

# Evaluation of Mechanical Properties of Hybrid Composite

Soppari Bhanu Murthy, Dr.M.S.Sreenivasa Rao, Narendra Pothula

*Department of Mechanical Engineering*

*VNR Vallurupalli Nageswara Rao Vignana Jyothi Institute of Engineering and Technology, Hyderabad, Telangana, India*

**Abstract-** composites are playing important role in industrial needs and natural fibers are balancing the environmental issues and being substitute applications. This paper, hybrid composites prepared with combinations of bi-directional jute glass fibers with epoxy resin matrix. Main focus is to compare functional properties of laminates such as tensile, flexural and impact strength of varying in stacking sequences of laminar. Testing made it very clear for understanding the glass layer enhances strength, hybridization of any material provides superior output than any other individual materials i.e. here we have combined both Jute and glass fiber which is eventually can be used for a moderate application in respect to strength. Hence, it been used over cost effective to synthetic fiber reinforced composites. Conventional hand method lay-up technique is used to prepare laminate of pure Jute and Jute- glass fiber reinforced polyester composites. Preparation of laminate and testing was carried out as per ASTM standards. Hence, hybrid composites for intermediate load-bearing bids.

**Keywords – Jute(J), Glass fiber(G), Polyester, Hand Lay-up, Mechanical properties.**

## I. INTRODUCTION

In Trends, environmental consciousness and the need of sustainable development, which coined the attention of researches to work on bio degradable. These are another composite which imparts the advantages like low density, eco-friendly, and biodegradable to change the manmade fibers [1]. Drawback of biodegradable fiber is the compatibility for reinforcement of fiber [2]. Environmentally no harm is the main attribute of the materials to get into the more and more use in the markets [3]. The composite designed by the combination of natural fibers and glass combined for improving its properties, and these composites can be utilized for general applications [4]. Hybrid composite has many parameters on the performance are subjected to mechanical testing such as tensile, flexural and impact test. The results explore the jute with other fiber material shows better tensile strength and the jute composite material shows incorporation of sisal–jute fiber with GFRP can improve the properties and used as an alternate material for glass fiber reinforced polymer composites[5].practical investigation were carried out with woven and non-woven jute fabric matrix. Woven fiber showed better mechanical behavior in tensile, flexural, and impact loadings compared to non-woven composite [6]. Study on Properties of Jute and Sisal matrix Polymer has better results than the sisal Composites [7]. composites exhibit's good tensile, flexural and impact strength influenced by the fiber lengths. application of the economical goods in composite era. Hybrid composite has very good properties of two different materials, lower manufacturing cost, tailored made output etc.

## II. EXPERIMENTAL PROCEDURE

### 2.1 Materials –

- Glass Fiber
- Jute Fiber
- Resin
- Hardener

Table 1 laminate sequence.

Samples	Fiber Composition	Sequencing
Sample 1	JUTE + EPOXY RESIN	J+J+J+J+J
Sample 2	JUTE+GLASS+EPOXY RESIN	J+G+J+G+J

## 2.2. Preparation of Composite Laminates –

The laminates are prepared by using hand lay-up technique. In the preparation initially the jute fiber and glass fiber are cut in dimensions of 36×36 cm. The layers are placed one on the above following the sequential manner i.e. a layer of jute and a layer of glass fiber one above the other. Now the resin is prepared by adding some amount hardener as per the calculation. Now the first layer that is jute which is place and the resin is poured on it and it is made to absorb into it and before it getting completely dried up the next layer that is glass fiber is placed the similar amount of resin is poured and the same process is repeated completely until the laminate is prepared. Similarly following the same process, the laminates are prepared by adding some filler materials to the same jute fibers. The prepared laminates are allowed to dry for about 24 hrs. the specimens are then removed and the corners and edges are made to cut in to the desired shape as per the required standards. These are the pictures bellow in fig.1 show the fabricated jute and hybrid laminate (jute +glass stacking).



Figure.1. Jute and Glass fiber laminate



Figure.2. Jute fiber laminate

Methodology: The step by step procedure for hand lay-up process in composites is shown in fig.3.

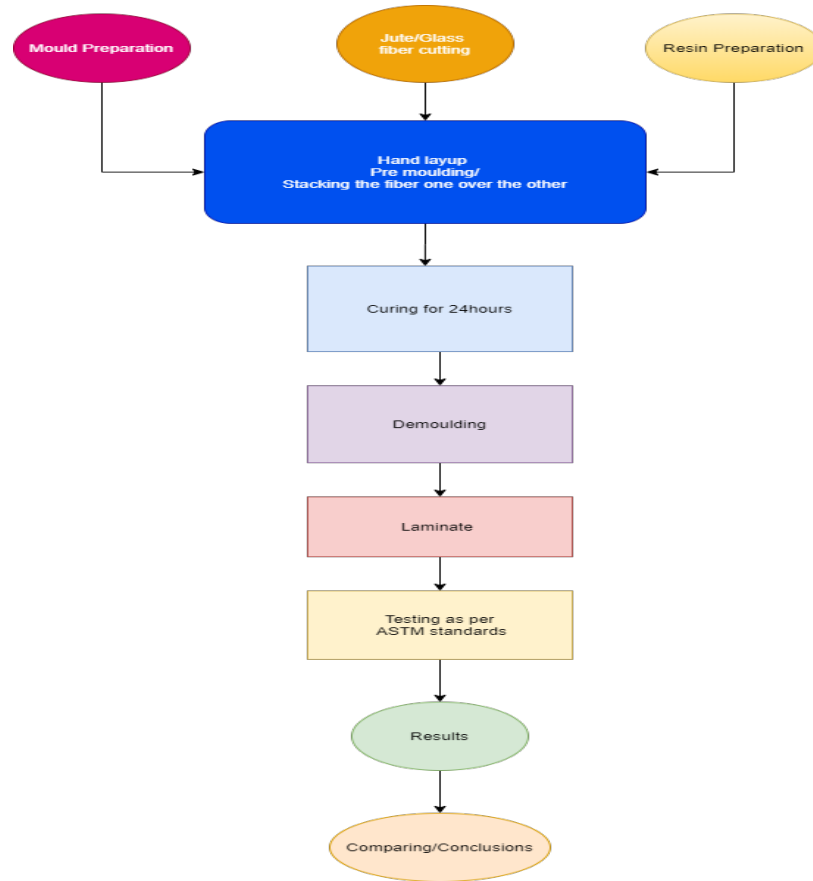


Figure .3. Methodology Block Diagram

### III. EXPERIMENT AND RESULT

#### *Mechanical Testing*

Three specimens taken from each sample for testing and the average value is considered as the property of that composite.

#### *3.1 Tensile Strength: -*

The test is carried on the specimens using ASTM D638 [9] the specimen size as  $70 \times 12.75 \text{ mm} \times 4 \text{ mm}$ . UTM with data recorded with the process crosshead speed of 5 mm/min.

#### *3.2 Flexural Strength*

Test is carried on specimens using the ASTM D 790 [10]. The size of  $75 \text{ mm} \times 12.5 \text{ mm} \times 4 \text{ mm}$ .

#### *3.3 Impact Strength*

The impact test is ASTM D 256 [11]. Specimen are  $100 \text{ mm} \times 10 \text{ mm} \times 3 \text{ mm}$ .

Table -1 Experiment Result

Composition	Specimen	Tensile Strength (MPa)	Flexural Strength (MPa)	Impact Energy (J/mm <sup>2</sup> )
Sample 1	1	32.24	62.00	0.33
	2	30.10	48.05	0.32
	3	37.65	44.00	0.33
Sample 2	1	46.93	62.00	0.29
	2	46.03	63.24	0.24
	3	45.61	66.08	0.24

*Tensile Strength: -*

Specimens were tested as per ASTM standard; results were used to calculate the tensile strength of the composite samples.

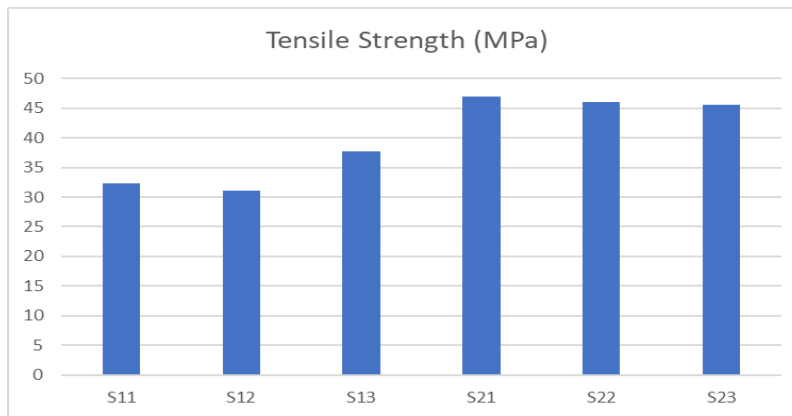


Figure.4. Tensile strength of samples

*Flexural Strength*

Specimens are tested according to the standard and results are analyzed and presented below.

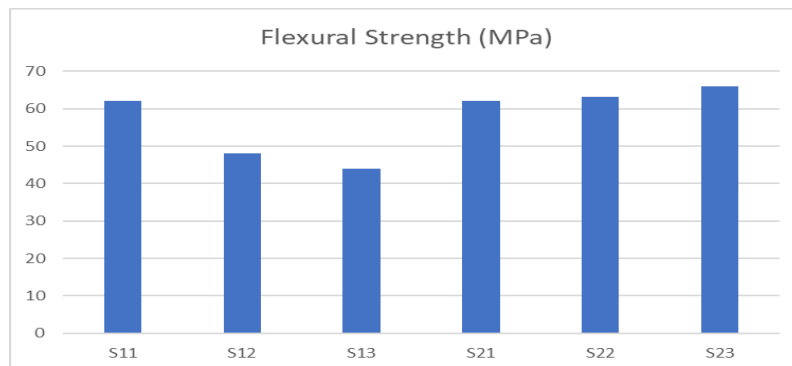


Figure.5. Flexural strength of samples

*Impact Strength: -*

Specimens are taken and tested as per the standard mention above and the results are shown below.

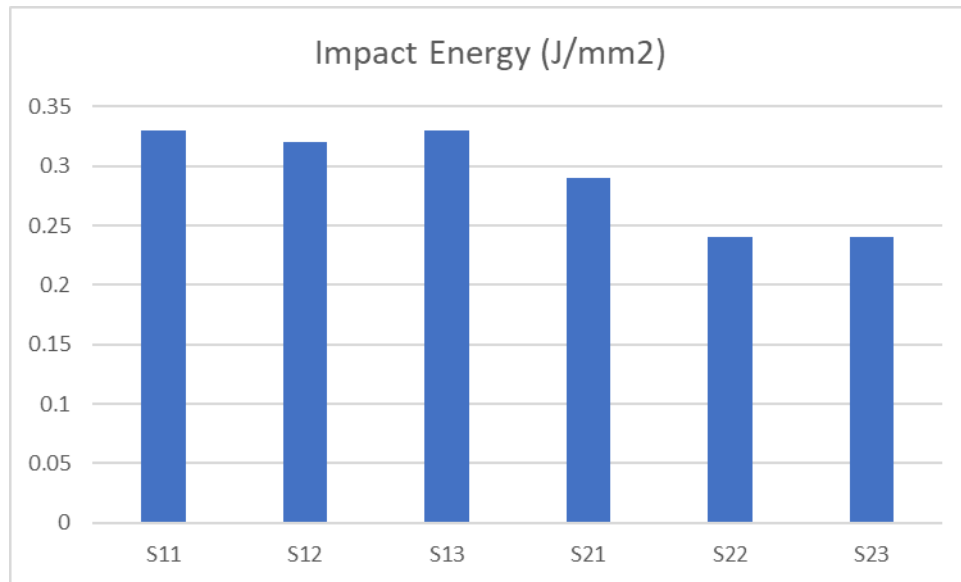


Figure.6. Impact strength of samples

#### IV.CONCLUSION

This experimental comparative investigation on Jute and Jute - Glass Fiber Reinforced composites leads to the following conclusions:

- The fabrication of the same carried out and tested for the mechanical properties like tensile, flexural and impact.
- In tensile test it is observed that sample S21 has exhibited 47Mpa @1767max yield force.
- In flexural the value is 66Mpa is observed in Sample S23.
- Impact strength 0.33 is recorded

The results are slightly varied with their flaws in the bonding by curing, as the voids play a very important role in the resistance to the applied force.

#### REFERENCES

- [1] Sathishkumar TP, Naveen J, Satheeshkumar S (2014) Hybrid fiber reinforced polymer composites—a review. *J Reinf Plast Compos* 5:454–471
- [2] Aquino EMF, Sarmento LPS, Oliveira W, Silva RV (2007) Moisture effect on degradation of jute/glass hybrid composites. *J Reinf Plast Compos* 26(2):219–233
- [3] Mohammed L, Ansari MNM, Pua G, Jawaid M, Islam MS (2015) A review on natural fiber reinforced polymer composite and its applications. *Int J Polym Sci F. Gonzalez and J. Hernandez, " A tutorial on Digital Watermarking ", In IEEE annual Carnahan conference on security technology, Spain, 1999.*
- [4] Dixit S, Goel R, Dubey A, Shivare PR, Bhalavi T (2017) Natural fiber reinforced polymer composite materials—a review. *Polym Renew Res* 2:71–78
- [5] M.Ramesh, Palanikumar K, Hemachandra Reddy K, Mechanical Property evaluation of sisal-jute-glass Fiber Reinforced Polyester Composites, *Composites Part B*, vol48 pp.1-9, 2012.
- [6] SairaTaj, Munawar Ali Munawar, Shafiullah Khan, Natural fiber-reinforced polymer composites, Received April 2006, accepted March 2007
- [7] M. Boopalan, M. Niranjana, M.J. Umopathy, Study on the mechanical properties and thermal properties of jute and banana fiber reinforced epoxy hybrid composites, *Composites: Part B* 51 (2013) 54–57.
- [8] M. Muthuvel, G. Ranganath, K. Janarthananand K. Srinivasan, Characterization Study of Jute and Glass Fiber Reinforced Hybrid Composite Material, *International Journal of Engineering Research & Technology*, ISSN: 2278-0181 Vol. 2 Issue 4, April – 2013.
- [9] ASTM D638 (2014) Standard test method for tensile properties of polymer matrix composite materials. ASTM International, West Conshohocken, PA

- [10] ASTM D790 (2007) Standard test methods for flexural properties of unreinforced and reinforced plastics and electrical insulating materials. ASTM International, West Conshohocken, PA
- [11] ASTM D256 (2006) Standard test methods for determining the impact resistance of plastics. ASTM International, West Conshohocken, PA