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EXPERIMENTAL STUDY ON MECHANICAL PROPERTIES OF SHEEP WOOL AND E-GLASS

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Abstract:- *Composites playing a vital role in the field of mechanical manufacturing. It becomes the replacement tool in the field of manufacturing. Composites are the material where we can combine more than two materials and produce a new material. Sheep wool is the natural fibre material which can be easily available and this possesses various good properties like it absorbs moisture, it is a strong and durable material etc. with this the mechanically developed Eglass material has been added, as it got higher strength, good bonding capacity. By varing the layers of sheep wool and E-Glass data has been analysed and compared and determine the better composite.*

Key Words: Sheep wool, E-glass, Hand layup, Resin

1. INTRODUCTION

Composite materials are the most advantageous and adaptable material and the most sophisticated engineering material introduced to the use of mankind in modern technology. It is the result of continuous progression of modern science of materials which helps to develop new product with varieties of material composites. Composite materials strength-to-weight ratio proportions compared to standard materials and design flexibility of these components fulfils the requirements of necessities of industries.

The word composite shows that, it is the combining of material to form an overall structure with different properties of various materials. At the present scenario composite materials are utilized by mankind in his day to day life, which includes a small gadget to big structures of airplanes and ships. These composites become our needs of everyday life.

Sheep wool is the natural fibre obtained by sheep and goat. Sheep wool is extracted by the skin of Sheep, it is a eco-friendly, low cost and possesses good characteristics. In European union, there are 90 million sheep which produces 270,000 tons of wool during the last decades, large amounts of wool were treated as wastes and burnt or landfilled [2], so by this issue natural composite has been added with a fiber to check various properties of it.

Table1. Mechanical Properties of various Fibers [6]

Fibers	Density d (gm/cc)	Tensile strength (MPa)	Modulus E (GPa)	Ratio (E/D)
E-Glass	2.55	2400	73	29
Hemp	1.48	550-900	70	47
Jute	1.46	400-800	10-30	7-21
Ramie	1.5	500	44	29
Coir	1.25	220	6	5
Sisal	1.33	600-700	38	29
Sisa	1.4	800-1500	60-80	26-46
Cotton	1.51	400	12	8

2. MATERIALS AND METHODS

A. Materials

The materials used in this study are available by the nearest industry in Belagavi. Polylite resin and E-glass fibers are taken from the industry. And sheep wool is purchased from near my village in shindolli, of Belagavi District, Karnataka state.

(a) Sheep wool

(b) E-Glass

(c) Polylite Resin Solution

Fig. 1. Materials used

❖ Sheep wool Characteristics[2]

- Sheep wool has a tendency to absorb moisture.
- Sheep wool has the capacity to absorb approximately one third of its own weight under water.
- Sheep wool has property to absorb sound waves like fabrics.
- Sheep wool fibres are resistant at burning. They burn slowly with a slight sputtering when flame is present.
- Sheep wool has the advantage that it is a self-extinguish material.
- Sheep wool can be considered as a strong and durable material
- Wool is a natural fiber with mechanical resistance, but also to bacteria and at burning
- Wool fibers are good absorbers of Noise.
- Wool manipulation does not put any danger to the health of workers.
- Wool is a renewable material and eco-friendly.

Table 2, Properties of sheep wool [6]

Length	5mm
Diameter	76-107 microns
Density	0.73 gm/cc
Moisture absorption	7.62%
Elongation in shear	9.54-30.69%

Chemical composition : [6] [11]

- Oxygen accounts for approximately 28%
- Hydrogen 7%
- Nitrogen 15% and Sulphur5%
- Sheep wool is based on Keratin containing more than 170 different proteins and polypeptides composed of different Alpha-amino acids structured in alpha- Helical form, mostly cysteine (7-20%) along with a small quantity of lipids (0.1%) and mineral salts (0.5%)

B. Methods

Before fabrication of composites, the sheep wool has been taken, it is in the form of thread, it has to be washed and kept in sunlight and poured tamarind seeds by making it in powder form. Then prepared a woven mat by it.

E- Glass is added with the sheep wool to give extra strength. And resin used in this case is Polylite resin is used, it possesses high heat resistance, good bonding and adhesive property.

Fig.2 Preparing Sheep wool yarn

Fig.3 Polylite Resin

3. FABRICATION OF COMPOSITE

The sheep wool and E-Glass fiber are mixed by using hand layup technique. The correct amount of resin is poured for its bonding. The layers are prepared on the open mould. Glass has been used as an open mould and layers has been drawn on the glass mould. Layers are drawn as per the requirement, then the resin is poured, by using hand layup technique it is moulded in a required form. No other binder is added, only sheep wool, E-glass and Polylite resin has been used in the present study.

Table3. Composition of Sheep wool and E-Glass

Sl. No.	Layer 1	Layer 2	Layer 3	Layer 4	Layer 5
1	E-glass	E-glass	Sheep wool	E-glass	Sheep wool
2	Sheep wool	E-glass	Sheep wool	E-glass	Sheep wool
3	E-glass	Sheep wool	E-glass	Sheep wool	E-glass
4	E-glass	Sheep wool	E-glass	Sheep wool	

Specimens are prepared, as per the standards of ASTM. Layers are drawn one over other as per the size required and releasing agent has been applied on it. And it is removed then by using grinder. It has been cutted into the required size.

Fig 4. Prepared by using open Mould

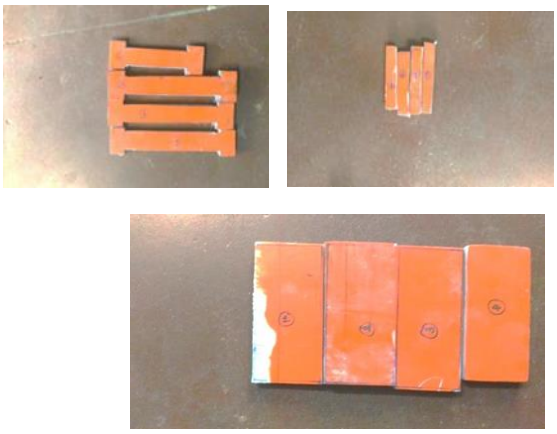


Fig. 5 Prepared Composite Specimen

4. MECHANICAL TESTING OF COMPOSITES

A. Tensile stress

Tensile test is carried out to check the deformation under the axial load. Specimen is prepared as per the ASTM D-3039 Standards. Tensile test is carried out in UTM under the applied load, until it gets failure. And the maximum strength of prepared composite has been noted down.

In the present study, Tensile stress of prepared E-glass and Sheep wool has been studied. Specimens are prepared according to the layers drawn [Table2]

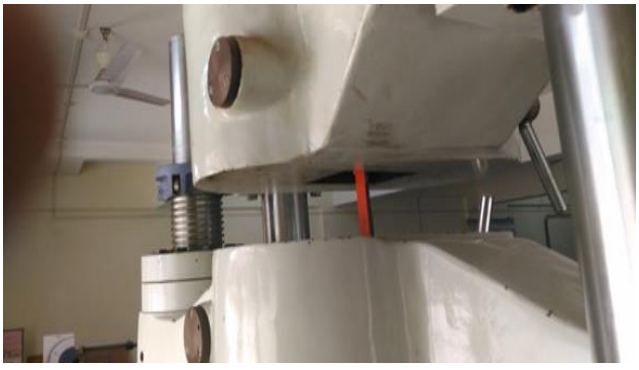
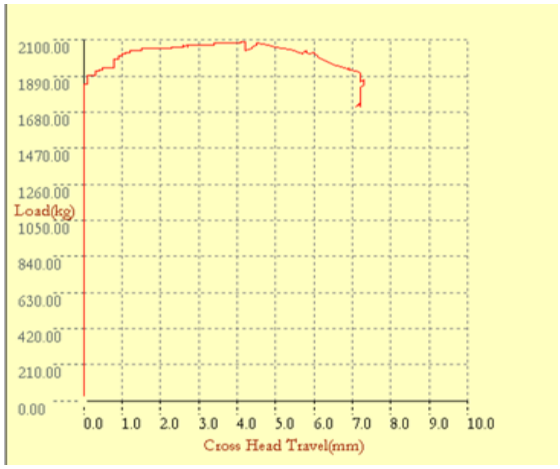
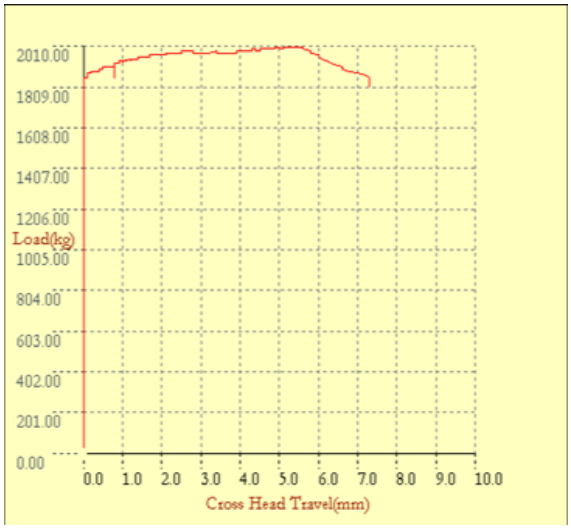


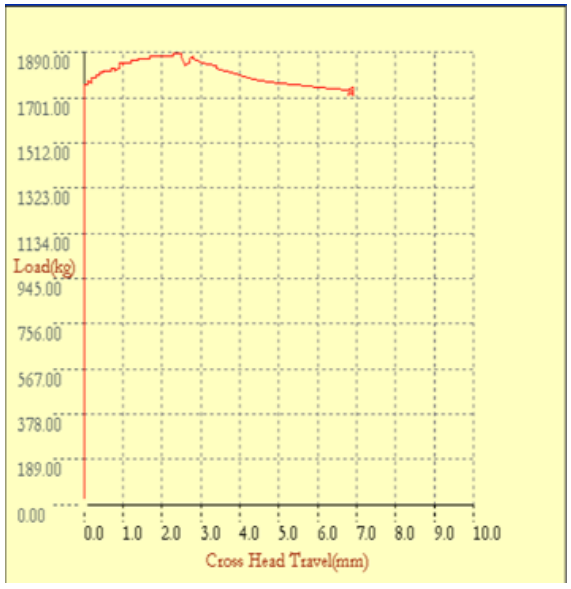
Fig.6 Tensile test setup



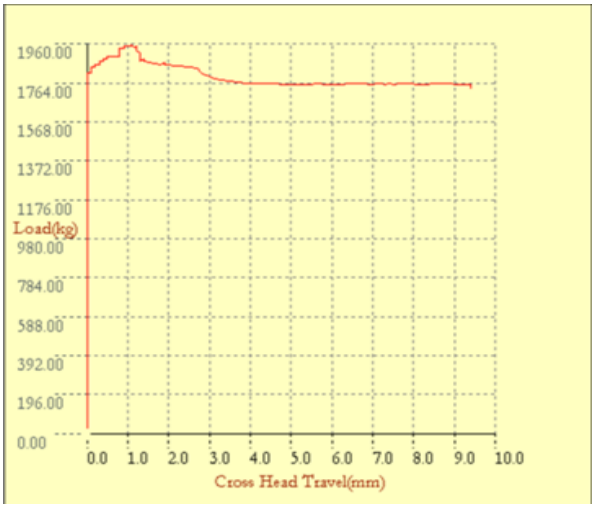
A.3 layers of E-glass and 2 layers of Sheep wool



B.3 layers of Sheep wool and 2 layers of E-glass



C.3 layers of E-glass and 2 Sheep wool



D.2 layers of E-glass and 2 Sheep wool

By the above results it is observed that maximum tensile strength is achieved by adding first layer E-Glass and the sheep wool, maximum 20KN is achieved. Up to 9% elongation is achieved by it. When first layer is drawn as sheep wool, the stress maximum tensile strength has been reduced. Tensile stress induced is largely depends on the E-glass in present study, Ultimate strength increases as the layers of E- Glass increases. Ultimate strength also depends on the maximum layers drawn of E-glass and sheep wool alternatively.

B. Impact Test

To check the composite specimen toughness and strength, the impact test is carried out. Izod or Charpy test can be used to check the toughness. In the present study, Izod test has been carried out. As per the ASTM standards the Izod specimen is prepared (55*10*10). It determined the composite specimen energy absorbed during the fracture. And test results are shown in below table.

Fig. 7 Impact test setup

Table 4. Impact test results

Sl. No	Specimen	Results (Joule)
1	3 layers of E-glass & 2 layers of Sheep wool	4
2	3 layers of Sheep wool & 2 layers of E-glass	4
3	3 layers of E-glasss & 2 layers of Sheep wool	4
4	2 layers of E-glass & 2 layers of Sheep wool	2

C. Hardness Test

Indentation hardness test is carried out to determine the harness of a material to deformation. Hardness test quantifies the resistance of a material to plastic deformation. Rockwell hardness test is used to measure the Hardness of a prepared composite specimen. During the test, Pointer of a Rockwell penetrates on the composite specimen, and then the scale will move and shows he reading, and minimum three reading we should take and note down the average of that. The present study follows the same procedure. And average of the specimen has been listed in below table.

Fig.8 Hardness test setup

Table 5. Average result of Hardness test

Sl. No	Specimen	Average of Results
1	3 layers of E-glass & 2 layers of Sheep wool	45.66
2	3 layers of Sheep wool & 2 layers of E-glass	27.66
3	3 layers of E-glasss & 2 layers of Sheep wool	52.66
4	2 layers of E-glass & 2 layers of Sheep wool	32.66

5. CONCLUSION

Tensile, Impact, Hardness tests are conducted on the Sheep wool and E-Glass composite. Data are analysed and compared. Composite 1 [Table2] has better tensile, Hardness and impact strength, compared to other 3 composite specimen.

Mechanical properties can be varied with the layer drawn method. It is also observed that, the composite specimen which is having E-glass as its first layer, it possesses higher strength. As the sheep wool is available naturally, so other tests can be carried out on this composite to utilize it in future.

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