# Fabrication and Characterization of Ly556 Epoxy based Glass Fiber and Natural Fiber Composite Materials

**G. Sirisha[1], Y. V. Ramana murthy[2], CH.Durga jaya teja[3],CH.Vinodh[4]**

[1]M.Tech Student, Department of Mechanical Engineering, B.V.C Engineering College(A), Odalarevu, Andhra Pradesh, India

[2]Asso.Professor, Department of Mechanical Engineering, B.V.C Engineering College(A), Odalarevu, Andhra Pradesh, India.

[3]Asst.Professor, Department of Mechanical Engineering, BVCITS, Batlapalem Andhra Pradesh, India.

[4]Asst.Professor, Department of Mechanical Engineering, B.V.C Engineering College(A), Odalarevu, Andhra Pradesh, India.

sirish.309@gmail.com[1], yvr.bvce@bvcgroup.in[2,]
chdjteja@gmail.com[3]chvinodh.bvce@bvcgroup.in[4,]

***Article Info***

***Page Number: 3393 - 3402***

***Publication Issue:***

***Vol 71 No. 4 (2022)***

***Abstract***

In this frame work is mainly focused for developing of green and sustainable materials , in previous years, bio degradable natural and bio fiber composite materials are attracted a great attention from research and innovation fields . for improving their mechanical and wear ,tribological properties , such as strength consideration , yield , frictional, and resistant against wear, making a good and suitable and user friendly materials for a long life and usage of wastage and recycle point of view for industrial and aerospace applications, these ecofriendly materials gives more strength than synthetic ands and plastic materials .as for taking the basis of recent and related investigations found in the literature, an overview focused on mechanical , wear ,thermal characteristics of bio degradable based natural fibers and different waste fibers is presented. The aim is to introducing of eco material and develop superior properties it is only possible for preparation of bio degradable epoxy from the natural wastages and acid

***Article History***

***Article Received**: 25 March 2022*

***Revised**: 30 April 2022*

***Accepted**: 15 June 2022*

***Publication**: 19 August 2022*

treatment method for preparation of this epoxy, the main focusing for highlighting the upmost suitable future research directions to achieve a complete framework on the wear behavior of many possible bio degradable natural fiber composite materials. Using hand layup method the fabricated rectangular objective are plan for its tribological behavior such as friction, wear & tearand machining of composites for joining .

Keywords used: Epoxy, natural fiber, composites, polymer matrix, mechanical properties

## 1. Introduction

For the most part, a composite is characterized as comprising at leasttwo distinct materials. An illustration of an ordinary composite is a fiber-built-up polymer (FRP), where the polymer goes about as lattice, and the strands go back as the support. The framework ties the strands together somewhat like glue and makes them more impervious to outer harm. The grid is here delicate in contrast with the filaments, so when joining both of them, mechanical properties (firmness, strength, sturdiness, and so forth) is required to expand, contrasted with the network material. The properties are frequently anisotropic as in filaments regularly are situated in the same direction (unidirectional), subsequently excellent properties in the fiber course. It is feasible to accomplish near isotropic properties if the strands are arbitrarily located in a multifaceted framework (multidirectional). These sorts of composites made of polymer lattices are called PMCs (Polymer grid composites). There are likewise different composites, like MMCs (metal network composites) and CMCs (clay framework composites). Composites are typically utilized for supplanting metals since they are similarly solid yet a lot lighter. This theory is, anyway, to examine PMCs.

Composite materials are a huge kind of materials that are by and by open to humankind in immense sum. Recently, many glasses supported by fiber composite materials have been comprehensively used in flying and vehicle organizations. Composite materials are huge for mechanical, science, and primary engineers. Material analysts use them on a great deal of building and various applications. These materials have transformed into the alternative of standard fundamental materials, for instance, steel, wood, or metals, in multiple applications.

**Natural Fibers:**

Plants, creatures, and geographical cycles deliver the filaments. They can be used as a part of composite materials where the direction of strands changes the properties. In addition to monetary considerations, the usefulness of fiber for business purposes depends on such characteristics as length, strength, malleability, flexibility, scraped spot obstruction, receptivity, and different surface properties. Most material filaments are thin, adaptable, and generally solid. As a result, they stretch when under strain and return to their original lengthafter the pressure is relieved.

Figure 1: Cotton

Figure 2: jute

Researchers and industry are taking a keen interest in the utilization of regular fibers for the support of composites. Natural filaments enjoy numerous critical upper hands over manufactured strands. As of now, many sorts of regular strands have been examined for use in plastics, including flax, hemp, jute straw,

Figure 3: Asbestos

Figure 4: Kusha Fiber

**Composite**

Composite includes various materials with unmistakable properties to make anunrivaled and extraordinary material. Composites are assembled by support or by kinds of network in which fortifications are load conveying component though grid material assist them with keeping in wanted area and become load move medium among support and frame work. Fiber build up composites are acquiring interest in different application, however their development is restricted because of strength. Hybridization of fiber is a way to deal with cause composites to harden by consolidating diverse sort of fiber and these mixture composites offer great mechanical properties contrast with non-half breeds composites. Blending of fiber in unit grid, mixture fiber supported composites offer wide scope of mechanical properties. Mixture composites enjoy a few three primary upper hands overcomposites which made of utilizing one kind of fiber support. In the first place, they furnish new freedom to architect for certain one of kind properties. Second, successful expense usage of costly strands can be brought by somewhat trading them to most economical filaments. Third, they give assorted blend of mechanical properties like malleability, strength and solidness. Additionally, half breed composites are weight saving, improvement of fractural strength, decrease in score affectability, great effect obstruction, longer weakness life contrasted with composite which made of single support.

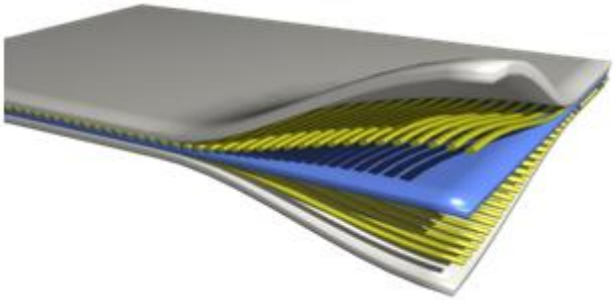


Figure 5:. Composite material.

A "Composite" can be characterized as where at least two unique materials are trulyjoined together.

## 2. Literature survey

N. M. Mathur and K. Bairwa [1] has lifted the research and industrial attention towardsthe growth of natural fiber-based on green composite material. Research is going on todevelop newer fiber-reinforced plastic composites to replace metals and alloys.

Cost and quality control of natural filler reinforced composite is the major stone to use as alternative material by product designers and manufacturers. Besides all these, the main motive is to fabricate an economic natural fiber-based composite material for commercial usage.

A. Moudood et. al.[2] analysis that the utmost environmental circumstances, e.g. hotness, moist, frosty situations, in between others, can diminish the mechanical characteristics of organic-composites when these are exposed to cruel conditions. In submerged usage, the life cycle of a composite can shorten likewise.

B.

S. Nunna et. al.[3] found that hybrid composite is fabricated by consolidating at least two strands in a single matrix. These composites produced from unnatural strands, organic strands, and by a mix of both organic or unnatural strands.

The outcome showsthat the handling of organic strands with NaOH plays a significant job in enhancing the Interfacial bond among strands and matrix in this manner upgrading the mechanicalproperties.

N.V. Nayak. [4] discovered that fiber-reinforced polymer composite materials got quickly gaining ground as a favored material for the development of aircraft, spacecraft. In an overall examination, it was discovered that composite materials offerhigh fatigue and corrosion resistance. The materials have a high strength to weight proportion. So, they are most appropriate for different aviation applications.

## 3. Methodology

Stage 1: Collecting data and information about the composite materials and theirbehavior towards given conditions.

Stage 2: Select the epoxy material and its hardner, natural fiber used and othercomponents.

Stage 3: Select the method to prepare the composite and i,.e, Hand layup method.Stage 4: Arrange the components and materials according to the method procedure and make the composite.

Stage 5: Then it will be examined under the desirable tests like tensile, flexural,Hardness, wear, thermal tests.

Stage 6: Tensile, flexural, hardness, wear tests are carried as per ASTM standards ASTM D638, ASTM D790, ASTM D2240, ASTM D1044 respectively.

Stage 7: The fabricated composite material is then analyzed by using above testResults.

## 4. Materials

Epoxy LY556, Hardener HY951, glass fiber, Kusha fiber

## 5. Fabrication of composite specimens (hand layup).

Figure:6. Hand layup method

After fabrication specimens are cut form sheets according to the ASTM statndards165mm long, 12.5mm in width and 4mm in thick are fabricated for tensile testing. 100mm long, 25mm width and 4mm in thick are fabricated for flexural testing.63.5mm long, 12.36mm width and 6mm thick are fabricated for impact testing.

## 6.Preperation of specimens.


Figure 7: Specimens

**1T:** Normal type natural fiber specimen for tensile test (30 x 3.3) mm.

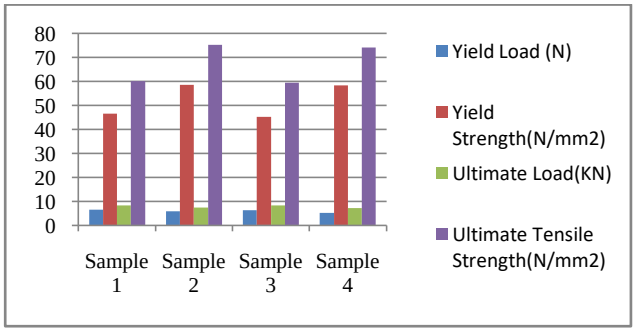
**1B:** Normal type natural fiber specimen for flexural test (30 x 3.3) mm**.**

**2T:** Matt type natural fiber specimen for tensile test (30 x 4.6) mm.

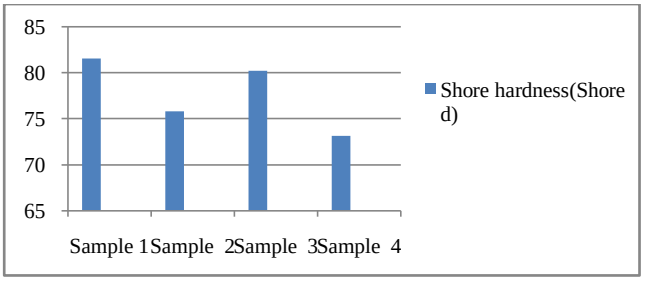
**2B:** Matt type natural fiber specimen for flexural test (30 x 4.6) mm.

## 7. Mechanical tests

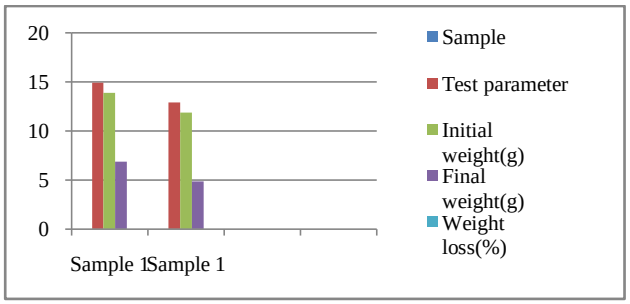
### Tensile testing




### Hardness test



**Pin on disk tribometr**

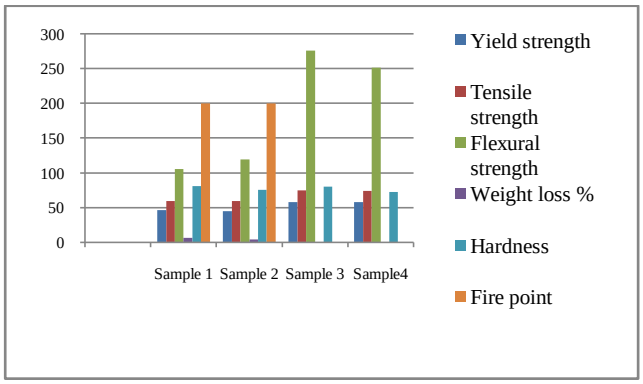



**Fire point test**

| **Temperature $^0$c** | **Results** |
|---|---|
| 100 | Test piece is not exposed to heat |
| 200 | Test piece is started slowly exposed to heat |
| 300 | Test piece is started slowly exposed to heat |
| 400 | Test piece is started completely exposed to heat & ash observed |

## 8. Results and Discussion.

The two different composite specimens were tested in the universal testing machine to find the tensile properties. It was observed that the tensile strength and yield strengthof the Sample 2 was found to be of the highest value of 75.225 (N/mm$^2$) and 58.6 (N/mm$^2$) and percentage of elongation is 5%.




## 9. Conclusion

The natural fibers have been successfully reinforced with the epoxy resin by simple wet hand lay-up technique. The aim of this project is to find the tensile, flexural strength, hardness and wear resistance and fire point of natural fiber reinforced bio- composites.

The present work has been done with an objective to explore the use of Kusha fiber strands+glass fiber, matt type kusha fiber+glass fiber and kusha fiber+wood powder+glass fiber are manufactured using hand lay-up method. Epoxy is used as matrix in the reinforced composite. And investigated the mechanical properties like tensile, flexural, wear, hardness number and fire point of composites. This work is focused to find the best composite amomg the two combinations. After all the tests has performed on the speciemens the matt type kusha fiber+glass fiber shows a best result in the tensile strength wear resistance, hardness test and as well as flexural strength. For the above investigations we are proposed the MATT TYPE KUSHA FIBER having good mechanical properties when comparing with other results.

**Refrence**

[1] N. M. Mathur and K. Bairwa, "A literature review on Composite material and scope of Sugar cane Bagasse," vol. 5, 2017, pp. 125–133.

[2] M. Thiruchitrambalam, A. Athijayamani, S. Sathiyamurthy, and A. Syed Abu Thaheer, "A review on the natural fiberreinforced polymer composites for the development of roselle fiber-reinforced polyester composite," J. Nat. Fibers, vol. 7, Dec. 2010, pp. 307–323, doi: 10.1080/15440478.2010.529299.

[3] S. V. Joshi, L. T. Drzal, A. K. Mohanty, and S. Arora, "Are natural fiber composites environmentally superior to glass fiber reinforced composites?,"Compos. Part A Appl. Sci. Manuf., vol. 35, 2004, pp. 371–376, doi: 10.1016/j.compositesa.2003.09.016.

[4] T. P. Sathishkumar, P. Navaneethakrishnan, S. Shankar, R. Rajasekar, and N. Rajini, "Characterization of natural fiber and composites - A review," J. Reinf. Plast. Compos., vol. 32, July 2013, pp. 1457–1476, DOI: 10.1177/0731684413495322.

[5] V. K. Thakur, M. K. Thakur, and R. K. Gupta, "Review: Raw Natural Fiber-Based Polymer Composites," Int. J. Polym. Anal. Charact., vol. 19, 2014, pp. 256–271, DOI: 10.1080/1023666X.2014.880016.

[6] A. Moudood, A. Rahman, H. M. Khanlou, W. Hall, A. Öchsner, and G. Francucci,"Environmental effects on the durability and the mechanical performance of flax fiber/bio-epoxy composites," Compos. Part B Eng., vol. 171, May 2019, pp. 284–293, DOI: 10.1016/j.compositesb.2019.05.032.

[7] A. E. Venkateshwaran Narayanan, "Banana Fiber Reinforced Polymer Composites - A Review Journal of Reinforced Plastics and," J. Reinf. Plast. Compos., vol. 29, Aug. 2010, pp. 2387–2396, DOI: 10.1177/0731684409360578.

[8] M. R. Sanjay, P. Madhu, M. Jawaid, P. Senthamaraikannan, S. Senthil, and S. Pradeep, Characterization and properties of natural fiber polymer composites: A comprehensive review, vol. 172, 2018 DOI: 10.1016/j.jclepro.2017.10.101.

[9] K. Rohit and S. Dixit, “A review - future aspect of natural fiber reinforced composite,” Polym. from Renew. Resour., vol. 7, 2016, pp. 43–60, DOI: 10.1177/204124791600700202.