Second International Conference on Nexgen Technologies
Sengunthar Engineering College, Tiruchengode, Namakkal Dist. Tamilnadu (India)
8th - 9th March 2019 www.conferenceworld.in ISBN : 978-93-87793-75-0

Mechanical Behavior of Prosopis Juliflora Fiber Reinforced Composite Materials

M.Gopalakrishnan[1], Mr.N.Thiru Senthil Adhiban[2] C.Sathishkrishna[3], M.Baranikumar[4], N.Govindarasan[5]

[1]*Department of Mechanical Engineering, Sengunthar Engineering College, TN, India*
[2]*Assistant Professor Department of Mechanical Engineering, Sengunthar Engineering College, TN, India*
[3]*Department of Mechanical Engineering, Sengunthar Engineering College, TN, India*
[4]*Department of Mechanical Engineering, Sengunthar Engineering College, TN, India*
[5]*Department of Mechanical Engineering, Sengunthar Engineering College, TN, India*

ABSTRACT

Environmental awareness, increasing concern with the greenhouse effect and bio-degradation has hastened the construction industry to look forward for sustainable materials with least impact on the existing surroundings. Natural fibre reinforced composites seems to be a good alternative because of their eco-friendly nature. Natural fiber reinforced composites are widely used for different application such as building industry, automotive industry, aerospace industry, furniture industry, bio-medical industry. In this present investigation of "Mechanical Properties of Prosopis Juliflora Fiber Reinforce Composite Material", its four different composite specimens are prepared. The samples are testing for their tensile, flexural strength hardness testing, water absorption test.

***Keywords:* Composite Material, Epoxy, Natural Fibre.**

1. INTRODUCTION

A Composite material (also called a composition material or shortened to composite) is a material made from two or more constituent materials with significantly different physical or chemical properties that, when combined, produce a material with characteristics different from the individual components. The interest in Natural Fibre reinforced polymer Composite materials is rapidly growing. They are renewable, cheap, completely or partially and biodegradable.

These fibres are incorporated into a matrix material such as thermosetting plastics. A Fibre Reinforced Composite (FRP) is a composite material consisting of a polymer matrix imbedded with high-strengths fibres, such as glass, aramid and carbon. Fabrication of a composite fibre involves the combining of the Natural fibre (Reinforcement) with the Polymer (Matrix), these two are the building blocks of any composite material. The most common procedure used for the fabrication of the natural composite is Hand- Layup process which includes the saturation of Natural fibre (Reinforcement) with the Polymer (Matrix). Layers of the Natural fibre are kept in mould

and resin is poured on each layer such that all layers are coated. Then a roller is used to roll over such that all layers gets coated well and extra resin comes out. Left undisturbed till the composite is ready.

2. Fabrication of composite material

Fabrication is done through Hand- layup technique and four composites are prepared with different fibre compositions. The weight of the fibre is varied in each composite by 45 grams.The fibre has a composition of Reinforcement (Natural fibre) and the rest is the Resin and Hardener mixture. The same way remaining three composites are also fabricated with 90 gms, 135gms, 180gms and 225gms.

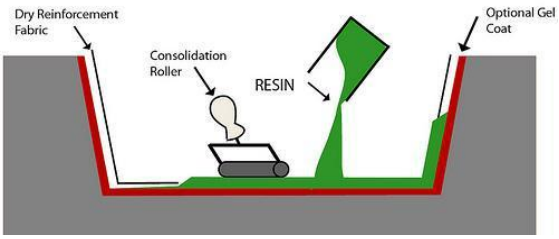

Fig.1. hand lay-up technique

3. Tensile testing

Testing of the specimens include Tensile testing and Flexural Testing of the composite materials. Firstly composites are cut into the required shape according to the concerned standards. Tensile testing specimen is to be cut into Dumbbell shape as shown in figure. Figure below shows four different dumbbell shaped composites with different compositions of the Natural fibre in them

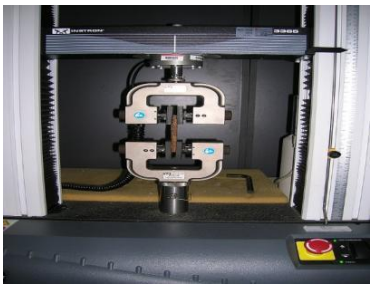

Fig.2 tensile test specimens

Tensile testing involves the application of tension at its ends. The specimen is loaded into the UTM (Universal Testing Machine).The two jaws of the machine are relieved and the specimen is loaded and is tightened. Once this is done tension is added onto the ends till the failure happens. The table below shows the tensile strengths of the various specimens with different compositions.

Table. 1 Tensile Strengths of composites with different compositions

Material	Maximum Load(N)	Maximum Displacement(mm)	Maximum stress(N/mm^2)	Maximum Strain
20% wt of PJ	360.30	0.891	3.431	0.00297
30% wt of PJ	551.23	1.235	5.25	0.00412
40% wt of PJ	676.48	2.253	6.443	0.0075
50% wt of PJ	632.10	1.980	6.02	0.0066

4. Flexural testing

Firstly composite material is cut into the Rectangular shape according to the standards and then loaded into the UTM where a bending load is added on the composite material at the centre and it is supported at the extreme two ends. The figure below shows the loading of the specimen into the UTM for Flexural testing of the specimen.

Fig.3 flexural test specimens

The Flexural method measures behavior of materials subjected to simple beam loading. It is also called as transverse beam test.

Table.2 Flexural Strengths of composites with different compositions

Material	Ult./Break load (N)	Maximum Displacement(mm)	Ultimate Stress (KN/mm^2)
20% wt of PJ	90	1.5	2.308
30% wt of PJ	110	2.3	2.82
40% wt of PJ	210	3.2	5.384
50% wt of PJ	150	2.9	3.846

5. Conclusion

The fibre reinforced natural composites are fabricated by the simple hand lay-up technique in the laboratory condition. The proposed composites are subjected to the mechanical characterization, such as tensile strength, flexural strength and etc. The following conclusions have been driven out from the experimental results.

1. Based on the experimental investigations, micro mechanics assessment and static analysis the strength determining factors such as ultimate breaking load, ultimate stress, displacement at maximum force, Tensile strength, and Flexural strength.
2. The Prosopis Juliflora fibre reinforced composites have more Tensile properties obtained at 40% weight of fibre, and Maximum Flexural Strength is obtained at 40% weight of the fibre.
3. Results indicate that the fibre improves the properties and can be considered as great potential to increase with varying the fibre weight ratio.
4. In future, there are tremendous investments on natural fibres, to bring a great impact on manufacturing sectors.

6. Acknowledgement

The authors thank to the workshop staff of mechanical department, sengunthar engineering college, Tiruchengode for helping in carrying our fabrication work.

REFERENCES

[1] Kabir, M.M., H. Wang, T. Aravinthan and et al., 2011. Effects of Natural fiber surface on composite properties: A Review. Edd BE2011 Proceedings, pp: 94-99.

[2] John, M.J., and S.Thomas, 2008. Biofibres and biocomposites: Review. Carbohydrate Polymers, 71: 43-364.

[3] Samal, S.K., S. Mohanty and S.K. Nayak, 2009. Banana/glass fiber-reinforced polypropylene hybrid composites: Fabrication and performance evaluation. Polymer-Plastics Technology and engineering, 48(4): 397-414.

[4] Panthapulakkal, S., and M. Sain, 2007. Injection-molded short hemp fiber/glass fiber reinforced polypropylene hybrid composites – Mechanical, water absorption and thermal properties. Journal of Applied Polymer Science, 103(4): 2432- 2441.

[5] Koradiya, S.B., J.P. Patel and P.H. Parsania, 2010. The preparation and physicochemical study of glass, jute and hybrid glass–jute bisphenol-C-based epoxy resin composites. Polymer- Plastics Technology and Engineering, 49(14): 1445-1449.