International Journal of Research in Advent Technology, Special Issue, March 2019
E-ISSN: 2321-9637
3rd National Conference on Recent Trends & Innovations In Mechanical Engineering
15th & 16th March 2019
Available online at www.ijrat.org

Experimental Investigation on Mechanical Properties of Lady Finger Glass Reinforced Polyester Composites

[1] Pinjala.Tejomurthi ,[2]K. Syam Sundhar , [3]M.R.Ch.Sastry
[1,2,3]Department of Mechanical Engineering College,
Gudlavlleru Engineering College, Gudlavalleru.

Abstract: The present paper work is to increase the life of thermoplastic materials. The thermoplastic materials utilization gradually increases in automobile and home needs. The major role to improve the life time usage of material to control the replacement and it is indirectly helps to the environment. In this paper the thermoplastic materials is reinforced with Lady finger fibre and glass fibre polyester resin (LGP) composites 5% ,10%,15% ,20% and 25%. The lady finger fibre is natural fibre and eco-friendly to the environment. The mechanical properties calculated by various weight fractions of lady finger and glass fibre fixed(LGP). The fabricated specimens tested, the results are compared with pure polyester resign. The tensile strength and impact energy obtained maximum at 20% of fibre weight fraction, the, flexural strength tensile modulus and flexural increased by increasing fibre weight ratio.

Keywords: Polyester Resin, Lady Finger fibre, Glass fibre

1. INTRODUCTION

The pollution rate increased in the Environmental growing day by day. The environment awareness id important for every

Research work on the development of natural fibres like sisal coir, jute, pineapple, ramie, bamboo, banana etc., is to explore its application in low load condition.

Composite material with light-weight, high strength to weight ratio and stiffness properties have come a long way in replacing the conventional materials like metals, woods etc. 60-80 percentage steel and 20-50 weight percentage Aluminium components replaced by thermoplastic composite materials. The polymer based composite materials use is increasing because of their light weight, good mechanical and tribological responses [1].

Flexural properties of glass-polyester composite materials of Flexural parameters derived flextural modulus of 84 MPa and 7 GPa and 110 MPa and 10 GPa for the HLU composites [2-3].

However, composites were reduced the fraction created on cracking of material the strength of base material improved by the laminated composite material [4-7].Polypropylene resin matrix hybridized with glass fibre for preparing composite specimens at various fibre weight percentages, the developed vakka fibre, glass reinforced hybrid polypropylene composites were then tested for their Tensile, bending and impact properties. To enhance the adhesion between the vakka fibre and the polypropylene matrix, small amount of fibre fraction maleic anhydride- grafted polypropylene (MAPP) was used as a compatibilizer for the composites (VGMAPP). It was found that the increase in fibre content reduces the mechanical properties of vakka glass-PP composite. However, VGMAPP composites exhibited better mechanical [6].

The object of the present work describes the procedure for extraction of lady finger fibre and its incorporation in lady finger glass fibre laminated polyester for preparing a composite(LGLPC) specimens at various weight percentages (5%,10%,15%,20%,25%) and test the mechanical properties of the composites i.e., tensile, bending and impact strength or impact Energy.

2. EXTRACTION OF LADY FINGER FIBRE

The lady finger is naturally available material; it is generally extracted by soaking process. The steam of the leaf is soaked 12-15 days in the water. The top layer of the stem gradually removed

The source of the fibre is generally extraction from the tree stem. It is separated and dried 3 -5 days for complete removal of water in the fibre.

3. FABRICATION OF COMPOSITE SPECIMEN

The composite samples were fabricated as per the standard dimensions for testing machine. The samples were (0%, 5%, 10%, 15%, 20% and 25%) by weight fraction, glass fibre fixed and fibre percentage variable (25% of fibre weight) and polyester resign as matrix. Five different compositions were prepared by handmade method.

Table 1. Specimen composition

Polyester Resign	Lady Finger	Glass Finger	Total composition
100%	0%	0%	100%
95%	2.5%	2.5%	100%
90%	7.5%	2.5%	100%
80%	12.5%	2.5%	100%
70%	27.5%	2.5%	100%
60%	37.5%	2.5%	100%

4. CHARACTERIZATION OF COMPOSITES

4.1. Tensile Properties

A dog bone shaped specimens are used for preparation of tensile specimens.

A 2 Tone capacity Electronic Tensometer(METM 2000 ER-I model) was used , for find the flexural and tensile properties. A constant speed is used to measure the properties. The speed rate of the cross head 10 mm/min. The sample specimen after tensile testing is shown in Fig.1.

According to ASTM D638 (165 x 19) mm; thickness is 5 mm size 5 specimens are prepared.

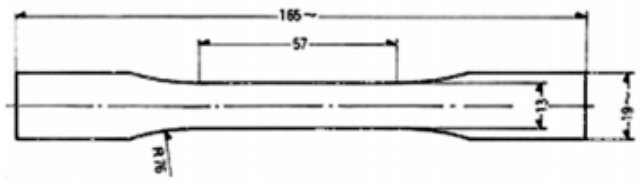

Fig.1: Tensile Specimen

4.2. Flexural Properties

Three point bending method is used to measure the flexural properties of the specimen(ASTM D790 test method 3 point bending test). The specimen dimensions were 98 mm x 10 mm x 4 mm. In this process the speed of the roller 2 mm/min

The flexural strength and flexural modulus of composite specimens were tested.The sample flexural specimen is shown in Fig .2

The Flexural Modulus, $E_B = \frac{L^3 m}{4bt^3}$ MPa

Flexural Strength, $S = \frac{3PL}{2bt^2}$ MPa

Where L= support span ,
b= width ,
t= thickness,
P= maximum load,
m= slop of deflection curve

Fig:2. Flexural Specimen

4.3 Impact Properties

V-shaped grove specimen prepared by 64mmx12mmx 9 mm dimensions. The specimen tested by the ASTM D256-97 I zod test . The angle of the notch had 45^o depth 10mm. The specimens (5sets) were prepared different fibre weight compassion. The sample specimen shown in Fig .3

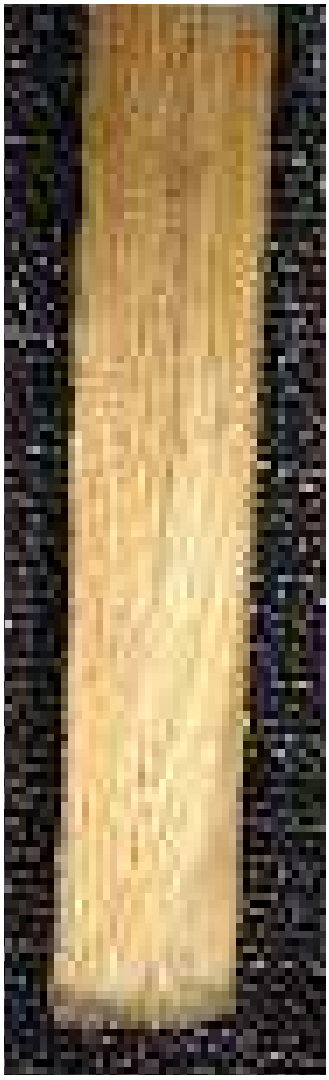

Fig .3 Impact Specimens

The Impact strength is calculated, $I = \frac{EI}{T}$ J/s

Where I = Impact Energy
EI = Impact energy
T= Thickness

5. RESULT AND DISCUSSION

5.1 Tensile Properties

The tensile strength of the Lady Finger glass polyester composites test result shown in fig 4.

The tensile strength increased up to 20% fibre weight fraction after that the volume occupied by fibre is more and the molecular bond between the polyester and the fibre decreases, the baring capacity through the fibre loose.

The tensile strength of the pure polyester is calculated as 49.46 MPa A tensile Strength of 79.1 MPa is noted at 20 weight % of LGP (lady finger fibre+ constant glass polyester21) composites.

The tensile modulus of the specimens are improved by adding the fibre weight on the specimens (0 % to 25%) the value is increased)

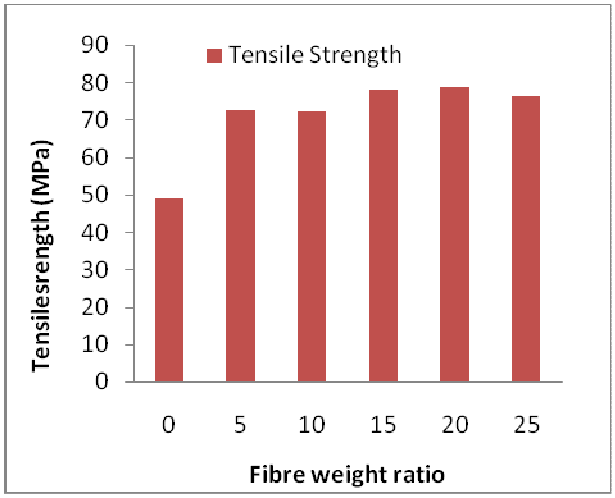

Fig 4. Fibre weight ratio (lady finger + constant glass) vs Tensile strength

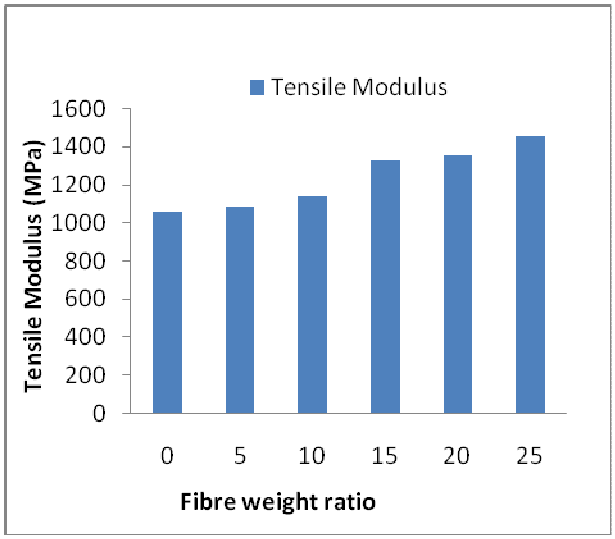

Fig 5. Fibre weight ratio(Lady finger +Constant glass) vs Tensile modulus

Pure polyester material tested, the tensile modulus value is 1.05 GPa .The prepared (0% to 25 %) weight fraction the optimum value at 25% is 1.39GPa. The value of tensile modulus is proportional to the fibre weight ratio by the experimental observation.

5.2 Flexural Properties

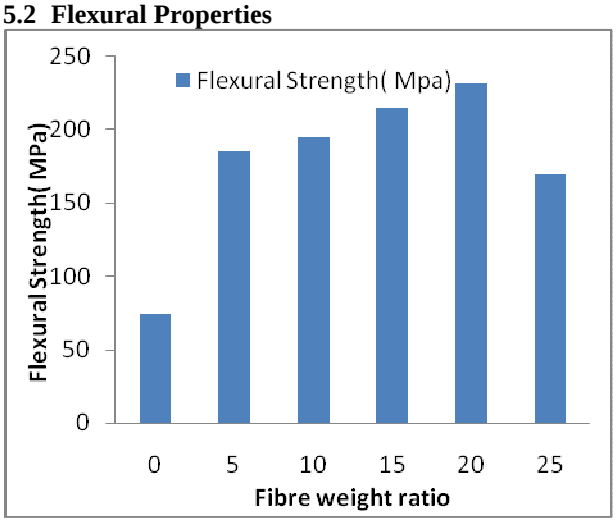

Fig 6. Fibre weight ratio(Lady finger +Constant glass) vs Flexural Strength

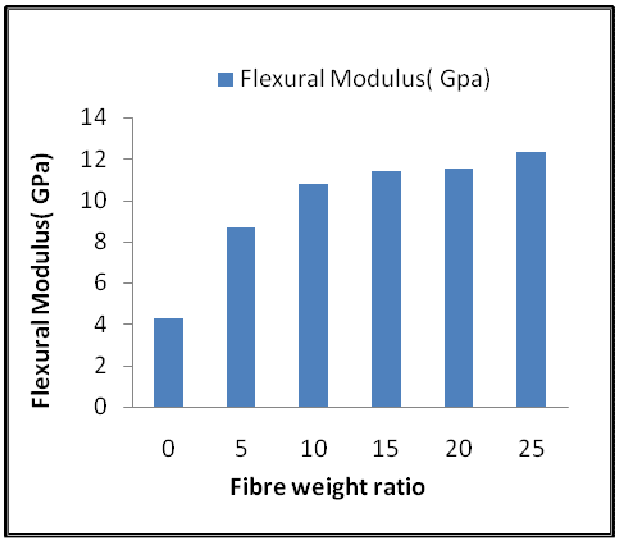

Fig. 7 Flexural Modulus Vs Fibre Weight ratio

Flexural properties are shown in fig 7 and 8, the flexural strength for the pure polyester material 74.92 MPa, the flexural test conducted by 3 point bending test . The value maximum at 20% fibre weight fraction is 232 MPa..

The flexural properties are increased due to increase in fibre weight ratio the value at 25 % of fibre ration is 12.3 GPa ,it is in pure polyester 4.28 GPa.

5.3 Impact properties

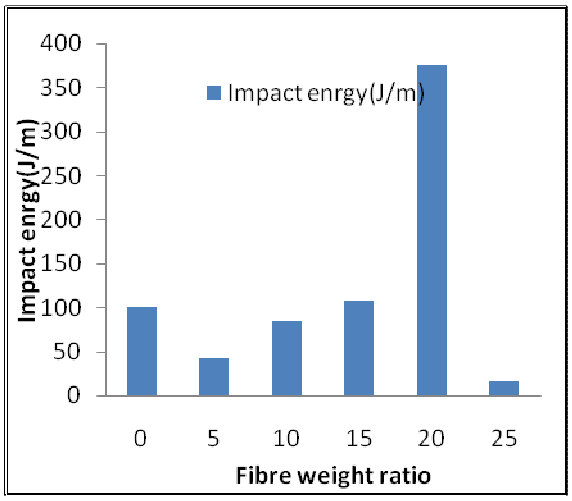

Fig. 8 Impact Energy Vs Fibre Weight ratio

Impact strength or energy is ability to resist the fracture The impact energy of the prepare composite material maximum at 20% of fibre weight composition. The fibre content up to 20% of weight fraction resist the maximum energy by increase the fibre ratio the matrix material binding to the fibre content is decreases and result fracture ability start.

6. CONCLUSION

The lady finger glass polyester composite material has the tensile, bending and impact properties are

- The Tensile strength are optimum at 20% fibre weight ratio, it is 55.3 % maximum than pure polyester material
- The Flexural strength is improved from 74.2 MPa (at 0% weight Fraction) to 232 MPa (20% weight Fraction),
- The Tensile modulus and Flexural modulus results are proportional by experimental observation

- The impact energy maximum at 20% weight fraction is 375 GPa.

The composite material improve the mechanical properties of pure polyester material and decrease the replacement of item in engineering applications, to reduce the replacement of item in the engineering application it is directly and indirectly to control the wastage in the nature.

REFERENCES

[1] Ramesh Chandra Yadaw, and Sachin Chaturvedi. An Investigation of Mechanical and Sliding Wear Behavior of Glass Fibre Reinforced Polymer Composite With or Without Addition of Silica (SiO2). International Conference on PFAM XXI, IIT Guwahati, (2012).

[2] Mukul Kant Paliwal and Sachin Kumar Chaturvedi. An Experimental Investigation of TensileStrength of Glass Composite Materials with Calcium Carbonate (CaCO3) Filler. Int. J. Emerg. trends in Eng. and Dev. 2012; 6 (2) : 303-309.

[3] Davallo, M. and Pasdar, H. 2009. Comparison of Mechanical Properties of Glass-Polyester Composites Formed by Resin Transfer Molding and Hand Lay-Up Technique. International Journal of ChemTech Research, 1, 3: 470-475.

[4] González, C. and LLorca, J. 2007. Mechanical Behavior of Unidirectional Fiber-Reinforced Polymers under Transverse Compression: Microscopic Mechanism and Modeling. Composites Science and Technology, 67, 13: 2795-2806. doi: 10.1016/j.compscitech.2007. 02.001.

[5] Cantwell WJ and Morton J. The impact resistance of composite materials - A review. Composites Part A 1991; 22: 347–362..

[6] Richardson MOW and Wisheart MJ. Review of low-velocity impact properties of composite materials. Composites Part A 1996; 27: 1123–1131.

[7] Bibo GA and Hogg PJ. Review - The role of reinforcement architecture on impact damage mechanisms and post-impact compression behaviour. J. Mater. Sci. 1996; 31: 1115–1137.

[8] Narra Ravi Kumar ,P.Tejomurthi, B. Raghava Rao" Investigation On Mechanical Properties Of Lady Finger Fibre Glass Reinforced Thermoplastic Composites" International Journal of Engineering Research & Technology (IJERT) Vol. 1 Issue 7, September – 2012 ISSN: 2278-0181.