

STUDY OF MECHANICAL PROPERTIES OF TREATED COIR SHEATH BY EPOXY RESIN

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ABSTRACT

In this research work deals about the fabrication process and testing on sheath reinforced polymer composite material. The composites were developed by means of hand lay-up method with ethyl methyl ketone peroxide as catalyst and cobalt naphthalene as accelerator. Fibre volumes fractions have been maintained as constant. Treatment of coir with NaOH at different time period has been performed for improving bonding strength included fibre as well as matrix materials. Orientations have been maintained in coir fibre. The composites are properly maintained at 3mm. Tensile and flexural strength of fibre was improved after treating the fibre for 10 hours of alkali treatment. The fabricated composites were characterized using tensile testing. In view of determining properties of coir and all the fibre would be suitable as reinforcement of green composites.

Key words: Mechanical properties; Coir rein-forced Polymer; Composite material; Hand Lay-up technique; Surface roughness.

1. INTRODUCTION

In recent years natural fibers are drawn considerable attention as an alternative to synthetic fibres in composite materials. Natural fibres have many advantages, such as biodegradability, renewability, wide availability, low density and low cost, which offer greater opportunities to develop a

new class of light weight, environment friendly, structural composites.

Mukul Shukla et al 2012 [1] deals about the study on "Tensile and structural characterization of alkali treated Borassus fruit fine fibres" They found out the tensile properties of the fibre treated with sodium hydroxide solution was found to increase due to improved fibre structure and found to be the best for 8halkali treatment. The thermal stability of the fibres improved slightly by alkali treatment.

Low K. Ong, et al 2008 [2] deals about the study on "The Effect of Treatment on Tribo Performance of CFRP Composites". They concluded that for untreated condition, poor adhesion bonding between the coir fibre and polyester matrix leads to existence of debonding gap around the fibre. Prithviraj Arora, et. Al 2005 [3] deals about the study on "Tensile and flexural strength of coconut fiber reinforcement epoxy composites". The tensile and flexural strength of coconut spathe and spathe fibre reinforced epoxy composites evaluated to access the possibility of using it as a new material in engineering applications. The comparison of this fibre was done with banana fibre cotton and coconut coir. A. V. Ratna Prasad, et. al. 2010 [4] deals about the study on "Fabrication and testing of natural fibre composites: Vakka, sisal, bamboo and banana" They have fabricate davakka fibre and then tested. The results are in an excellent

quality, quantity and lengthy fibre useful for fabrication of large composite components. Stephen Michielsen 2003 [5] deals about the study on “Surface Modification of Fibres via Graft- Site Amplifying Polymers” They have found that by grafting polymers to the surface of fibres, we can greatly alter the surface properties.

Based on coconut sheath composites very little literature reports are identified. Some literatures have reported Borassus fine fibre was found to be best for 8 hours of Alkali Treatment. Many literatures have reported that treating the fibre with NaOH results in better strength than other properties.

The main objectives of this research work is to develop a new class of natural fibre polymer composite to explore the potential coir fibre and find a better strength for our fibre by treating it with Sodium Hydroxide Solution for different time periods. The composites are fabricated by surface modified fibre used as reinforcement material in composite. The enhancement in the strength of hybrid composite by mechanical testing is tensile strength and tensile modulus.

2. Methodology

The methodology diagram is shown in figure 1.

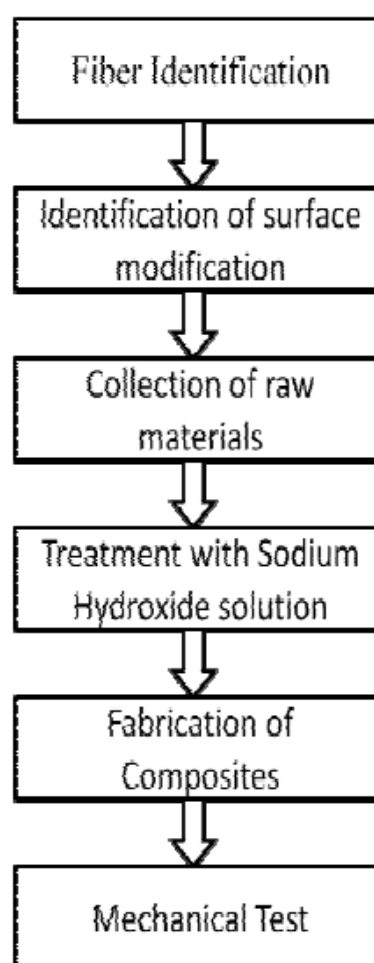


Figure1: Methodology

2.1 Fibre andMatrix

Coconut sheath is collected from local sources. Polyester resin was used as a matrix, ethyl methyl ketone peroxide and cobalt naphthanate was used as a catalyst and actuator and are collected from janaki enterprises, Chennai. NaOH was received from Indian research products, Chennai.

2.2 Alkali treatment of fibres

In composite material good inter facial bonding between the fibre and matrix is essential for optimum performance. To improve the bond strength, chemical treatment of fibres was one of the ways to achieve good bond strength between fibre and matrix leading to the improvement of mechanical properties.

The cut fibres are treated with sodium hydroxide in 1 liter of water for different time. After that fibers are cleaned with distilled water. Then these washed fibres are dried in direct sunlight or at a room temperature until the fibres are free from moisture. The image of NaOH is shown in figure 2.



Figure2: Image of NaOH pellets

2.3 Methods of Hand Lay

Reinforcement fibers can be cut and laid in the mould.

Resin must then be catalyzed and then added to the fibre.

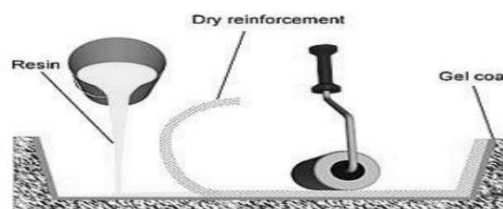


Figure 3: Schematic diagram of Hand Lay-up Process

A brush, roller can be used to impregnate the fibres with the resin. The hand lay of process is shown in Figure 3.

2.4 Fabrication of Hybrid Composites

The hybrid fibre is defined as the combination of two natural fibres or artificial fibres. The primary reinforcement is to fabricate hybrid composites coconut sheath. The selection of fibre is the major part in the composite material. The fibre should be selected after completing the following process.

The fibre is cut into as per the dimension of hand mould. The coconut sheath fibre is treated with distilled water to remove the foreign particles and is then kept at room temperature to remove the moisture. Weight of each fibre is measured and only the fibre which is having same weight is taken. Resin is taken depending upon the mould size. The actuator and catalyst are taken in 15 ml per 10 ml of resin. The actuator and catalyst are mixed with resin and stirred well. The stirring process should be effective and if the time increases it results in curing. The four fibres which consist of two jute fibre and two coir sheath are then treated with Hydroxide for various time periods (0, 2, 4, 6, 8 and 10 hours). Then the fibres are cleaned

by water continuously washed using distilling water then keeping at room temperature. The lower mould is coated with wax followed by resin pouring. Then the fibres are fabricated in order and the resin should be poured in between each fibre. The resin mixture should cover all the place of fibre for effective bonding between the fibres and to avoid delaminating. After the fibres are arranged in order with resin, the weight is kept on the mould to compress still the resin flow out of the mould and it is allowed to cure for 24 hours.

2.5 Design of the Mould

For Tensile Strength
ASTMD638M

Length of the material = 160 mm

Width of the material = 12.5mm

Thickness of the material = 3mm

3. RESULTS AND DISCUSSIONS

3.1 Tensile Testing of the Composite

Tensile strength has defined with stresses are measured with force. Some of the irregular homogeneous metals could be analyzed with force per unit width. Tensile stress of composite materials with various period of timing is mentioned Table 1.

Table 1: Tensile strength of the composite for different time period

Treatment time with NaOH in Hrs	Yield force In Kg	Break force In Kg	Tensile strength at break in MPa	Tensile strength at break in MPa	Elongation In mm
0	165.60	162.7	44.16	43.87	2.59
2	86.94	84.2	23.18	22.45	2.75
4	167.10	166.9	44.56	44.50	2.54
6	112	112	29.87	29.87	3.34
8	139.40	139.40	37.17	37.17	2.69
10					3.53

3.2 Effect of treated fibre on tensile strength

The test result for the elongation and tensile strength are figure 4 as well as figure 5.

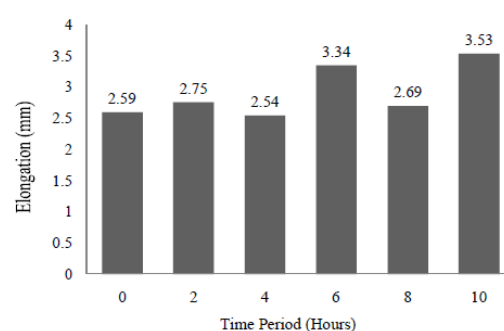


Figure 4: Elongation of composite for different time period

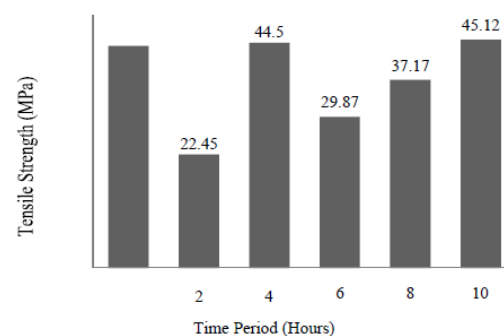


Figure 5: Tensile Strength of composite for different time period

It is seen that while the fibre is treated with 10 hours shows higher tensile strength. There can be a reason that the hemi celluloses component removes from fibre particles and shows high tensile strength while treating with fibre than untreated.

CONCLUSIONS

The experimental investigation of mechanical behavior of coir sheath reinforced polyester

composites leads to the successful fabrication of a coir with reinforced of polyester materials of composites through treated along with sodium hydroxide solution for different time period by using hand lay-up technique. It is identified that the property of mechanical composite materials like tensile strength on composite is big influenced through fibre treatment with different time period.

From this study it has been found that while treating the fibre for longer duration the strength has been increased.

Alkali treatment of the fibre was done in order to increase the roughness of the fibre surface which directly increases about properties of mechanical locking inter discipline with resin as well as fibre.

It is concluded from this research work, the coir sheath has a good strength of 45.12 MPa for tensile.

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