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Fabrication and Study the Effect of Mechanical Properties of Coconut Shell Powder and Rice Husk

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ABSTRACT

In this present work experimental investigation has been carried out to fabricate and study the effect of CSP and Rice husk powder at different weight percentages (30, 40 and 50) with epoxy resin. An epoxy resin has very good electrical insulation properties and outstanding mechanical strength including tensile and flexural. The composite material is fabricated by using hand lay-up method. Then the composite material is tested on universal testing machine (UTM) for tensile strength.

The addition of CSP and Rice husk powder weight percentage has improves the mechanical properties. it is observed that the strength of the composite material is increased with the increase in the CSP and Rice husk powder content in epoxy matrix.

KEYWORDS: *CSP and Rice husk powder, hand layup method, tensile strength*

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INTRODUCTION

In the recent years there is requirement of materials with unusual combination of properties, the main objective is not only to improve the strength but also the high performance for the materials. In order to fill the above requirement, the researchers are developing the new materials finally composites are developed for attain the required properties. Composite means "two or more distinct parts bound together". Thus, a material having two or more constituent materials or phases may be considered as a composite material. A composite material is a material is made from two or more constituent materials with significantly different physical or chemical properties that, when combined, produce a material with characteristics different from individual components. Composite materials are commonly classified at following distinct levels:

The first level of classification is usually made with respect to the matrix constituent. The major composite classes include Organic Matrix Composites (OMCs), Metal Matrix Composites (MMCs) and Ceramic Matrix Composites (CMCs). The term organic matrix composite is generally assumed to include two classes of composites, namely Polymer Matrix Composites (PMCs) and carbon matrix composites commonly referred to as carbon-carbon composites.

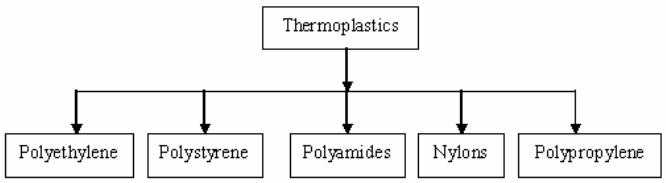

Fig. Types of thermoplastics matrix material

Thermosets are the most popular of the fiber composite matrices without which, research and development in structural engineering field could get truncated. Aerospace components, automobile parts, defense systems etc., use a great deal of this type of fiber composites. Epoxy matrix materials are used in printed circuit boards and similar areas.

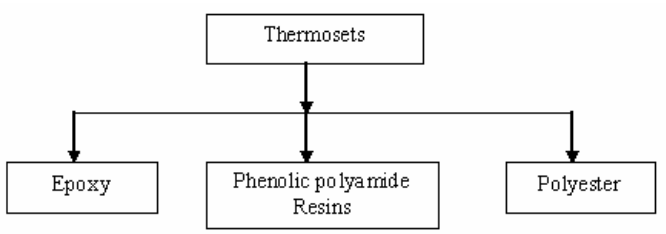

Fig. Types of thermosets matrix material

Epoxy resins are widely used in filament-wound composites and are suitable for moulding prepress. They are reasonably stable to chemical attacks and are excellent adherents having slow shrinkage during curing and no emission of volatile gases. These advantages, however, make the use of epoxies rather expensive. Also, they cannot be expected beyond a temperature of 140ºC.

Materials:

The following are the main raw materials used in this work

- Coconut shell powder and Rice husk powder
- Epoxy resin
- Hardener

The coconut shell powder and rice husk powder are used as reinforcement. Thermoset polymer epoxy (araldite LY-556) and Hardener is triethylene tetramine (HY-951) are used for making composite material.

Preparing of coconut shell powder and rice husk powder:

Materials used in this experimental work are Epoxy resin, Hardener and Coconut shell powder. Epoxy resin is a thermosetting epoxy resin of medium viscosity, India having outstanding properties as the matrix material like excellent adhesion to different materials, high resistance to chemical and atmospheric attack, high dimensional stability, excellent mechanical properties, nontoxic nature and negligible shrinkage. Hardener is used to harden matrix material. The chemical composition of coconut shell powder consists of Lignin (29.4%), Pentosans (27.7%), Cellulose (26.6%), Moisture (8%), Solvent Extractives (4.2%), Uronic Anhydrides (3.5%) and Ash (0.6%).

The cleaned coconut shells were crushed into small pieces by using hammer. These small pieces then converted into powder by using hammer. The collected powder was then sieved to different mesh sizes. For discriminating different CSP particle size about 1000g of CSP was put over the sieve shaker and shaken it for 20 min.

Fig. Coconut shell powder

Fig. Rice husk powder

Fabrication of composite:

Fabrication steps

Step 1 : Preparation of mould by using acrylic sheet in required dimensions.

Step 2 : preparation of CS and RH powder in required dimensions.

Step 3 : Weighing of epoxy resin into bowl of 50g.

Step 4 : Weighing of hardner into the same bowl of 5g i.e., (10:1) mixing ratio of hardner and epoxy.

Step 5 : Mixture is mixed thoroughly for 2-5 minutes to form homogeneous.

Step 6 : Mould releasing spray is sprayed all over the mould for easy erection of laminate from moulds.

Step 7 : Coconut shell powder is mixed with epoxy resin and hardner then poured according to the required percentages.

Step 8 : Remaining portion of specimen is poured the mixture, place the OHP sheep over it and roll thoroughly to ensure that no void spaces.

Step 9 : Leave the mould for 24 hours for curing to get solidified composite laminate.

Step 10 : After that remove the composite material carefully without any damage.

Fig. fabricated composites placed for 24 hours to solidify

Characterization of mechanical properties:

Tensile test:

Tensile test generally performs on flat specimen. Test of composite sample is carried out in ASTM D3039 standard. In this, a uniaxial load was applied through both the end. Samples are tested at a cross head speed of 10 mm/min, in a universal testing machine (UTM). Tensile test specimen sizes as per ASTM D3039

Testing and Results:

Tensile testing:

Three samples are taken for each test and average value of them is taken into consideration.

Tensile strength is defined as the ability of a material to support axial load without rupture and is determined through the tensile test. When equal and opposite forces are applied simultaneously at both the ends that pulls the material, it tries to elongate it and the diameter reduces. The test specimen and general setup has been shown given below.

S. NO.	SAMPLE	Tensile Strength (Mpa)
1	20% CSP Filled composite	19.23
2	30% CSP Filled composite	17.05
3	40% CSP Filled composite	14.64

Table Tensile test result

Flexural testing:

Three samples are taken for each test and average value of them is taken into consideration.

S. NO.	SAMPLE	Flexural strength (MPa)
1	20% CSP Filled composite	83.38
2	30% CSP Filled composite	86.45
3	40% CSP Filled composite	73.92

Table Flexural test results

Discussions:

The comparison of between the CSP and Rice husk powder percentage and tensile strength is considered of three samples at different percentages 30, 40 and 50.

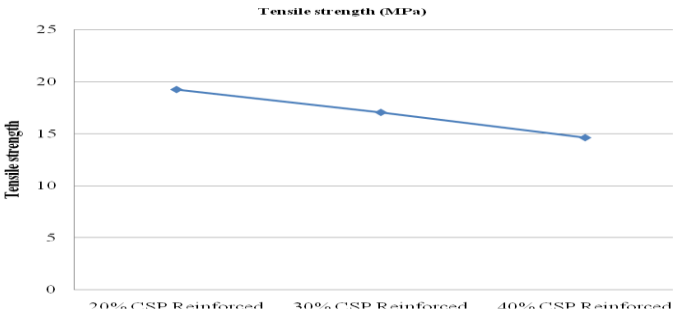

Fig. tensile strength v/s CSP percentages

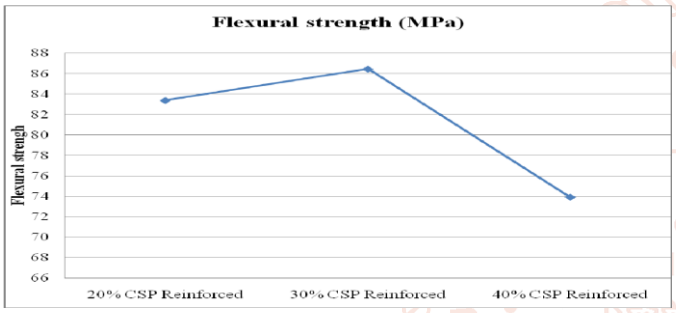

Fig. Flexural strength v/s CSP percentages

Conclusions:

The experimental investigation on mechanical properties viz. density, tensile strength and flexural strength of CSP epoxy composite material is greatly influenced by the CSP filled volume fraction.

- The maximum tensile strength is obtained for the composite prepared with 20% CSP volume fraction. The tensile strength curve (See Fig. 6) shows an increase of filler volume the tensile strength goes on decreasing. Thus, the rate of decrease of tensile strength from 20% to 30% and 30% to 40% CSP filled epoxy composite is approximately constant. The maximum flexural strength is obtained for the composite prepared with 30% CSP filled while; the flexural strength is minimum for the composite prepared with 40% CSP filled.
- The flexural strength curve shows that an increase of filler volume flexural strength increases from 20% to 30%, while, the flexural strength decreases on increasing filler volume from 30% to 40%. Thus, the rate of decrease of flexural strength from 30% to 40% is greater than the rate of increase from 20% to 30% CSP filled composite.

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