INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact factor: 4.295
(Volume3, Issue4)
Available online at www.ijariit.com

Experimental Investigation of Mechanical Properties of Luffa-Epoxy Composite

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Abstract: In current years composites have concerned considerable importance as a potential operational material. Low cost, light weights, high specific modulus, renewability and biodegradability are the most basic & common attractive features of composites that make them useful for industrial applications. Luffa- cylindrica locally called as "sponge-gourd" is one such natural resource whose potential as fiber reinforcement in polymer composite has not been explored till date for tribological applications. In this research twin layer fiber and triple layer fiber composites are prepared and were tested to study mechanical properties.

Keywords: Luffa Fiber, Epoxy Resin, Tensile Strength, Flexural Strength, Composites.

I. INTRODUCTION

India endowed with an ample availability of natural fiber such as Bamboo, Ramie, Jute, Sisal, Pineapple, Coir, Banana etc. has focused on the improvement of natural fiber composites mainly to explore value-added application avenues. Such natural fiber composites are well matched as wood substitutes in the housing and building sector. The development of natural fiber composites in India is based on two cleft strategy of preventing depletion of forest resources as well as ensuring good economic returns for the cultivation of natural fibers.

II. MATERIAL

Raw materials used in this experimental work are:

- **Natural Fiber**- Luffa Cylindrica
- **Epoxy Resin**- Araldite LY 556
- **Hardener**- Araldite HY 951
- **Flame Retardant Agent**- Antimony Tri-Oxide

Fig 1 (a) Fig 1 (b)

Fig. 1 The L. cylindrical plant with fruit (a), the inner fibre core (b)

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III. METHOD

The composite fiber is prepared by hand lay-up technique. The luffa fiber which is taken as reinforcement in this study is collected from local sources. Then it is properly cleaned and cut to appropriate size. Wooden moulds with dimensions of 250 x 150 × 6 mm were prepared for composite fabrication. For different volume fraction of fibers a calculated amount of epoxy resin and hardener (ratio of 9:1 by weight) was thoroughly mixed in a glass jar. The composition of the sample is shown in Table 1.

TABLE I
COMPOSITIONS OF EPOXY FILLED WITH LUFFA FIBERS

Designation of Composition	**Epoxy (*Wt%*)**	**Resin (*Wt%*)**	**Luffa Fiber (*Wt%*)**	**Antimony Tri-Oxide (*Wt%*)**
Twin layer sample (S2)	63	7	20	10
Triple layer sample (S3)	54	6	30	10

The composite was allowed to preserve at room temperature for 72 hrs. During application of pressure, some amount of mixture of epoxy and hardener squeezes out. Care has been taken to consider this loss during manufacturing of composite sheets. After 72 hrs the samples were taken out of the mold and specimen according to ASTM standard were made cut for testing as shown in Fig. 2.

Fig 2 (a)

Fig 2 (b)

Fig. 2 Tensile test specimen (a) and Flexural test specimen (b)

IV. RESULT AND DISCUSSION

Tensile Test

The tensile test was carried out on UTM machine in accordance with ASTM D-3039 standard with specimen dimension 200 x 20 x 6 mm. For tensile test, three specimens were prepared and tested for the subsequent results.

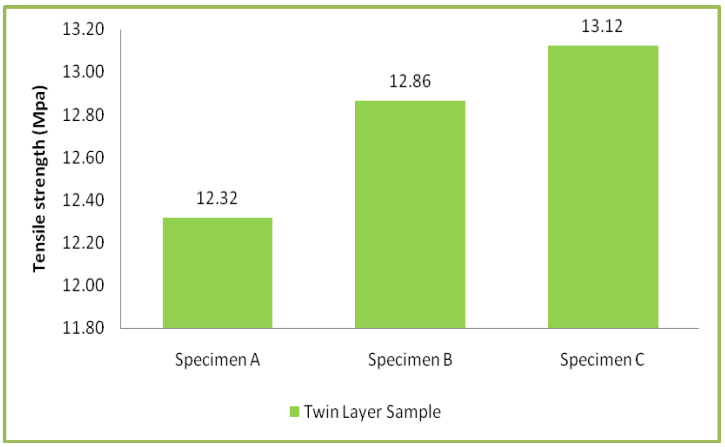

Fig. 3 Tensile Test Graph (S2)

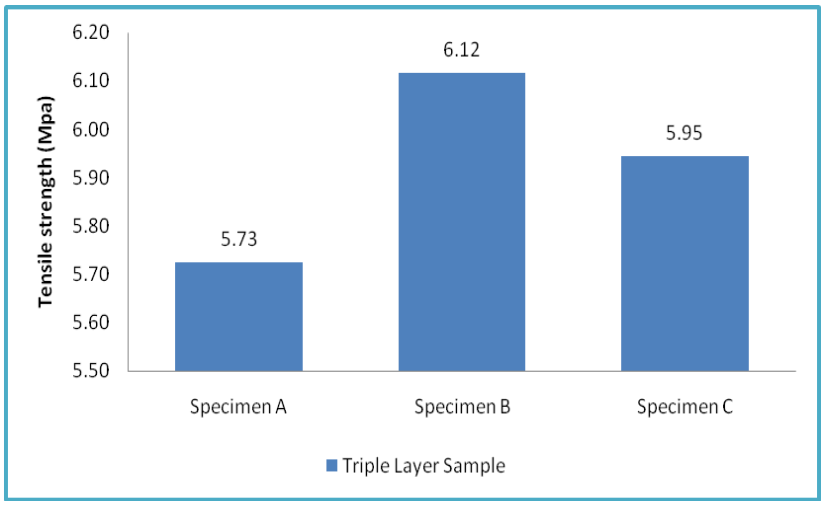

Fig. 4 Tensile Test Graph (S3)

Flexural Test

The flexural test was carried out on UTM machine in accordance with ASTM D-790 standard with specimen dimension 127 x 12.7 x 6 mm. For flexural test, three specimens were prepared and tested for the subsequent results.

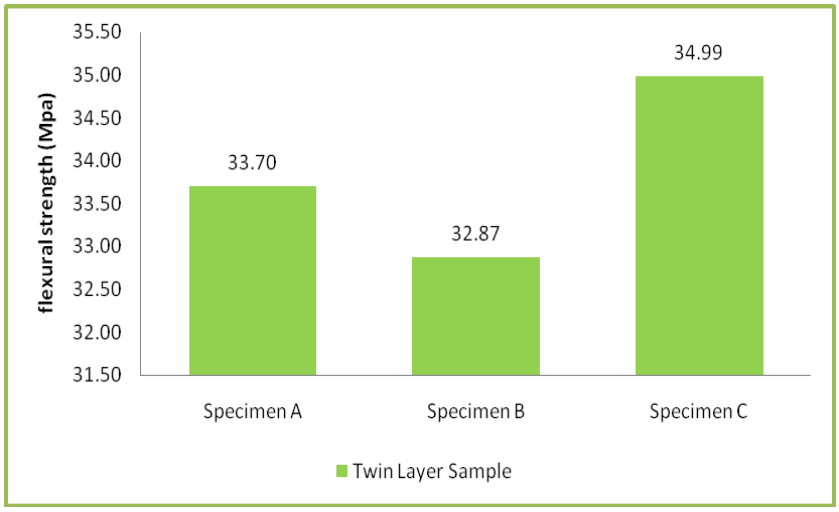

Fig. 5 Flexural Test Graph (S2)

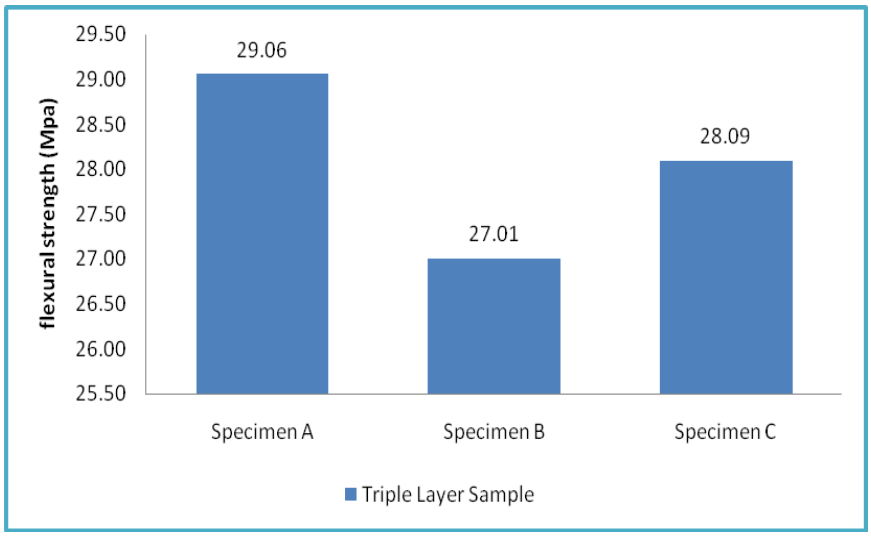

Fig. 6 Flexural Test Graph (S3)

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CONCLUSIONS

The present work deals with the preparation of luffa fibre reinforced epoxy composite. The variation in mechanical properties is shown subsequently.

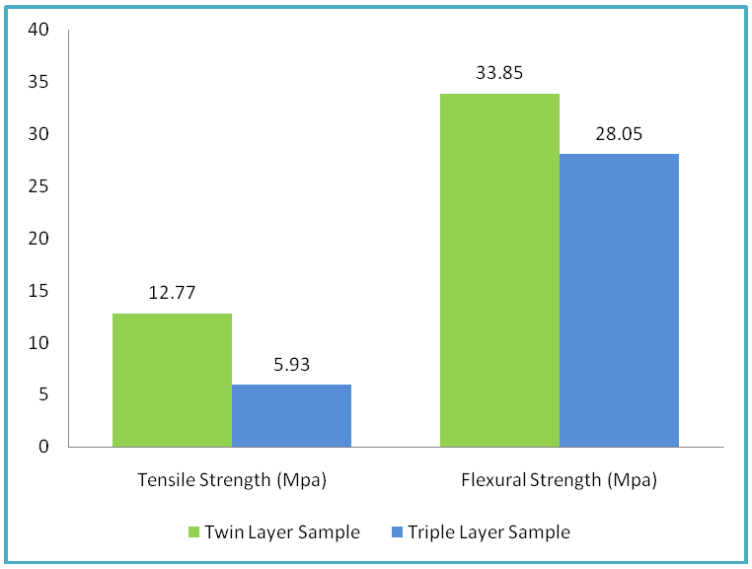

Fig. 9 Variation of properties with different layers of samples

The mechanical and thermal behavior of the composite lead to the following conclusions:

1. It has been observed from this work that the tensile strength is maximum for twin layer (S2) sample i.e., 12.77 MPa which is greater than triple layer (S3) sample i.e., 5.93 MPa.
2. It has been observed from this work that the flexural strength is maximum for twin layer (S2) sample i.e., 33.85 MPa which is greater than triple layer (S3) sample i.e., 28.05 MPa.

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