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STUDY ON TENSILE BEHAVIOUR OF SANCEVARIA TRIFASCIATA LAURENTII POLYESTER COMPOSITES

Thanesh A[1], *Vadivel kannan L[2] and Manisekar K[3]

[1]Asst.Professor, Vel tech Multi Tech Dr.R.R Dr.S.R. Engineering College, Avadi, Chennai - 600 062, India
[2]Asst. Professor, Centre for manufacturing sciences. National Engineering College, Kovilpatti-628503, India
[3] Professor, Centre for manufacturing sciences. National Engineering College, Kovilpatti-628503, India

ABSTRACT

In this article, an attempt is made to study the tensile properties of randomly oriented short Sansevieria trifasciata laurentii fibers /polyester (STLFP) composites. The fibers were extracted from Sansevieria trifasciata laurentii plants by manual process. The Composites were fabricated with varying fibre lengths of STLF and weight percentage. From this study, it is observed that the increase in weight percentage of the STLF fibres increases the tensile properties of the composite.up to 20% weight percentage of fibre and then further increase in fibre weight percentage reduces the tensile property.

***Keywords**:Sansevieria trifasciata laurentii fibers,TensileProperties, Random orientation,polyester resin.*

1. Introduction

The ecological aspect is gaining credibility nowadays since people are more and more pollution conscious today than in older days. Rapid industrialization and advancement in technology have added pollutants both to the product and to the environment. The situation has become so crucial that to tolerate the deposition of pollutants. This has necessitated to turn the assessment on bio degradable eco-friendly materials. The concept of eco-friendly and recyclable products are fully recognized which has brought natural fibers in to focus [1].Renewable natural fibers could be potential substitutes for energy-intensive synthetic fibers in many applications where high strength and modulus are not required. It is therefore important to characterize and improve the strength properties of the existing fibers and to search out new sources of natural fibers [2-3].In recent years, polymer composites reinforced with short, natural fibres have gained importance due to the advantages they impart during processing, their low cost and their high strength [4].The properties of short fibre composites are strongly influenced by the fibre length, fibre orientation and fibre weight percent [5].Velmurugan et al. [6] studied the mechanical properties of randomly oriented short Palmyra fibre-reinforced composites and identified the critical fibre length and optimum fibre weight percent of short Palmyra fibre polyester composites as 50 mm and 53%,respectively.There are many fiber yielding plants in our country, which have potential for use in diversified fields but they remain unexplored so far. The less explored natural fibers belong to leaf fibers. The objectives of this study are to fabricate Sansevieria trifasciata laurentii fibers /polyester composites and to investigate the effects of the Sansevieria trifasciata laurentii fiber weight percentage on the tensile properties of the composites. In this paper, the performance of the materials and suitability of the composites are discussed in terms of the tensile properties.

Physical properties of Sansevieria trifasciata laurentii fiber

Fiber tests	Sansevieria trifasciata laurentii fiber
Breaking force(g)	376.3
Elongation (%)	2.1
Length (cm)	109
Diameter (μm)	120
Fineness (tex)	9.8

2. Materials and Methods

2.1 Fiber material

The length of the Sansevieria trifasciata laurentii plants that grown in the field ranges from 30 cm to120 cm. The actual processing of fibres from the natural Sansevieria trifasciata laurentii plants is shown in Fig.1.The leafs are cut from the plant and cleaned by water. The leafs are immersed in water 30 days continuously to remove the primary and secondary layers of the plants by biodegradable process which will be useful to extract the fibers continuously from the

**Corresponding Author - E- mail: lavako@rediffmail.com*

plant without any damage. The extracted fibres are dried in the sun light for removal of moisture. The untreated Sansevieria trifasciata laurentii fiber is then cut into different lengths for preparing the specimens of composites as per the ASTM standards.

Fig.1 (a)Sansevieria trifasciata laurentii plant

Fig.1 (b) Stagnant water retting method

Fig.1(c)Sansevieria trifasciata laurentii fiber

The untreated Sansevieria trifasciata laurentii fiber is then cut into different lengths for preparing the specimens of composites. The length used for preparing the composite varies from 10 mm, 20 mm, 30 mm respectively.

2.2 Polyester resin

Commercially available isophthallic unsaturated polyester resins used for the investigation. Accelerator (Methyl Ethyl KetonePeroxide) and the catalyst (Cobalt Naphthalene) are used to cure the resin. Thermoset isiophthallic polyester resin is one of the economical resins when compare to other resins due to its very low water absorbing capability and excellent bonding tendency as well as mechanical properties.

2.3 Specimen preparation

The prepared ASTM standard mould was shown in fig 2.The chopped fibre is aligned properly in the mould. The extreme care must be taken to obtain the uniform distribution of fibres. The minor load is applied in the fibre for initial stacking of the chopped fibres for specimen preparation. This compressed sheet was placed in a mould with ASTM standard size of 160 mm X 12.5 mm X 3 mm. Then, the unsaturated polyester resin was mixed with 2% (catalyst) and 0.5% cobalt (accelerator). The prepared matrix solution was degassed before pouring in the mould. The degassed matrix solution was applied on the compressed sheet by using a brush, and air bubbles were removed carefully with a roller.

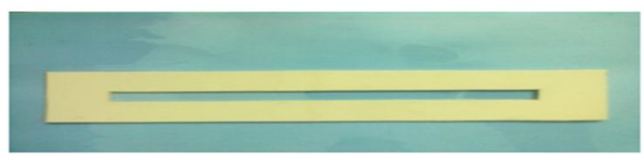

Fig.2 ASTM Standard mould

The mould was closed, and hydraulic pressure was applied until complete closure. The closed mould was kept under pressure for 24 h. The composites were fabricated in the form of a flat plate with a size of 160X 12.5 X 3 mm. Composite plates were prepared for fibre weights % of 10, 20, 30, in 10 mm fibre length .

3. Tensile Testing of the Composite

Tensile tests were conducted for the composite specimen using the electronic tensometer setup to obtain the tensile properties. The specimens of the composites were prepared according to the ASTM D 638 [7] standards. The specimens were machined to a standard size of 160X12.5X 3mm for a gauge length of 100 mm. the cross head speed of 1 mm/min [8]. Three identicaltest specimens were used for each testing and numbered in series as A, B and C. Properties such as tensile strength, tensile (elastic) modulus, tensile load and elongation at break of the composites were measured from the experimentation. During tensile testing, the specimens were broken in between the gauge length of the specimen and the corresponding image was shown in Fig. 3.

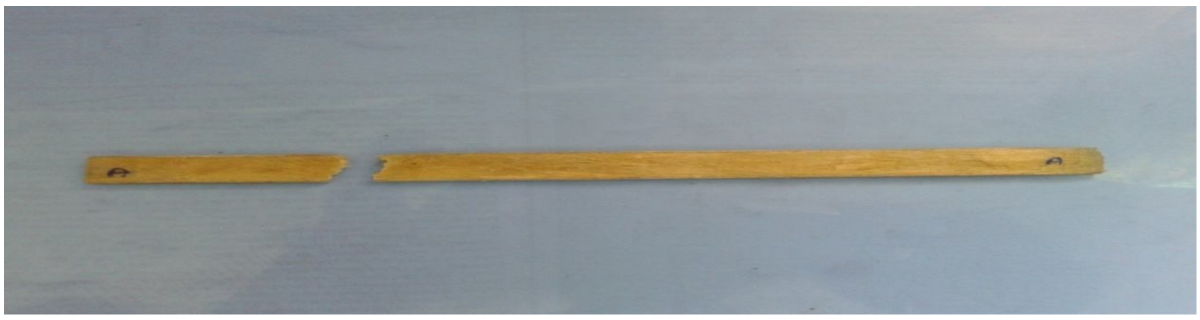

Fig.3 (a) 10% weight composition of 10mm length fiber

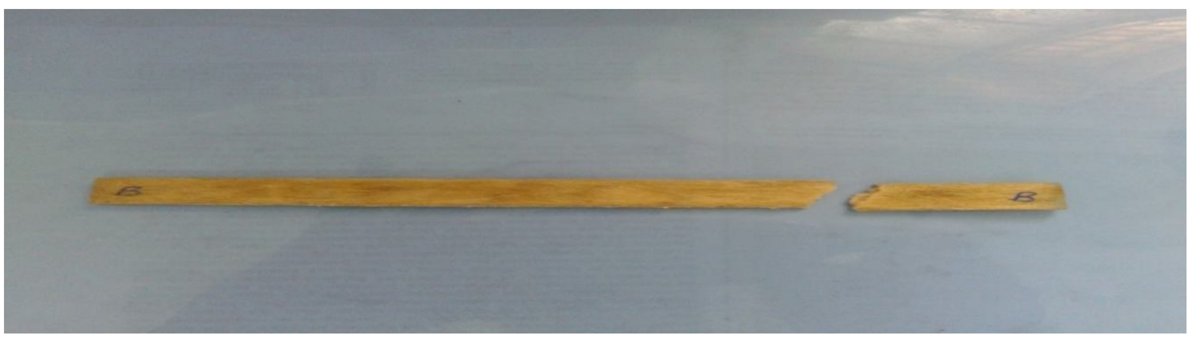

Fig.3 (b) 20% weight composition of 10mm length fiber

Fig.3(c) 30% weight composition of 10mm length fiber

4. Results and Discussion

4.1 Physical properties

The breaking force of S. trifasciata fibre was measured as 376g which is higher than S. cylindrica with less elongation value. The fibre should be at least 100 times longer than its diameter or breadth with ratio of 100:1. Thus S.trifasciata fibre has L/D ratio value of around 4800 which is higher than majority of the natural fibres. The fibre diameter determined using Scanning electron microscope ranges between 112µm - 128µm with the average of 120µm. The coefficient of variation (CV%) of the diameter was found to be 3.89 with the standard deviation value of 4.67. The fibres lack crimp when seen neither through naked eye nor under microscope. S. trifasciata fibre is finer than other leaf fibres with value of 9.8 tex. This increased in fibre fineness results in improved surface contact between fibre and matrix.

5. Effect of Tensile Properties of the Sansevieria Trifasciata Laurentii Natural Fiber Reinforced Composites

The tensile properties of the Sansevieria trifasciata laurentii chopped fiber reinforced composites are compared with the various fiber weight percentages for various fiber lengths. Fig.4shows the variation of tensile strength over the percentage increase in fiber weight percentage for the 10mm fiber lengths.

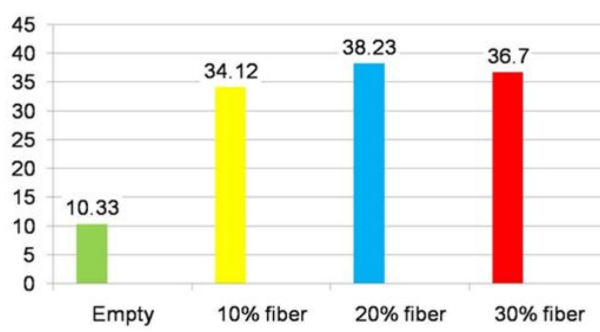

Fig.4 Different weight percentage for 10 mm fiber length

The tensile strength decreases from 38.23 MPa to 36.70 MPa when the fiber weight percentage is increased from 20% to 30% for 10mm fiber length, due to its poor bonding strength in 30% the strength was decreased.

6. Conclusion

Present work clearly shows that the Sansevieria trifasciata laurentii fiber will become a future alternative for the conventional materials due to its enhanced mechanical properties and availability.

Sansevieria trifasciata laurentii Fiber reinforced polyester composite was successfully fabricated by simple hand lay-up technique. The study also showed that 20wt% of fiber composite is having better tensile strength compared to other specimens. The cost of extraction of Sansevieria trifasciata laurentii is less compared to other natural fibres.

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