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N. Srinivasa Rajneesh, Ch. Ashok Kumar, K. Phani Raja Kumar, and S. UdayaBhaskar

Investigation on Mechanical Properties of Composite for Different Proportion of Natural Fibres With Epoxy Resin

N. Srinivasa Rajneesh[1,a)], Ch. Ashok Kumar [1], K.Phani Raja Kumar [2], S. UdayaBhaskar[1]

[1]Department of Mechanical Engineering, Malla Reddy Engineering College (Autonomous), Maisammaguda, Secunderabad-500100, India

[2]Project Manager in Supply Chain Management & Digital Transformation in Information Technology sector, Tech Mahindra, USA

[a)] Corresponding author: rajneeshsrinivasa@gmail.com

Abstract: When humans evolve, there are several problems that contaminate and pollute the environment. The developments in technology to find better products often lead to an increase in emissions in the atmosphere. To overcome these problems, a suitable solution to decrease polymer scrap is replaced by making the composites from natural fibres. The properties of FRP composites produced from epoxy resin and fibres are addressed. In this paper, we fabricated specimens at different natural fibres of coconut coir with different compositions of hardener (30,35and40%) and resin epoxy (70, 65, and 60%). The laminates are fabricated by hand layup method effectively. Mechanical Properties of the composite specimen are determined and compared.

Keywords: Coconut coir, FRP Composite epoxy resin, hardness, tensile strength.

INTRODUCTION

Composite material has evolved in engineering and domestic application for optimization of weight percentage. The coastal states of India have use production in natural fibres. In initial days the natural fibres were used only for firing, threading as ropes, and weaving of mats. With a huge production of the natural fibres many researches started to investigate in utilizing this fibres. Some of the researches have utilize the natural fibres in production of hand wiper, preparation of fibres beds along with spring in resistance the deformation. Due to increase in demand of composite material in avoiding the weight of metal there was huge demand in the market. Composite material were fabricated for false roofing which had a composition of calcium carbonate and natural fibres. Many of the furniture are attached with natural fibres coil for better cushioning. Natural fibres along with chemical agent are used for Cleaning of industrial equipment. In the view of metal matrix of composite material researches have concentrated in replacing them with natural fibres. The different types of natural fibres are flax, jute, hemp, ramie, kenaf and coconut coir.

LITERATURE REVIEW

Composite materials fabricated using natural fibres which are extracted from trees have been emerging in research considerations. As natural fibres are non-toxic they can be directly used for industrial and domestic applications. These composite materials have to be good in mechanical and chemical properties. Composite materials made up of coconut shells and epoxy resins have been investigated for tensile strength. Due to addition of the coconut shell percentage the specimens leaded to maximum tensilestrength [12,14,15].

The dust of wood having different grain sizes has been used to prepare a composite material. These composite materials were tested for fatigue test. From the experimental investigation it was observed that

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initially with increase in content of wood dust for composite material showed improvement in the mechanical properties. Later after certain percentage of wood dust content in the composite material the properties decreased gradually[10]

The strength of coir fibres was investigated in to probable cases. Dry coir fibre was subjected to fatigue loaded which indicated high strength when compare to wet fibre [11,2]. Strength of synthetic fibres was compared with natural fibres. Matrix reinforcement is done to increase the surface roughness and good modelling due to chemical treatment using sodium hydroxide. The study revealed increasing in mechanical properties with a variation of volume of fibres [3,4,13]

The MESOCERP of coconut has high energy absorption properties along the grain direction the specimen's prepared used coconut MESOCERP scrap. Where compressed quasistatistically along principle directions. Microscopic structure was studied to evaluate the physical property of material [9].Polymers have been replaced due to its toxic nature with reinforced natural polymers. The fibres reinforced for the fibres increase their strength due to which these composites have been used for engineering applications [8,7].

The natural fibres which were reinforced with polymers have replaced artificial synthetic fibres for automotive applications. Automobile parts have to be water resistant in view of the construction of the automotive body the natural fibre reinforcement were used. An optimize thickness of the composites reveled good absorptions for acoustic conditions [5].Composite materials fabricated with natural fibres have been considered as renewable materials. The flexural strength of this material has made a remark for the present engineering applications [6].

EXPERIMENTAL PROCEDURE

The raw material used is coir and Epoxy is the chemical name and Araldite is the marketing name by manufacturing company Hindustan international (India) private limited.

FIGURE 1. Raw material of Coir

TABLE 1. Physical properties of coir

Length in inches	6-8
Density (g/cc)	1.40
Tenacity(g/Tex)	10.0
Breaking Elongation %	30
Diameter In mm	0.1 to 1.5
Rigidity of modulus	1.8924 dync/cm2
Swelling in water(diameter)	5 percent
Mosture at 65 % RH	10.50 percent

TABLE 2. Properties of Different Natural Fibres:

Properties	Tensile Strength (Mpa)	Modulus (Gpa)	Elongation (%)	Density (g/cc)
Coir	252	4 to 6	30	1.4 g/cc

FIGURE 2. Hardener and Resin

FIGURE 3. Experimental Material Setup

This has high mechanical properties like large cohesive force. It has flexibility and diversity in designing. It also has the excellent stability without impurities. This has good strength and low absorption of moisture. When these get reacted with hardener, it does not melt due to its heat resistant nature.Amine anhydride is used as the major constituent for bonding. They are partially natural but usually synthetic and most commonly derived from petrochemicals.

This experimental process follow the Hand lay method for fabricated the laminates in dog bone shape as per the standards. The coir is placed in the mould tool and spread uniformly. The resin and hardener are mixed thoroughly and poured on to the coir, such that coir gets submerged. With the help of the tool, the mixture of resin is spread on to the coir in the mould. It is seen that no air bubbles should roll inside the sheets. The mold is then closed and pressured on the single mat. The mold is not disturbed until it gets settled and kept for drying at room temperature.

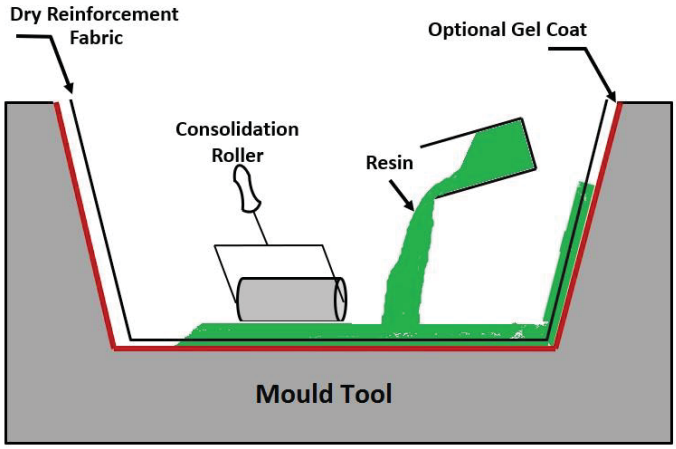

FIGURE 4. Basic preparation method

Preparation of Laminate

The experimental technique follows the hand lay method. This has a long wide plate used as a base. The resin and hardener are mixed firstly, and then the coating is applied uniformly on the entire area of the required size of the laminate. A little amount of force is applied on it with the roller for uniform spreading of the resin mixture. Then again a coating is kept on it.

This process is repeated until the required thickness is obtained. Then a coating of wax is kept to finish the product or a Teflon sheet is kept on it with a little weight.

FIGURE 5. Mixture of resin and hardener

FIGURE 6. Spreading the resin as a composition

FIGURE 7. Laminated profile of Coir natural fibre

FIGURE 8. Preparation of the Dog-bone shape

Specimen Preparation

The laminate setting on the board is gently removed by releasing the Teflon sheet. The laminate has on the edges with the fibres are cut in to make laminate to a uniform shape. Fibres are cut by the carpentry chisel. The extra parts are also cut by the chisel.The ASTMD 638 specimen shape is marked on a paper; this paper is cut and pasted on the laminate. The shape is to be cut on the laminate to make the specimen. This laminate with the marked specimen is taken to the carpentry shop for cutting a specimen.

Experimental investigations

In this experimental set up the specimens undergo two types of testing methods. They are:

- Tensile testing
- Shore hardness testing

Tensile Testing

The specimens are cuts as per the required dimensions and placed in the jaws of UTM, as the tensile force is applied on the specimen takes the load for elongation. This is the fundamental material testing for all the materials in the engineering field, The purpose of this testing is:

- Selection of a material for an application.
- Predict how a material will perform in use: normal and external forces.
- To demonstrate the utility of a proposed material.

FIGURE 9. Grippers of a UTM 2010

FIGURE 10. Tested specimens of the coir fibre

In this testing process we will be finding the strength of the specimen up to the breaking point. The stiffness can be found by tensile modules is found from stress-strain diagram. At a cross head speedof 3mm/min, the grippers are tightened uniformly and evenly and tensile test is found by the UTM.

Hardness

The scales were invented to the people to have the common point of reference. The scale indicates a greater resistance to indentation is the higher number on the scale indicates and material is harder and become soft material when the lower number indicates less resistance.The object having Shore durometer of 90s also used to describe a material rating of the scale . This is developed in 1920s to measure the suitable hardness of the materials.

FIGURE 11. Shore hardness testing machine

RESULT AND DISCUSSION

The specimens with different composition of fibre and resin have been tested to investigate the mechanical properties. The specimen-1 had a proportion of 30% hardener 70%Coir epoxy, the specimen-had a proportion of 35% hardener 65%Coir epoxy and the specimen-3 had a proportion of 40% hardener 60%Coir epoxy.

From Figure.12it is observed that due to increase in percentage of hardener along with coir epoxy it is observed that tensile strength is more for composition of 60% coir epoxy and 40% hardener. With increase in hardener from 30% to 40% there was an increase in tensile strength of 60.43%.

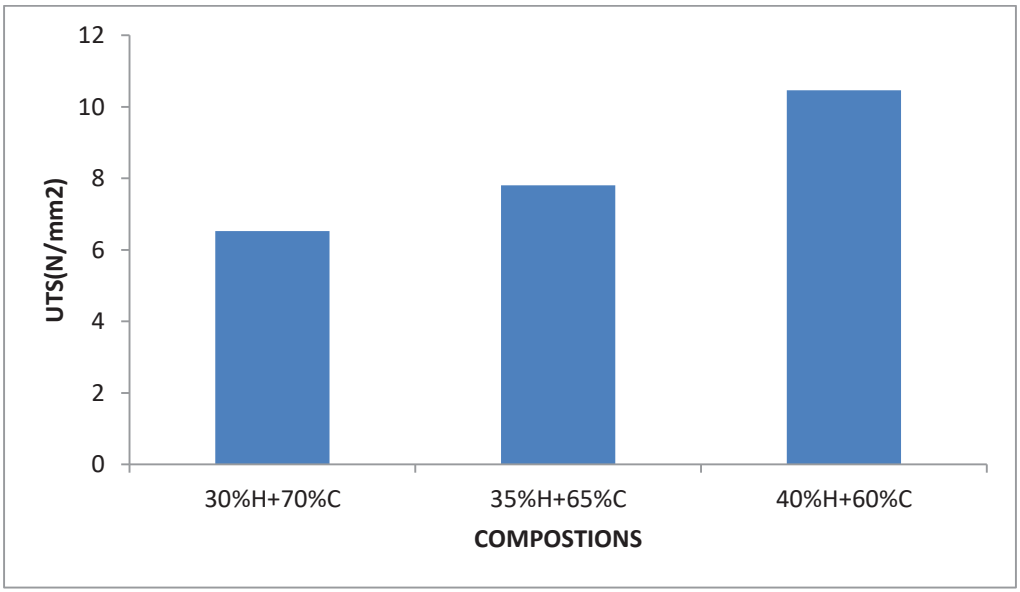

FIGURE 12. Universal tensile strength Vs. Compositions

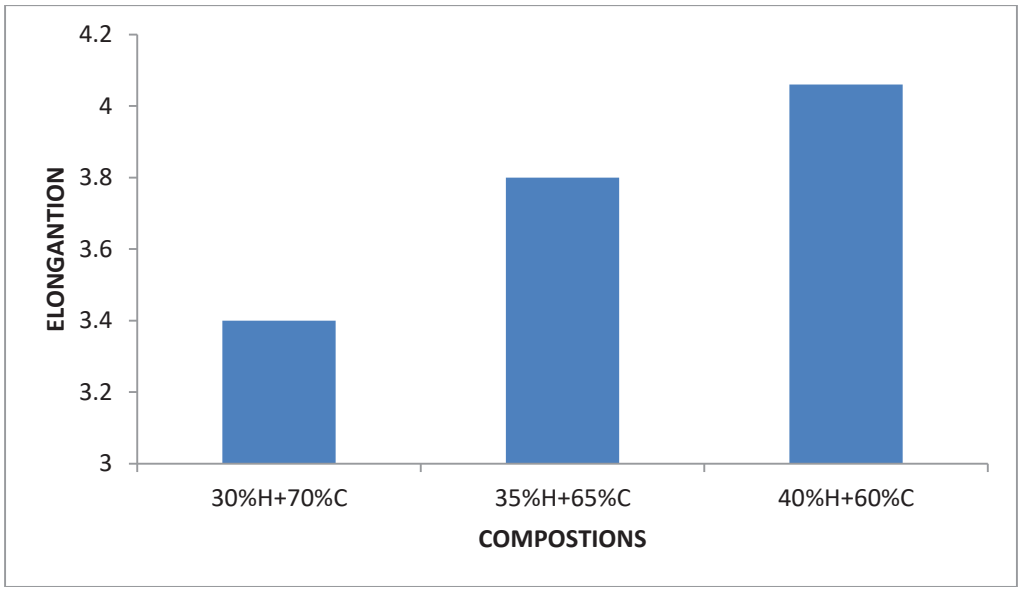

FIGURE 13. Elongation Vs. Compositions

Due increase in percentage of hardener along with coir epoxy it is observed that tensile strength is more for composition of 60% coir epoxy and 40% hardener is shown in figure 13. The elongation of the specimens was observed a rise in elongation of 19.41% with variation of hardener from 30% to 40%. There was an increase in mechanical properties with the variation of hardeners.

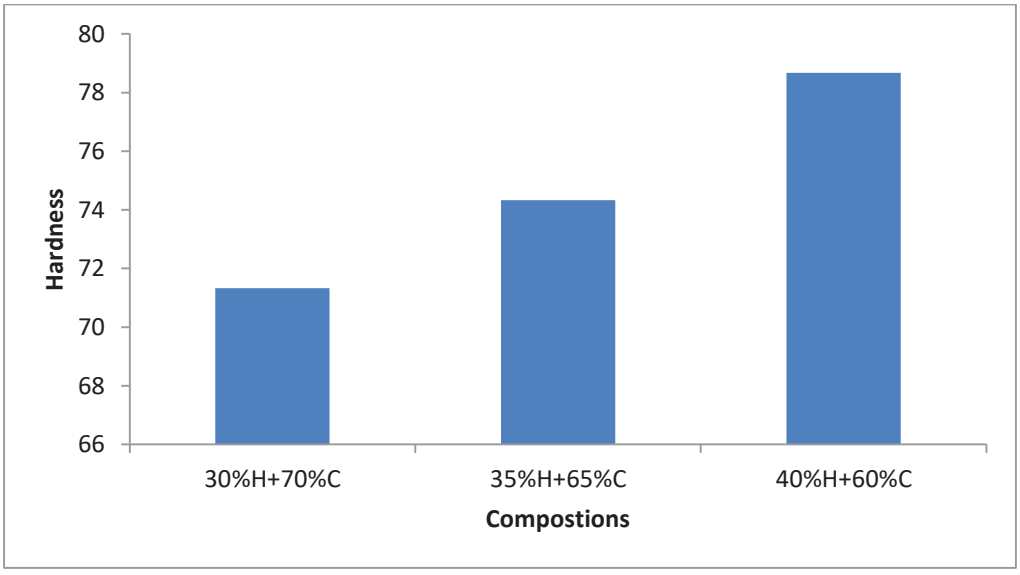

FIGURE 14. Hardness vs. Compositions

From Figure.14 with increase in percentage of hardener along with coir epoxy it is observed hardness is more for composition of 60% coir epoxy and 40% hardener. The hardness variation was 10.29% due to the variation of hardener from 30% to 40%

CONCLUSIONS

In this paper natural filler based epoxy composites from coconut coir is developed and its mechanical behavior under various testing of different compositions hardener and resin epoxy is investigated and comparative study is done. The laminates are fabricated by hand layup.The compositewith specimen having coconut coir epoxy 60% + hardener 40% was better when compared to other compositions.There was an increase in tensile strength by 60.43%, elongation in the specimen by 19.41% and hardness by 10.29%.

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