Investigation on Mechanical Properties of Lady Finger Fibre Glass Reinforced Thermoplastic Composites

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Abstract - *The present paper work is decrease the usage of thermoplastic materials by increasing strength, the replacement of materials in our daily application decreases by increasing the strength of materials it is indirectly helps to the nature because the thermoplastic composites are non biodegradable .The strength of the material increased by natural fibre reinforcement. Lady Finger fibre, Glass fibre and polyester composite specimens are prepared by variable weight fraction (5%, 10%, 15%, 20% and 25%). The fibre and glass fibre are taken 50% in each composition. The fabricated specimens are tested and Mechanical properties of the tested specimens are given better result when compared to the pure polyester resign.*

Keywords — *Lady Finger fibre, Polyester Resin, Glass fibre*

I. INTRODUCTION

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. Composites, the wonder 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]. However, composites encounter problems such as fibre fracture, matrix cracking and de lamination. Of these, fibre fracture and matrix cracking plays an important role in laminates under tensile load [2-5]. 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 (VGPP) were then tested for their mechanical properties. To enhance the adhesion between the vakka fibre and the polypropylene matrix, 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.

II. EXTRACTION OF LADY FINGER FIBRE

The source of the fibre is generally extraction from the tree stem. It is separated from the tree and dried for days then immersed in water in the first 15 days the top layer around the steam loosen after that separated fibre is washed in water then socked in another tank 3 to 5 days, the total fibre retting process takes 18 to 20 days .

III. FABRICATION OF COMPOSITE SPECIMEN

The composite samples were prepared by proper proportions of fibres (0, 5, 10, 15, 20 and 25%) by weight fibre (50% of fibre weight) and polyester resign as matrix. The specimen dimensions were taken as standard per stand dimensions. Five different compositions were prepared by handmade method.

IV. CHARACTERIZATION OF COMPOSITES

a). Tensile properties

Electronic Tensometer (A 2 ton capacity)-, METM 2000 ER-I model was used to find the flexural and tensile properties of the prepared composite specimens. The specimens were made in Dog Bone shape accordance with ASTM-D 638M to measure the tensile properties. The extensometer maintains a cross head speed of speed

of 10 mm/min. The sample specimen after tensile testing is shown in Fig.1.

Fig.1: Tensile test Specimen

b). Flexural properties

According to ASTM D790 test method 3point bending test are conducted. The test sample were 98 mm Long 10 mm wide by 4 mm thick. In this process the outer rollers are 64 mm apart and samples are prepared at a strain rate of 1mm/min. The flexural strength and flexural modulus of composite specimens are tested .The sample flexural specimen is shown in Fig .2

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

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

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

Fig: 2. Flexural test Specimen

c). Impact Properties

Impact strength is measured by ASTM D256-97 Izod impact test. The test specimens

prepared by 64x12x 9 mm dimensions. A V shape notch generated at an angle of 45^0 specimen centre and depth of the specimen is around 10 mm. 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, $I = \frac{EI}{T}$

Where I = Impact Energy
EI = Impact energy in Joules per minute
T= Thickness of the sample specimen in mm

V. RESULT AND DISCUSSION

a) .Tensile Properties

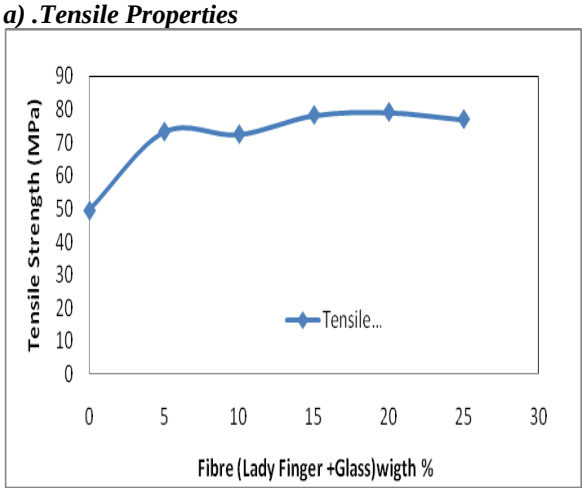

Fig. 4 Tensile Strength Vs Fibre Weight ratio

The tensile strength of the LGP composites at different fibre loading is shown in Fig.4 the tensile strength is found to be increasing up to 20% by fibre weight and then decreases. 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 LGLPC (lady finger fibre/glass laminated polyester composites).

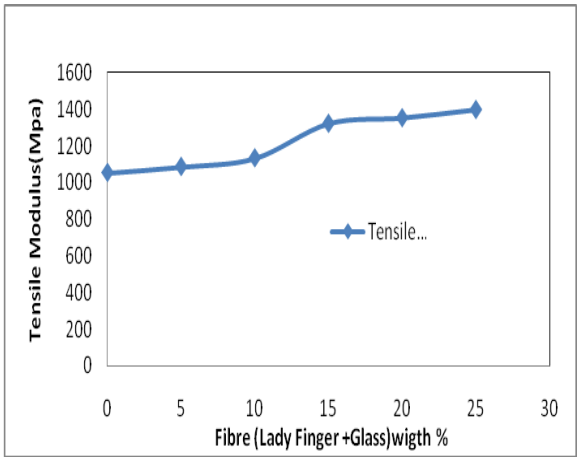

Fig. 5 Tensile Strength Vs Fibre Weight ratio

The pure polyester is tensile Modulus calculated value is 1.05 GPa .The prepared (variable weight composition) composite specimens tested results are increased by increasing the fibre content. The percentage of flexural strength is maximum at 1.39 GPa at 25% fibre weight.

b).Flexural Properties

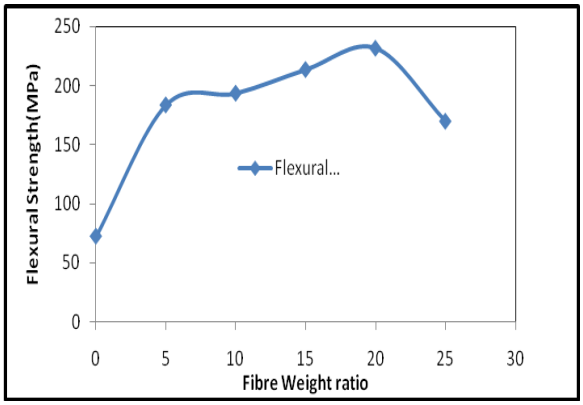

Fig. 6 Flexural Strength Vs Fibre Weight ratio

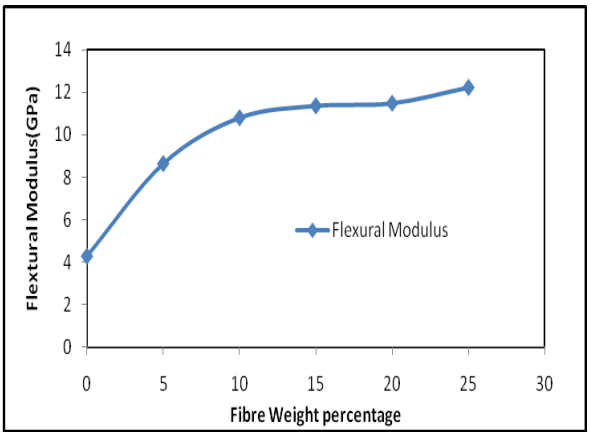

Fig. 7 Flexural Modulus Vs Fibre Weight ratio

Flexural strength of LGP(lady finger ,glass fibre laminated polyester)composites at different percentages of fibre loading is shown in Fig:7 . The maximum flexural strength is obtained at 25% of fibre weight the percentage ration 231.62 MPa and it is 64.31% maximum than pure polyester resign. The Flexural Modulus is increased when the increased the fibre weight ratio.

c). Impact properties

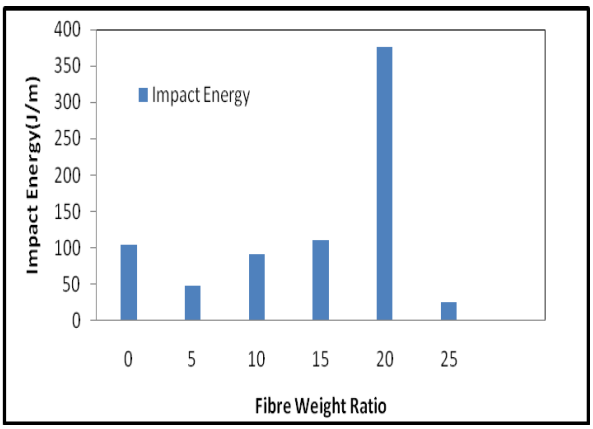

Fig. 7 Impact Energy Vs Fibre Weight ratio

The ability to resist the fracture behaviour called impact strength or impact energy. The impact energy of the prepare composite material maximum at 20% of fibre weight composition. The percentage ration of impact energy compare to pure polyester is 72.33 %

VI. CONCLUSION

The incorporation of lady finger fibre, glass fibre laminated polyester composite has shown a moderate improvement in the tensile, bending and impact properties of the composites. 20% fibre weight fraction composites exhibited maximum tensile strength and maximum flexural strength is observed for 20% fibre weight fraction composites which increased 37.48% and 68.78% than pure polyester. Maximum Impact strength is observed in 20% fibre weight composites which has increased 72% than pure polyester . Tensile and flexural modulus values increased with increase in fibre weight fraction composites. Tensile and flexural modulus values increased with increase in fibre weight fraction and higher values are observed at 20% fibre weight fraction, which has increased 24.67% and 64.75% than pure polyester. The composites can regarded as a useful light weight engineering material and also the manufacturing cost of the composites can be reduced considerably by adding lady finger fibre hybridized with Glass fibre to the matrix.

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