

# Experimental Study on Thermal, Mechanical and Acoustic Performance of Mixed (Jute, Coir & Bamboo) Natural Fiber Reinforced Epoxy Composites

Mahesh Kumar <sup>1</sup>, Om Prakash <sup>2</sup>

M.Tech Student, Department of Mechanical Engineering, Government Engineering College, Jagdalpur, Chhattisgarh, India<sup>1</sup>

Assistant Professor, Department of Mechanical Engineering, Government Engineering College, Jagdalpur, Chhattisgarh, India<sup>2</sup>

**ABSTRACT:** This study works primarily issues the handling and characterization of the epoxy composites reinforced with combination of mixed (jute, coir & bamboo) natural fiber. The effective thermal conductivity, mechanical property (Tensile and Compressive Strength) and the sound absorption coefficient of the epoxy reinforced with combination of mixed natural fiber are experimentally investigated by consuming the jute, coir & bamboo fiber within the production of the thermal resistance good mechanical strength and sound-absorbing material by using an easy manual made up system. The Thermal conductivity are calculated through the Model 2022 Unitherm TM testing machine through the ASTM E-1530 standard, Tensile strength value are calculated through Tensile testing machine through the ASTM D-3039, Compressive strength value are measured with universal testing machine, & the Absorption coefficient values are calculated by an impedance test tube machine. According to the readings estimate, the reinforcement of the combination of mixed natural fiber produces a decrease the thermal conductivity of the epoxy, growth in mechanical property and rises the coefficient of sound absorption by means of increasing the weight segment of the mixed natural fiber. With a rising in thermal isolation, mechanical property and sound absorption capability, those reinforced epoxygums can discovered their function inside the insulation of walls, in meals boxes, and in various similar packages of thermal and sound protection.

**KEYWORDS:** Sound absorption coefficient ( $\alpha$ ), mixed natural fiber, Effective Thermal Conductivity coefficient ( $K_{eff}$ ), Mechanical property (Tensile and Compressive strength).

## I. INTRODUCTION

India provided with a plenteous accessibility of natural fiber for example Jute, Sisal, Coir, Pineapple, Bamboo, Ramie, Banana, Bagasse etc. has concentrated on the progression of characteristic fiber and particulate composites essentially to explore respect involved use ways. Such regular fiber and particulate composites are suitable as timber alternatives in the housing and development segment. The improvement of natural fiber and particulate composites in India depends on two dimensional arrangement of forestalling exhaustion of timberland assets as well as ensuring good economic returns for the advancement of natural fibers.

The improvements in composite material resulting to meeting the difficulties of aeronautics section have fell down for considering nearby similarly as present day applications. Composites, the miracle solid with lower mass, higher solidarity to-weight extent and solidness properties have gained significant ground in displacing the conventional materials like metals, wood, etc. The material analysts wherever all through the world focused on standard composites invigorated with Jute, Bamboo, Sisal, Pineapple, Coir, Bagasse etc. basically to cut down the expense of raw materials.

**Requirement of Thermal Insulation**

The aim of thermal insulation, primarily in the construction and making of houses, is to keep a fresh and pleasant climate in the event of excessive heats or to keep heat in the event of comfortable conditions by slowing down the heat flow with the help of the means of isolation.

**Requirement of acoustic insulation**

Sound protection is the avoidance of acoustic vitality or waves that are sent from one side of the structure divider to another. In this quickly developing current world, the extension of electrical, electronic and Mechanical gadgets in residential and business organizations, ventures have cantered the issue of sound Pollution produced by them.

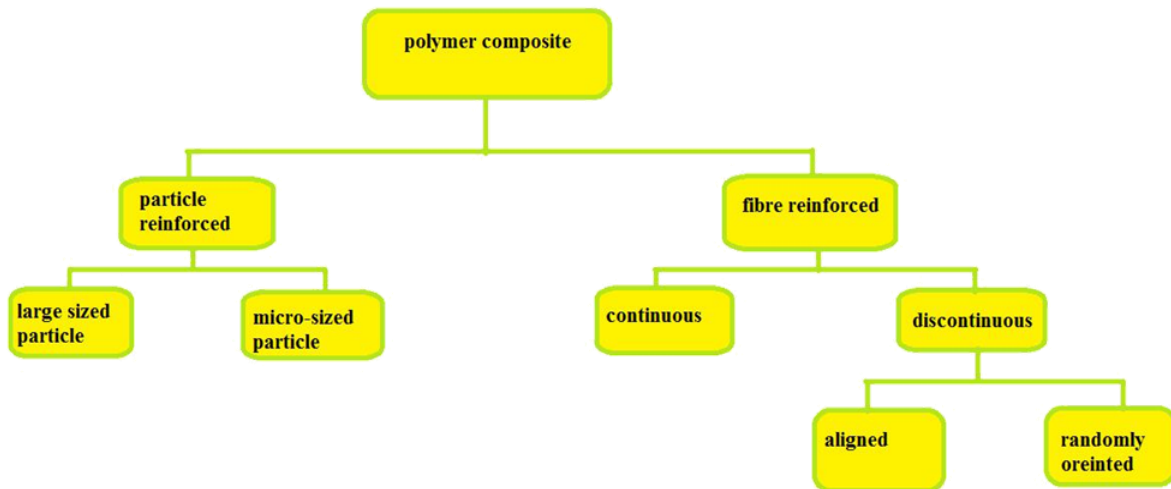


FIGURE. 1 TYPES OF COMPOSITES

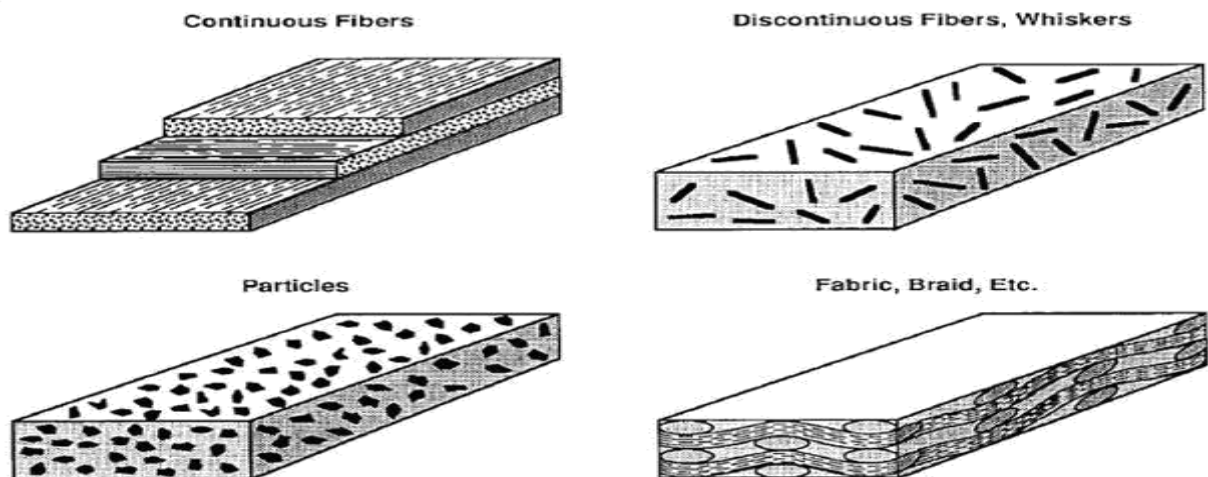


FIGURE. 2 TYPES OF REINFORCEMENT

## II. RELATED WORK

A surprising work was done by various experts on built fiber reinforced polymer composites. Subhankar et al. [1] Study on malleable properties of jute, coir and bamboo fiber composites. Mahbub Hasan et al. [2] concentrated on the investigation of physical and mechanical properties of jute, coir and bamboo characteristic fiber, strands and polymers. Munder et al [3] concentrate on mechanical and thermal properties of characteristic fiber composites. Marom et al. [4] concentrated on the adaptable properties of designed fiber-strengthened polymer composite materials that identify with biomedical applications and shows the extent of robustness sensible through selection of constituents and by choice of edge of fortress. Vijay et al. [5] passed on an inside and outside assessment and complete figuring out how to the beginners in the field of ordinary cellulose strands/polymer composites. The essential purpose of this review article is to reveal the current improvement and creating employments of typical cellulose strands and their polymer materials. Yongli et al. [6] considered the mechanical acts of unidirectional flax and glass fiber reinforced cross variety composites with the purpose of assessment on the blend effects of the composites made by typical and made fibers. Bonner et al. [7] pondered the effect of various metal powders like copper, zinc, iron and bronze on the warm properties like conductivity, diffusivity and specific warmth of high-thickness polyethylene arrange. Nielson et al. [8] later revealed the mechanical property of two particular characterizations of polymers for example thermoplastic (polyvinyl chloride) and thermoset (epoxy) stacked with copper and nickel particles. Notwithstanding the way that in 1990s, Peter et al. [9] and Young et al. [10] had adequately used copper powder as filler and estimated the thermal conductivity of the composites by hot circle procedure.

## III. METHODOLOGY

The manufacture after mixed (jute, coir & bamboo) natural fiber keen on a curved composite examples are divided into 2 phases, which are additionally utilized in place of estimating the thermal conductivity, mechanical property and acoustic absorption coefficient. First step is the pre action step and second is Manufacture organize. In the first step, mixed (jute, coir & bamboo) natural fiber was changed keen on 3-4 mm size. At that point they were dehydrated below sun for approx. 15days and additional warmed in the heater at 85 °C for in any event 10 minutes, with the goal that the overabundance dampness in the fiber gets dissipated. In the planning step, the mixed fiber is blended in 5 various weight division with the epoxy gum mixing with hardener The Polymer matrix composite blended in with mixed natural fiber and thereafter 5 tests are made by clear hand made up system. Epoxy pitch regenerated at the Low temperature is taken as a system material which is then blended in with the hardener. These both must be blended in the extent of 3:1 by weight as permitted. The blended (epoxy stacked up with fiber) is then carefully cleansed into the barrel made glass to acquire the composite model having plate shape. By then finally the semi liquid manufactures are preserved at possibility temperature for around 36 hours to encountercomplete polymerization, at long last the glass casts are damaged to develop the models for additional testing of test to get sound ingestion coefficient, mechanical property and thermal conductivity tests are set up concurring the overhead framework through different natural fiber weight segment.



**Figure. 3** Natural fiber composite

#### IV. CONCLUSION

- Successful fabrication of mixed (jute, coir & bamboo) natural fiber reinforced epoxy composites are promising by simple hand made up system.
- By adding the mixed natural fiber, thermal conductivity is remarkably reduced.
- By adding the mixed natural fiber, tensile strength is notably increased then to the decreased.
- By adding the mixed natural fiber, compressive strength is remarkably reduced.
- By adding the mixed natural fiber, sound absorption coefficient is remarkably improved.
- It is established that the outcomes acquired by adding of 0gm, 1gm, 2gm, 3gm and 4gm the thermal conductivity decreased 18.3%, 33.9%, 59.7% and 85.3% correspondingly.
- It is established that the outcomes acquired by adding of 1gm, 2gm, 3gm and 4gm, the tensile strength is increased then also added the mixed natural fiber then to the decreased.
- It is established that the outcomes acquired by adding of 1gm, 2gm, 3gm and 4gm, the compressive strength is decreased.
- It is established that the outcomes acquired by adding of 0gm, 1gm, 2gm, 3gm and 4gm, the absorption coefficient is increased.

#### REFERENCES

- [1] Subhankar et al. Study on tensile properties of jute, coir & bamboo fiber composites.
- [2] Mahbub Hasan et al. focused on the study of physical and mechanical properties of jute, coir & bamboo natural fiber, fibers& polymers.
- [3] Munder et al [3] study on mechanical and thermal properties of natural fiber composites.
- [4] Gad Marom, Albert Reuveni and Daniel Cohn, “Stiffness Variability and Stress-Dependent Elastic Response of Synthetic Fiber-Reinforced Composites for Biomedical Applications”, Biomaterials, Vol.14, No. 2, 1993.
- [5] Vijay Kumar Thakur and Manju Kumari Thakur, “Processing and Characterization of Natural Cellulose Fibers/Thermoset Polymer Composites”, Carbohydrate Polymers, Vol.109, pp. 102–117, 2014.

- [6] Yongli Zhang, Yan Li, Hao Ma and Tao Yu, “Tensile and Interfacial Properties of Unidirectional Flax/Glass Fiber Reinforced Hybrid Composites”, *Composites Science and Technology*, Vol. 88, pp.172–177, 2013.
- [7] Cho, J., Chen, J. Y. & Daniel, I. M. “Mechanical Enhancement of Carbon Fiber/Epoxy Composites by Graphite Nanoplatelet Reinforcement”, *Scriptamaterialia*, Vol. 56 (8), pp. 685-688, 2007.
- [8] Chauhan, S. R., Gaur, B. & Dass, K. “Effect of Fiber Loading on Mechanical Properties, Friction and Wear Behaviour of Vinylester Composites Under Dry and Water Lubricated Conditions”, *International Journal of Material Science*, Vol. 1(1), pp. 1-8, 2011.
- [9] Jung-il K., Kang P.H. and Nho Y.C. (2004) “Positive temperature coefficient behavior of polymer composites having a high melting temperature”, *Journal of Applied Polymer Science*, Vol.92, pp. 394–401.
- [10] Nikkeshi S., Kudo M. and Masuko, T. (1998), “Dynamic viscoelastic properties and thermal properties of powder-epoxy resin composites”, *Journal of Applied Polymer Science*, Vol.69, pp 2593-2598.
- [11] Zhu, K. and Schmauder, S. (2003), “Prediction of the failure properties of short fiber reinforced composites with metal and polymer matrix”, *Computational Material Science*, Vol.28, pp743–748.
- [12] Rusu M., Sofian N. and Rusu D. (2001), “Mechanical and thermal properties of zinc powder filled high density polyethylene composites”, *Polymer Testing*, Vol.20, pp. 409– 417.
- [13] Tavman I.H. (1997) “Thermal and mechanical properties of copper powder filled poly (ethylene) composites”, *Powder Technology*, Vol.91, pp. 63–67.
- [14] Rothon R.N., (1999), “Mineral fillers in thermoplastics: filler manufacture and characterization”, *Advanced Polymer Science*, Vol.139, pp. 67–107.