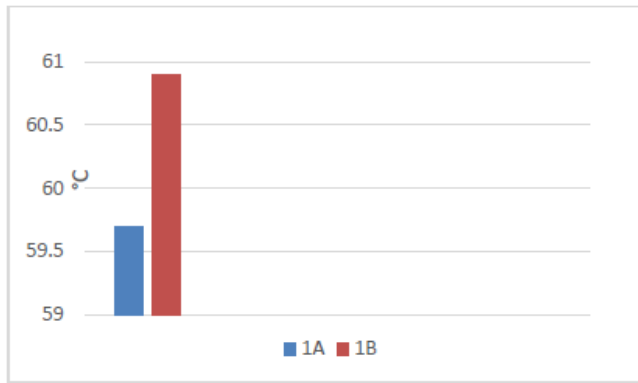


Fig. 12. Comparison of HDT test

C. Rate of Burning

In terms of Rate of burning it is high in sample B followed by sample A by small margin.

Table.3. Rate of burning

Speciman	Rate of Burning (mm/mins)
A	12.44
B	14.43

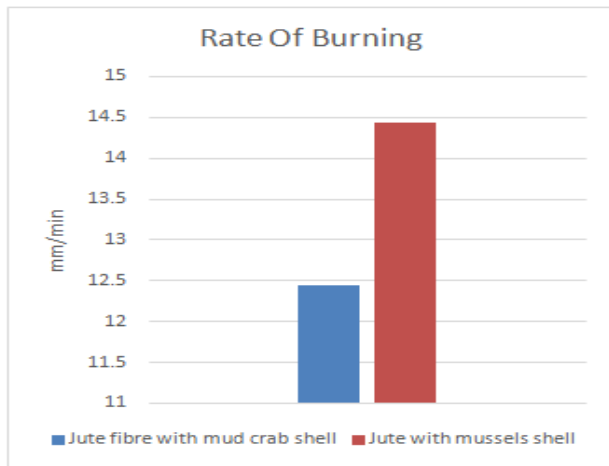


Fig. 13. Comparison of Rate of Burning

VI. CONCLUSION

In technology of frisky environment utilization of natural fiber as reinforcement has been demonstrated as environment friendly choice to usual artificial fibers. Extensive study has been made to discover the mechanical strength of Jute Fiber with mud crab and mussels shell powder bolstered composite, with an result proving the following Inference

- Mechanical properties of Jute Fabric composite are nearly at par with the plastic fabric in each aspect, thinking about the environmental component it is wise to use natural based natural Jute fabric composite than the plastic composite.
- The Jute Fabric composite with mud crab and mussels shell powder produces nearly the equal charge of burning, so they can be used in the area of Thermal application

- Further lookup on Jute fabric mat is recommended, examined with two one of a kind filler material and resins in order to extend the mechanical property and structural integrity Bamboo fabric composite

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