Physical Properties of Hybrid Particulate Composite Materials

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Abstract: **In recent past automobile industry is growing enormously. All the manufacturers of automobiles are in the process of supplying them at low cost. The cost of the automobile depends on the materials used in the processes. So, all the researchers are concentrating on new materials which will be strong enough, low cost, less weight, recyclable, high specific strength, non abrasive, eco-friendly, fairly good mechanical properties with biodegradable characteristics. In nature, none of the single material will have all the required properties. Hence much amount of research is intensified on the composite materials.**

In India, large amount of borassus fruit fibre and coconut leaf sheath fibre is available in different states which can be utilized for the preparation of composite materials.. To obtain this new composite material in different ratios, the present experimental work is planned accordingly with the above materials. Physical tests such as Impact & Flexural test will be conducted to evaluate Impact & Flexural strength of the composites

Keywords **- Borassus fruit fibre, Coconut leaf sheath fibre , Impact & Flexural test**

I. INTRODUCTION

Natural fibre have played a very important role in human civilization since prehistoric times. The Natural fibre reinforced composite has recently attracted the attention of researchers because they are environmental friendly, being light weight, strong, cheap, nonabrasive, high specific mechanical properties and abundantly available. In present research, we have been characterized the behaviour barassus and coconut sheath fibre . The borassus and coconut leaf sheath fibre are available in nature. It is a genus six species of fan palms, native to tropical regions of Africa, India and Gunea. They are growing upto 30 m high and 2-3 m long. The flower small in densely clustered spikes, followed by large brown, roundish fruits.

Coconut tree is native to coastal areas of Southeast Asia (Malaysia,Indonesia, and Philippines), tropical Pacific islands Melanesia, Polynesia, and Micronesia) and westward to coastal India, Sri Lanka, East Africa, and tropical islands (e.g., Seychelles, Andaman, Mauritius) in the Indian Ocean. Many fibre are available in different parts of the coconut tree (Satyanarayana et al. 1982). The sheath is made up of an inner mat which is sand wiched between two layers of coarse fibre . Only preliminary studies of coconut leaf sheath fibre were reported in the literature (Satyanarayana et al. 1982). Though the fibre from many parts of the coconut trees are put to use, the sheath fibre are left as huge waste. In the present work, we separated the coarse fibre from the outer layers and the fine fibre from the inner mat to study their properties

II. METHOD OF MANUFACTURING SPECIMEN

A. Extraction of Borassus Fruits Fibre

Borassus fruit fiber is a natural fiber(Scientific name is CARYOTA URENS) of Arecaceae family and is used for making strong ropes. The borassus fruit fiber is extracted by a process is known as RETTING PROCESS .The borassus fruits were taken from the tree and immersed in water tank for 2to 3 weeks .After that the fibre were stripped from the stalks by hand.So that fibre will be remain.washed and dried borassus fruit fiber was taken in separate trays to these trays 10% NaOH solution was added.Then the fibre were soaked in the solution for 10 Hours.After that the fibre were washed thoroughly with water to remove excess of NAOH sticking to the fibre

Fig. 1 Borassus fruits

Fig.2 Borassus fruits fibre

B. Extraction of Coconut Sheath Fibres

The Coconut Palm (*Cocos nucifera*) is a member of palm family (Arecaceae). Coconut leaf sheath fibre occur in mat form. The leaf sheaths collected from the trees were dipped in water for one week, thoroughly washed with tap water followed by distilled water, and dried in the sun for a week. Cleaned leaf sheath was separated to inner sheath mat and the outer layer fibre . The fibre of the inner mat and outer layers were separately kept in open to atmosphere temperature for 2 – 3 days to remove the moisture. Some of these fibre were treated with 10% sodium hydroxide (NaOH) solution for 24 hour at room temperature, maintaining a liquor ratio of 25:1 to remove the hemi cellulose and other greasy materials. These fibre were washed with water repeatedly. Finally the fibre were washed with distilled water before drying in atmosphere temperature.

Fig.3 Coconut Leaf Sheath Fibre

C. Epoxy resin and HY951 Hardener

The resin- hardener mixture is used for binding various layers fibre. LY556 epoxy resin and HY951 hardener gives thebest binding property under standard room temperature. Recommended by researchers an optimum mixing ratio of 10:1 between resin and hardener is used.

D. Specimen Preparation Method

In this study, Manual hand layup method is used for preparing composite laminates. We have taken two plane glasses and fax is applied on top and bottom surface of glass. The LY556 epoxy resin and HY951 hardener mixture is completely applied. The specimens are manufactured borassus fruit fibre, Coconut leaf sheath fibre and combination of borassus fruit fibre & Coconut sheath fibre. The combination laminate composite is prepared by layer by layer respective fibre. The first layer is Coconut leaf sheath fibre and applied epoxy and resin mixture. After that second layer of borassus fruits fibre placed over the first layer. The specimen prepared per ASTM-D 638 standard.

Fig.4 Specimen of laminate composite

Fig.5 Specimen for Flexural test

Fig.6. Specimen for Impact test

III. TESTING OF COMPOSITES

The main objective is to determine material properties of natural fiber laminate composite material by conducting the tensile tests.

A. Impact Strength

The impact test specimens are prepared according to the required dimension following the ASTM- D638 standard. During the testing process, the specimen must be loaded in the testing machine and allows the pendulum until it fractures or breaks. Using the charpy impact test, the energy needed to break the material can be measured easily and can be used to measure the toughness of the material and the yield stress. Generally sisal fibers possess good impact absorbing properties. The fracture values were calculated by dividing the energy by cross sectional area of the specimen

Fig.7 Experimental set up for Impact test

B. Flexural Test

The flexural specimens are prepared as per ASTM- D638 standard. The 3-point flexure test is the most common flexural test for composite materials. Specimen deflection is measured by the crosshead position. Test results include flexural strength and displacement. The testing process involves placing the test specimen in the universal testing machine and applying force to it until it fractures and breaks. The specimen used for conducting the flexural test. According to the ASTM-D638 standard

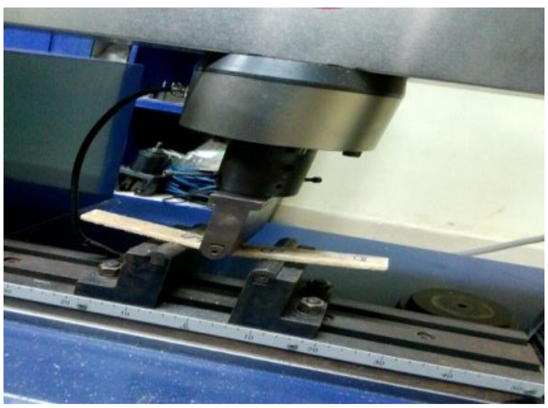

Fig.7. Specimen for Flexural test

IV. RESULTS AND DISCUSSION

Table 4.1 Results for Flexural Test

S.No	Flexural Test (Mpa)
CLSF1	17.82
CLSF2	15.9
CLSF3	16.45
Avg	16.723
BFF1	18.76
BFF2	20.12
BFF3	19.2
Avg	19.36
C1	20.62
C2	24.25
C3	18.94
Avg	21.27

CLSF: Coconut Leaf Sheath Fibre

BFF: Borasus Fruit Fibre

C: Composite

The variation of Flexural strength of the laminate composite materials is shown in the above table. It exhibits the variations of Flexural strength with different composite specimens for the peak loads. The specimen composite has high Flexural strength of 21.27 Mpa and the specimen individual has low Flexural strength of 19.36 MPa for Borassus Fruits Fibre and 19.36 Mpa for Coconut Leaf Sheath Fibre.

Table 4.2 Results for Impact Test

S.No	Impact Test(J)
CLSF1	7
CLSF2	6
CLSF3	8
Avg	7
BFF1	7
BFF2	7
BFF3	8
Avg	7.33
C1	6
C2	6
C3	6
Avg	6

The variation of Impact strength of the laminate composite materials is shown in the above table 2. It exhibits the variations of Impct strength with different composite specimens. The specimen composite has low Impact strength of 6 J and the specimen individual has high Impact strength of 7.33 J for Borassus Fruits Fibre and 7 J for Coconut Leaf Sheath Fibre.

V. CONCLUSION

From the experimental results are obtained, the following conclusion are given:

- The Flexural strength of laminate composite is 21.27 Mpa greater than individual of borassus Friuts fibre and Coconut Leaf Sheath fibre.
- The Impact strength of laminate composite is 6 J less than individual of borassus Friuts fibre and Coconut Leaf Sheath fibre.

- Good Impact strength for Borassus fruit fibre is 7.33J.

Hence the effect of borassus fruit fibre and Coconut Leaf Sheath fibre based laminate composite exhibit better Flexural strength than individual laminate materails. These filled natural fibres composites has a wide range of applications such as in automobile industries as front and rear door liners, seat backs and sun roof interior shield, valence panels below front and rear bumper, electronic packages, in aircrafts as cabin and cargo hold furnishings, artificial limbs for physically handicapped, in oil industry.

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