# Fabrication and Mechanical Characterization of Gongura Fibre Reinforced Epoxy Composites

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*Abstract*— **In the present scenario, there has been a rapid attention in research and development in the natural fibre composite field due to its better formability, abundant, renewable, cost-effective and eco-friendly features. This paper exhibits an outline on natural fibres and its composites utilized as a part of different commercial and engineering applications. In this paper we study the tensile, bending and flexural behaviour of Gongura fibre with epoxy as the polymer. The parameters considered here are the duration of fibre treatment, the concentration of alkali in fibre treatment and nature of fibre content in the composites.**

***Keywords:- Component; Natural fibres ; FRP; Fibre Treatment;***

## I. INTRODUCTION

A composite material is made by combining two or more dissimilar materials. They are combined in such a way that the resulting composite material or composite possesses superior properties .which are not obtainable with a single constituent material. So, in technical terms, we can define a composite as 'a multiphase material from a combination of materials, differing in composition or form, which remain bonded together, but retain their identities and properties, without going into any chemical reactions.

Natural fiber is a type of renewable sources and a new generation of reinforcements and supplements for polymer based materials. The development of natural fiber composite materials or environmental friendly composites has been a hot topic recently due to the increasing environmental awareness. In the present scenario, there has been a rapid attention in research and development in the natural fiber composite field due to its better formability, abundant, renewable, cost-effective and eco-friendly features. This project will exhibit an outline on natural fibers and its composites utilized as a part of different commercial and engineering applications. It will helps to provide details about the potential use of natural fibers and its composite materials, mechanical and physical properties and some of their applications in engineering sectors. [1][2]

Nirjharinisamal et.al; In his work, The acetone treatment of coir fiber composites were prepared using coid fiber and epoxy resin using handmade mold. FTIR study no peak shifting has been occurred. However the peak becomes narrower in case of treated fiber due to decrease of hydroxyl group. [3]

Isiaka Oluwole OLADELE et; In his work, Treatments were carried out on the fiber at an elevated temperature of 70°C for 2 hours with 2 molar solutions each of NaOH, KOH, $H_2O_2$ and Ethanol. Both treated and untreated fibers were used to develop the sisal fiber reinforced polyester composites in predetermined proportions after which they were tested for mechanical properties. From the results, it was observed that, KOH treated fiber reinforced polyester composite followed by Ethanol treated fiber samples gave the best results. [4]

Lingenthiran A, L Samylingam et; This research was conducted to study the physical properties, mechanical properties and scanning electron microscope studies of reinforced kenaf fiber with TPE. Generally, the tensile and flexural properties of kenaf reinforced composites. The 30% of kenaf mixture exhibit highest mechanical properties where it has 31 GPa modulus of elasticity, 32 MPa of tensile strength, and 47 MPa of flexural strength. The 30% of kenaf mixture contain moisture of content 4.99%, absorbs 2.99% of water before heat treated, and 1.03% of water after heat treated. [5]

Chang-Mou Wu , Wen-You Lai, and Chen-Yu Wang; In his work, The effects of surface treatment of flax fibers featuring vinyltrimethoxy silane (VTMO) and maleic anhydride-polypropylene (MAPP) on the mechanical properties of flax/PP composites were investigated. α-polypropylene (α-PP) and β-polypropylene (β-PP) were used as matrices for measuring the mechanical properties of the flax fiber/polypropylene (flax/PP) composites. The influence of surface treatment on the tensile, flexural, impact, and water uptake properties of Flax/PP composites were investigated. MAPP treatment was suitable for flax/PP composites in terms of superior tensile and impact properties. [6]

P. Prabaharan Graceraj et.al studied "analysis of mechanical behaviour of hybrid fiber (jute-gongura) reinforced hybrid polymer matrix composites". He concluded that Hybrid green composites are prepared with Jute and Gongura as the reinforcement and with 75% GP resin and 25% CNSL oil by volume as matrix. The composites prepared are tested to evaluate the mechanical properties. [7]

J. Revanthkumar et.al studied "the tensile behaviour of gongura fiber made hybrid polymer matrix composite". The influence different parameters on tensile strength of composite is studied using ANOVA technique. The regression equation is arrived which explains the level of influence of different parameters on ultimate tensile strength of composites. [8]

From the literature survey it has been seen a lot of research on natural fibres being carry out in recent years. Gongura fibre is a plant base fibre majorly grown in north Karnataka, Maharashtra and Telengana. It is less explored for the application of composite materials. Therefore in the present work an attempted has been made to study the mechanical properties of the Gongura fibre reinforced epoxy composites. And also surface treatment of Gongura fibre on its mechanical properties studied.

## II. MATERIALS, FABRICATION AND MECHANICAL CHARACTERIZATION

### *A. Materials*

a. Epoxy LY 556

Epoxy resins are the commonly used thermoset plastic in polymer matrix composites. Epoxy resins are a family of thermoset plastic materials which do not give off reaction products when they cure and so have low cure shrinkage. They also have good adhesion to other materials, good chemical and environmental resistance, good chemical properties and good insulating properties.

b. Gongura Fibres

Gongura fibres are plant based fibre extracted from Gongura plant. Steps involved included extraction of Gongura fiber from gongura palnt, Matts were prepared by manual weaving Technique and then followed by treatment of the extracted fibers with NaOH solution for the improvement of surface morphology.

### *B. Fabrication*

Preparation of Gongura fiber mat of dimension 150*200mm and Chopped of dimension 200*200. Prepare a Chemical treatment by adding a 2%,4% of NaOH. Prepare Matrix by mixing epoxy resin with 10% of hardener. Then spread the epoxy resin on the transparent sheet and place the first layer of mat on that resin, then again spread the resin and place second layer of mat and finally spread the resin. After completion of laminate apply the load on the laminate and kept it for 24hr for curing. Marking and cutting to required dimension. After curing, specimens are prepared for each laminate to conduct testing according to standards.

Table 1. Details of Fabricated Samples

| Sl No | Sample | Details |
|---|---|---|
| 1 | Chopped fibre | Chopped Gongura fibre Epoxy Composite |
| 2 | Natural fibre | Untreated Gongura fibre Matt reinforced Epoxy Composite |
| 3 | 2% treated | 2% NaOH Treated Gongura fibre Matt reinforced Epoxy Composite |
| 4 | 4% treated | 4% NaOH Treated Gongura fibre Matt reinforced Epoxy Composite |

### *C. Mechanical Characterization*

Gongura Fibre Reinforced Epoxy composites were performed on prepared laminates. Tensile and flexural tests were conducted on the universal testing machine according ASTM standards ASTM D638 and ASTM D790 respectively. Tensile test is the most commonly used mechanical test in which specimen is subjected to gradual loading until it breaks/fails. Flexural strength is one of the major mechanical characteristics of any material. Flexural strength is an ability of the composite material to withstand bending forces applied perpendicular to its longitudinal axis until it fractures or starts yielding permanently using with three point flexural test technique. Impact strength is ability of the material to withstand a suddenly applied load or it can also defined as the ability of the material to absorb mechanical energy in the process of deformation and fracture under impact loading. According ASTM D256 impact tests were conducted on the impact testing machine. [9][10]

Fig 1. Tensile Testing Machine

Fig .2: Flexural Testing Machine

Fig .3: Impact Testing Machine

## III. RESULTS AND DISCUSSION

### A. *Tensile Test*

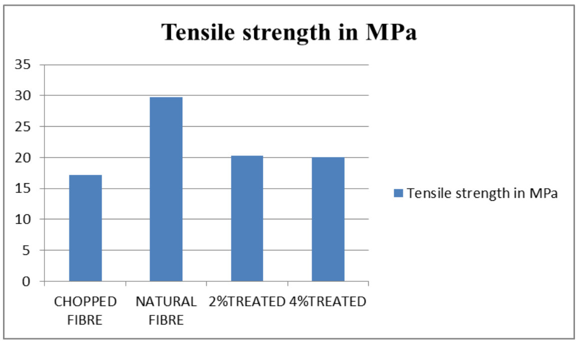


Fig. 4: Tensile Test Results

According to the ASTM standards the specimen are prepared and tensile test results shown as in Fig.4. By analyzing tensile test results for different composites it can be concluded that with a Chemical treatment of gongura fibre material in NaOH solution has less tensile strength compared to the pure untreated gongura fiber.

### B. *Flexural Test*

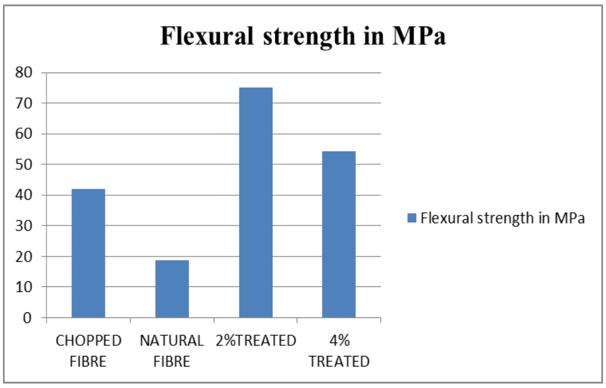


Fig. 5: Flexural Test Results

From Flexural Test analysis it can be seen that gongura fibre treated with the 2% of NaOH solution gives good flexural strength compared to other composites.

### C. *Impact Test*

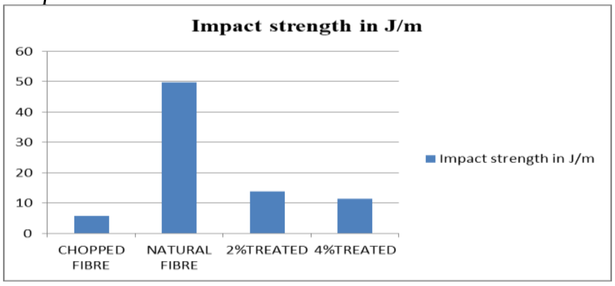


Fig. 6: Impact Test Results

From impact test results analysis, it can be seen untreated gongura fibre poseses good impact strength compared to other composites.

## IV. CONCLUSIONS

Based on the experimental results and analysis, the following conclusions were arrived at:

- Experimental results shown untreated woven gongura fiber composites higher tensile and impact strength compared to other 2%and 4% NaOH treated gongura fiber .
- 2% NaOH treated gongura fiber shown better flexural strength.
- Experimental results also shown woven fibre composites exhibits better mechanical properties as compared to Chopped fibre composites.

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