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Flame Retardant Luffa Fiber Reinforced Composites with Epoxy Resin Matrices

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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- cylindrical 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 thermal properties.

Keywords: Luffa Fiber, Epoxy Resin, Antimony Tri-Oxide, Limiting Oxygen Index, 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 Cylindrical
- **Epoxy Resin**- Araldite LY 556
- **Hardener**- Araldite HY 951
- **Flame Retardant Agent**- Antimony Tri-Oxide

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

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 AND ANTIMONY TRIOXIDE

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 Limiting Oxygen Index test specimen

IV. RESULT AND DISCUSSION

Limiting Oxygen Index Test

Limiting Oxygen Index test was carried out on LOI apparatus in accordance with ASTM D-2863 standard with specimen dimension 100 x 6 x 4 mm. Test specimens were having Antimony Tri-Oxide (Flame Retardant Agent). For limiting oxygen index test three specimens were prepared and tested for the subsequent results.

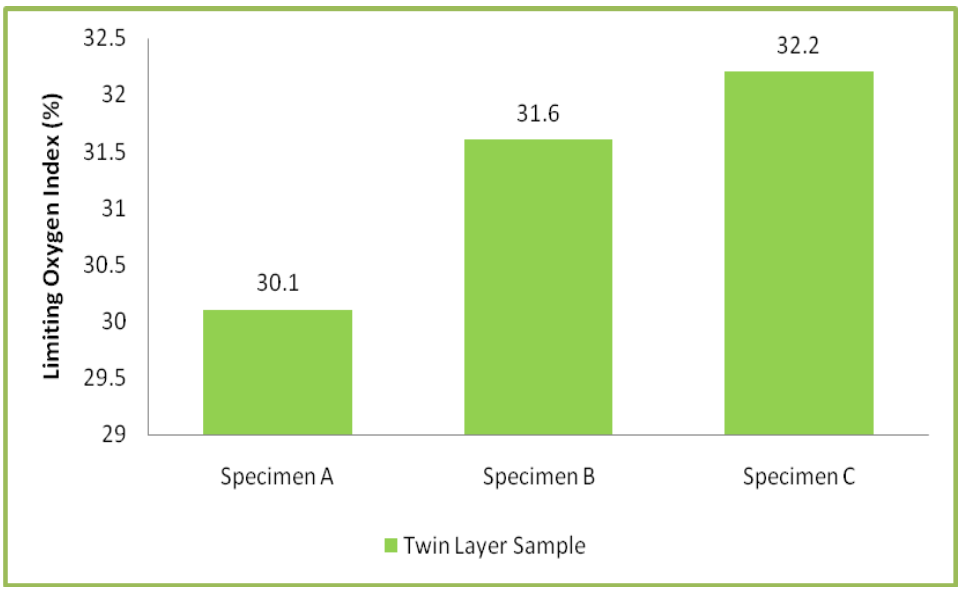

Fig. 7 LOI Test Graph (S2)

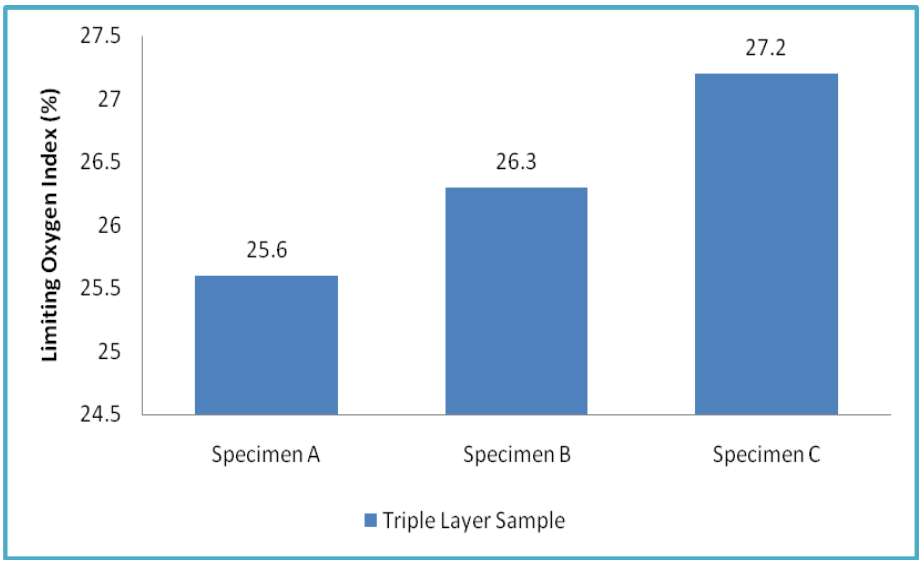

Fig. 8 LOI Test Graph (S3)

CONCLUSIONS

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

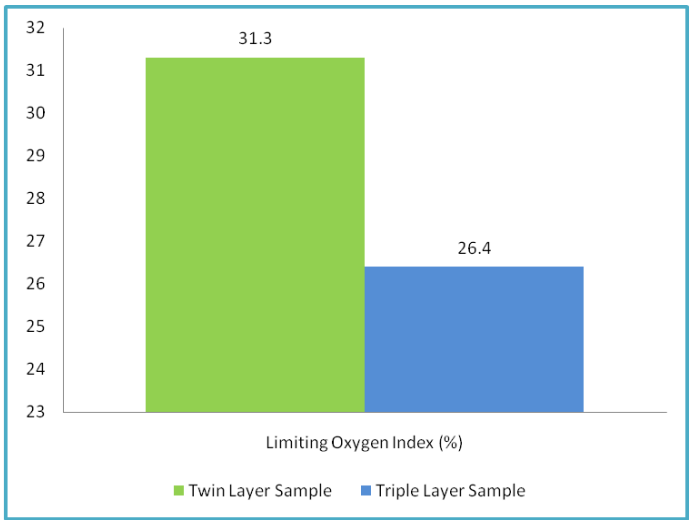

Fig. 9 Variation of LOI % with different layers of samples

The thermal behaviour of the composite lead to the following conclusions:

1. It has been observed from this work that the limiting oxygen index is greater for twin layer (S2) sample i.e., 31.3 % which is greater than triple layer (S3) sample i.e., 26.4 %.

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