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ENHANCEMENT OF TENSILE STRENGTH OF MECHANICAL PROPERTIES OF BANANA FIBER REINFORCED EPOXY COMPOSITES FILLED WITH GROUNDNUT SHELL ASH

Guruji Ramakrishna[1], Dr. G. R. Selokar [2]

[1]*Ph D Scholar, Mechanical Engineering,Sri SatyaSai University of Technology & Medical Sciences, Sehore, MP, (India)*

[2]*Ph D Supervisor, Sri SatyaSai University of Technology & Medical Sciences, Sehore, MP, (India)*

ABSTRACT

In the fast-developing world, the concern for the environmental pollution and the prevention of non-renewable and non-biodegradable resources has attracted researchers seeking to develop new eco-friendly materials and products based on sustainability principles. The fibers from the natural sources provide indisputable advantages over synthetic reinforcement materials suchas low cost, low density, non-toxicity, comparable strength, and minimum waste disposal problems.

In the present work, banana fibre reinforced epoxy composites filled with groundnut shell ash was prepared and the mechanical properties of these composites areevaluated. The composite samples with different groundnut shell ash and epoxyweight fractions were prepared by using the hand lay-up process and apply pressure at room temperature. Later, the samples were tested for the evaluation of mechanical properties such as tensile strength, hardness,compressivestrength and impact strength.

Keywords: Banana fibres, Resin, Groundnut Shell Ash.

I.INTRODUCTION

It is a truism that technological development depends on advances in the field of materials. One does not have to be an expert to realize the most advanced turbine or air-craft design is of no use if adequate materials to bear the service loads and conditions are not available. Whatever the field may be the final limitation on advancement depends on materials. Nature is full of examples where the idea of composite materials is used. Wood is a fibrous composite: cellulose fibres in a lignin matrix. The cellulose fibres have high tensile strength but are very flexible (i.e. low stiffness), while the lignin matrix joins the fibres and furnishes the stiffness. Bone is yet another example of a natural composite that supports the weight of various members of the body. It consists of short and soft collagen fibres embedded in a mineral matrix called apatite. In addition to these naturally occurring composites, there are many other engineering materials that are composites in a very general way and that have been in use for very long time.

II.FABRICATION METHODS OF PMCS

There are two general divisions of composites manufacturing processes: open moulding and closed moulding. With open moulding, the gel coat and laminate are exposed to the atmosphere during the fabrication process. In closed moulding, the composite is processed in a two-part mould set, or within a vacuum bag. There are a variety of processing methods within the open and closed moulding categories.

2.1 Open Moulding Method

(a) Hand Lay-Up.

(b) Spray-Up.

(c) Filament Winding.

(a) Hand Lay-Up

Hand lay-up is an open moulding method suitable for making a wide variety of composites products including: boats, tanks bath ware, housings, truck/auto components, architectural and many other products ranging from very small to very large. Production volume per mould is low; however, it is feasible to produce substantial production quantities using multiple moulds. Simple, single-cavity moulds of fibreglass composites construction are generally used. Moulds can range from very small to very large and are low cost in the spectrum of soft.

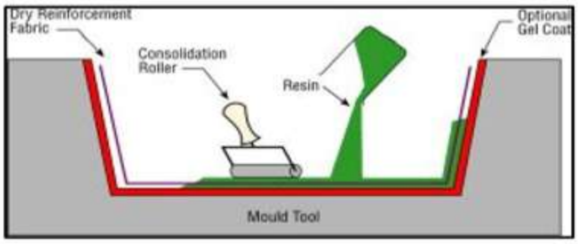

FIGURE2.1 Hand Lay-Up Technique

2.2 NATURAL FIBRES

2.3 Structure Of Natural Fibre

The chemical structure of natural fibre or plant fibre comprises of cellulose, hemicellulose, lignin, pectin and extraneous materials. characterization of plant fibre can be done based on its cellular structure. each cell of fibre comprises of crystalline cellulose regions (microfibrils) which are interconnected via hemicellulose and lignin fragments. a natural fibre cell has one thin primary wall and three thick secondary walls . The primary wall is the first layer deposited during cell growth surrounding a secondary wall. the secondary wall consists of three layers and the thick middle layer controls the mechanical properties of the fibre. It is observed that the higher

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fibre strength takes place when the microfibrils are arranged more parallel to the fibreaxis .cellulose is the major framework component of the fibre and provides the strength, stiffness and structural stability of the fibre.

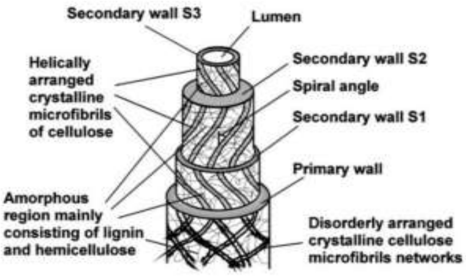

FIGURE 2.3 Structure of natural fibre

III.MATERIALS

3.1 Matrix Material

In composite materials, the constituent which is continuous and present in greater quantity is called matrix. The main functions of the matrix are to hold or bind the fibre together, distribute the load evenly between the fibres and protect the fibre from the mechanical and environmental damage. Epoxy resins are unique among all the thermoset resins due to several factors. The distinct properties of epoxy such as high corrosion and chemical resistance, outstanding adhesion to various substrate, good thermal and mechanical properties, good electricalinsulating properties, low shrinkage upon cure, and the ability to processed under a variety of conditions make it suitable matrix material for the fibrereinforced composite materials.

FIGURE 3.1Epoxy LY556 & Hardener HY951

IV.FIBRE MATERIAL

In composites, the discontinuous phase is usually harder and stronger than the continuous phase and is called the reinforcement. In polymer composites, the reinforcing phase can either be fibrous or non-fibrous (particulates) in nature. In FRP composites, fibre acts as a reinforcing agent. Fibres are the load carrying members which provide strength, stiffness, thermal stability and other structural properties in FRP . If the fibres are derived from the natural resources likeplants or some other living species, they are called natural fibres.

FIGURE 4 Raw banana fibre

4.1. GROUNDNUT SHELL ASH

Groundnut shells were kept in Electricalfurnance at 1400°C temperature for ½ hr to burn completely.After this ,burned groundnut shells are pulverised into ash. Then, the filler was dried in an oven at a temperature of 250 °C for 3 hrs.

FIGURE 4.1 Ground nutshell ash

V.EXPERIMENTATION

5.1chemical Treatment Of Banana Fibres

The fibres were immersed in the 1% NAOH solution for 30 min and then washed with tap water. The washed fibres are wiped with cloth and then placed in oven at 50°C for 45 min for complete removal of moisture.

FIGURE 5.1 Banana fibres dipped in 1% NAOH solution

5.2Hand layup process

Ground nutshell ash mixed with epoxy **Hand layup process** **Composite**

VI.MECHANICAL TESTS

6.1TENSILE TEST

The universal testing machine is used for to determine the mechanical properties like: strength and the stress, strain elongation of the given standard specimen made up of the different combinations. A universal testing machine is used to test the tensile stress and compressive strength of materials. It is named after the fact that it can perform many standard tensile and compression tests on materials, components, and structures. Here we have to check the strength of the composite which is in the standard cuboid in shape for the measuring of the tensile strength. We have taken the two specimen.

Specimens

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FIGURE 6.1 Universal testing machine

TABLE 6.1Ultimate tensile strength readings

S.NO	WEIGHT OF GROUNDNUT SHELL ASH (GRAMS)	MAXIMUM LOAD (kN)	LOAD AT BREAK (kN)	UTS (MPa)
1	0	2.72315	2.72	10.21
2	10	3.23015	3.23	12.02
3	15	2.79324	2.79	10.30
4	20	2.33734	2.33	8.61

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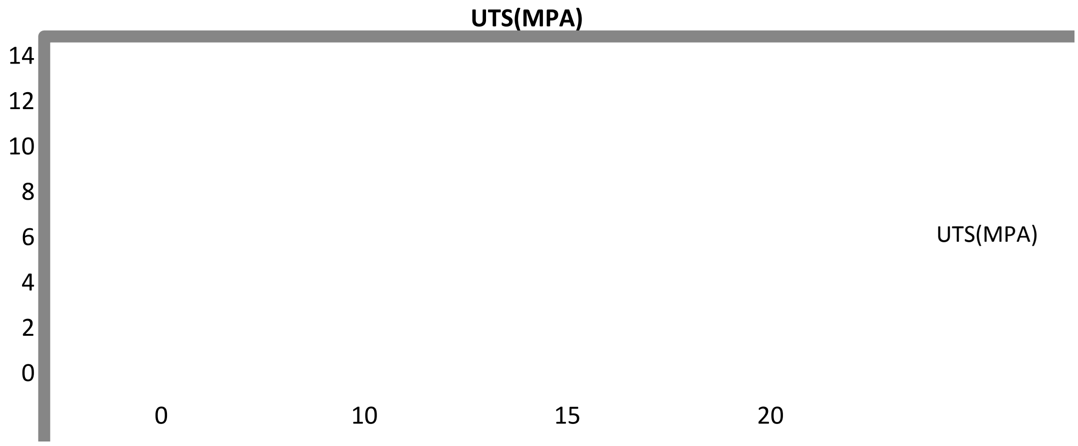

GRAPH 6.2Weigt of groundnut shell ash vs Ultimate tensile strength

TensileStressvsStrainDiagram

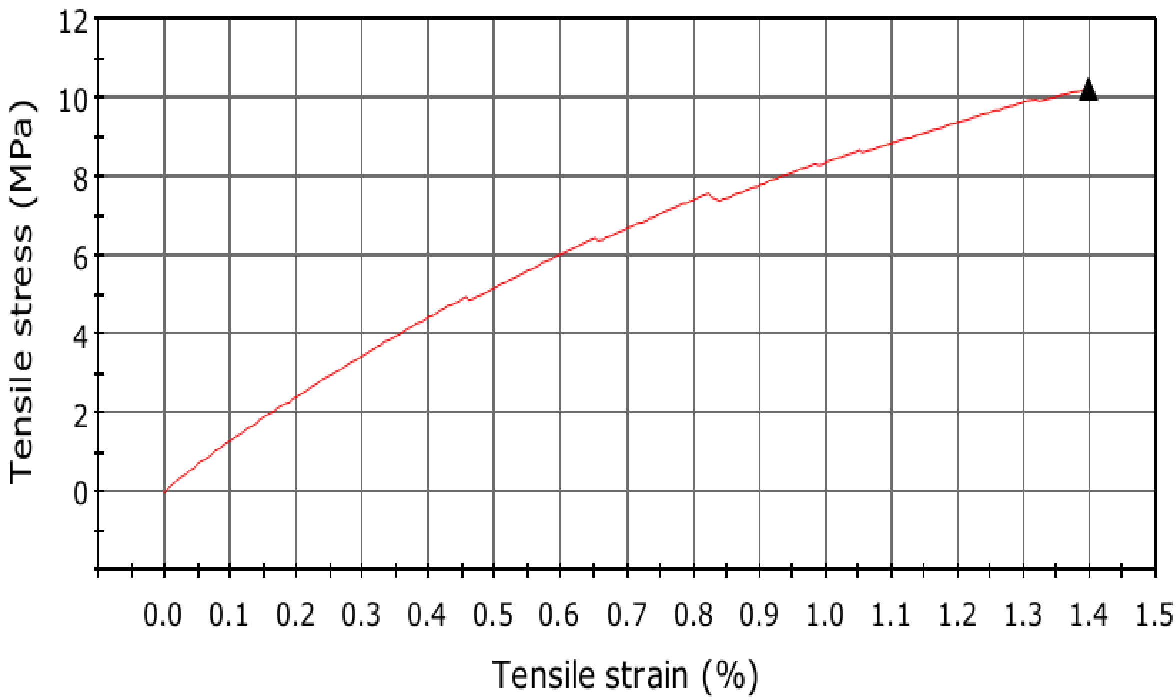

FIGURE 6.3 Zerograms of groundnutshell ash tensile stress-strain graph

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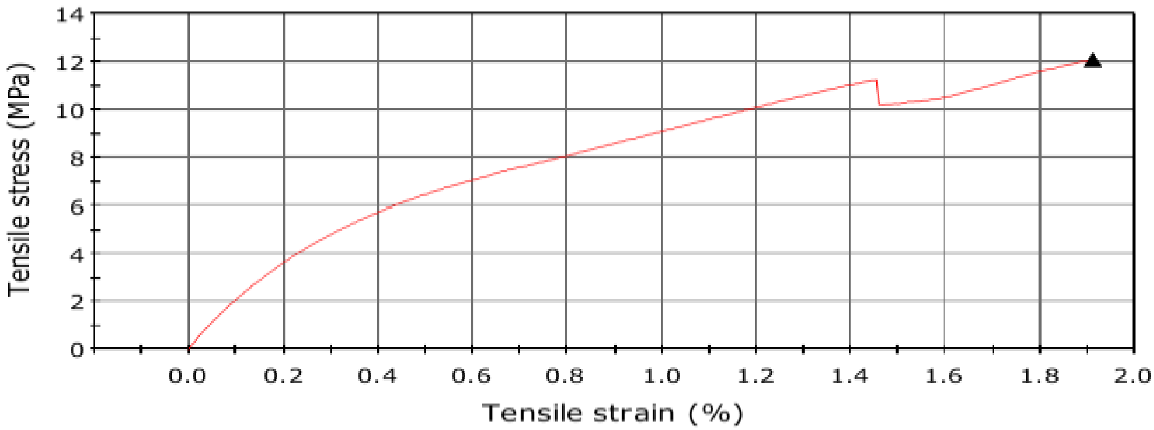

FIGURE 6.4Ten grams of groundnutshell ash tensile stress-strain graph

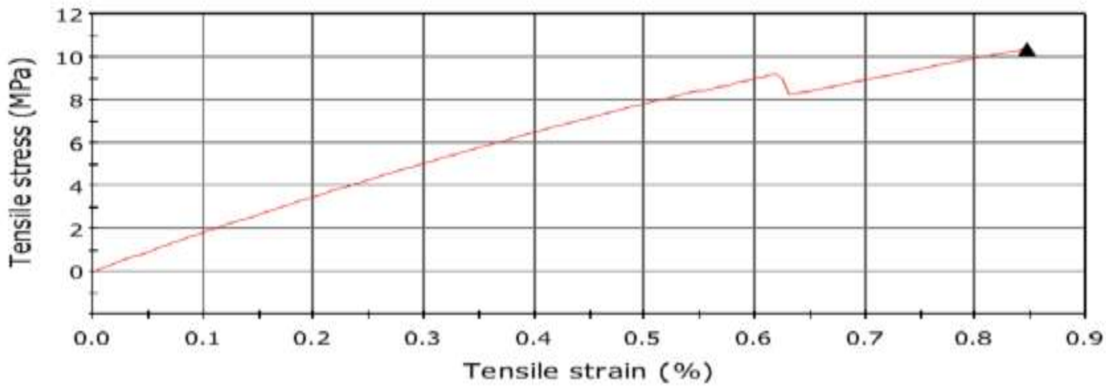

FIGURE 6.5 Fifteen grams of groundnutshell ash tensile stress-strain graph

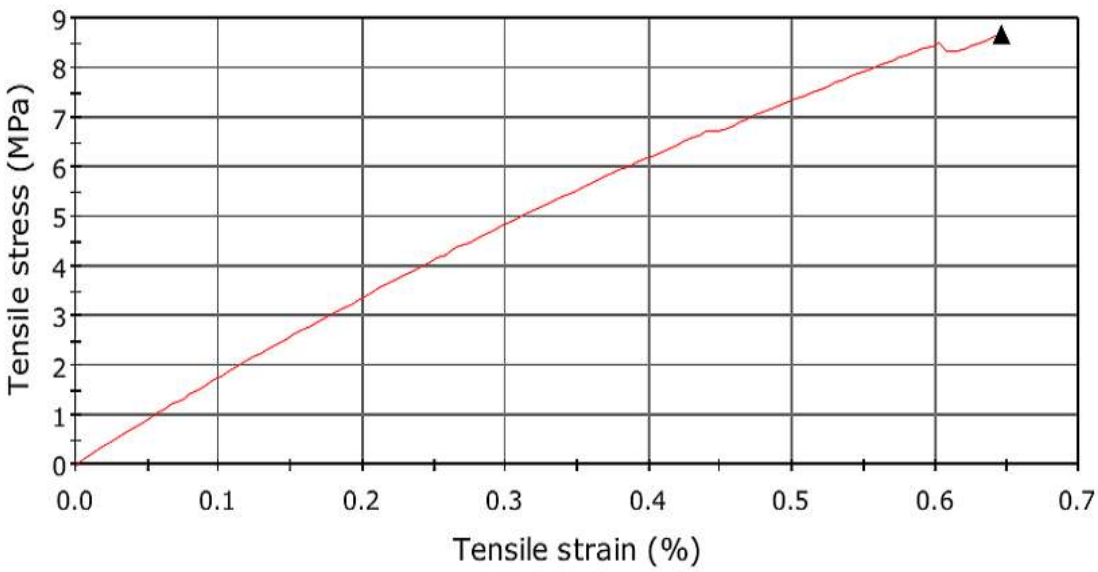

FIGURE 6.6Twenty grams of groundnutshell ash tensile stress-strain graph

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VII.CONCLUSION

The mechanical tests of all the four specimens were evaluated. The experimental investigation on the composites with different weight ratios have been carried out. The conclusions drawn from the present work are:

⇨ 240gm of epoxy + 45gmsof banana mats+ 10gms of groundnut shell shows high tensile strength of
12.02 MPA among other proportions.

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