PARTICULATE COMPOSITE USING EPOXY RESIN WITH RICE HUSK

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Abstract
Molecules with more than one epoxy group can be hardened into a usable plastic. Epoxy resins are produced from combining Epichlorohydrin and Bisphenol A to give Bisphenol A diglycidyl ether. Adding the ratio of Bisphenol A to Epichlorohydrin during manufacturing process produces higher molecular weight linear Polyether with Glycidyl end groups, which are semi-solid to hard crystalline materials at room temperature depending on the molecular weight achieved. The epoxide content reduces with increase in molecular weight and the material behaves more and more like a thermoplastic.The substance called hardener is made of react with epoxy resin and rice husk with correct combination to convert it into epoxy plastic which is bio degradable polymer, than analys is the characteristics of the specimen

1.Introduction:

The tremendous growth of science and technology has paved for the development of some new materials with unique properties. A composite is a multiphase material. The advancement in the arena of composite technology is more promising to meet the constantly changing and challenging demands in all the field. Composite materials have gained popularity in high-performance products that need to be lightweight, high stiffness, strength, corrosion resistance.

1.1 Composites:

A composite material is a material made from two different materials which are having different charectristics, when combined, produce a material with characteristics different from the individual components. Composites made up of individual material referred to as constituent material. A composite consist of matrix, reinforcement, and the interface between matrix and reinforcement. Composite materials typically offer enhanced strength over many other products and may provide additional benefits like resistance to corrosion.

1.2 Need for composites:

This is partly having the specific properties and low weight of the individual components, and partly because it is possible to manufacture composites for very particular purposes. The important reason we need composite materials is the versatality. Other reasons is light weight, corrosion resistance.

1.3 particulate composites:

A composite that consists of small particles of one material combined in another material. The particles can be too small,choppedfibers, platelets, hollow spheres. They provide restructure to the matrix thereby strengthening the material. The combination of reinforcement can provide for very specific properties. Particulate phase is harder and stiffer than the matrix reinforcement. It is expected that the particulate composite to lower mechanical properties but higher dimensional stability.

Biodegradable polymers produced from reusable and bio-based resources. reduce waste producing, do not contribute to CO_2 emissions, and ease dependency on petroleum-based fuels. Along with their positive impact to environment, biodegradable bio-based polymers have many other properties such as biocompatibility, bioactivity, high stiffness and strength, good film-forming properties and low toxicity. Although bio-based polymers have enormous benefits to conventional plastics, they usually have high cost, higher crystallinity, sensitivity to thermal degradation, and poor mechanical properties. By blending bio-based polymers with other biodegradable natural fillers to create a composite, the overall mechanical properties can be improved while reducing cost. higher mechanical properties of synthetic fibers such as glass fibers, natural fibers are attractive due to growing concern environmental and ecological impacts and societal preferences. For example, wood fiber (WF) is an inexpensive and easily available from furniture manufacturing and other wood processing businesses. that is reused as a filler. Natural fibers serve as good reinforcements and fillers in biocomposites, fewer health hazards during processing, less abrasiveness to processing equipment, and good specific strength, thermal,and acoustic properties. Poor interfacial adhesion between the hydrophobic polymer and hydrophilic natural fibers causes decrease in strength properties and increase affinity in water of the composites.

2.Materials:

2.1epoxy:

Molecules with many no of epoxy group, which can be hardened into a usable plastic. Epoxy resins are produced from combining epichlorohydrin and bisphenol A toproducebisphenol A diglycidyl ether. Increasing the ratio of bisphenol A to epichlorohydrin during manufacture produces max molecular weight linear polyethers with glycidyl end groups, which are semi-solid to hard crystalline materials at room temperature depending on the molecular weight. the molecular weight of the resin increases, the epoxide reduces and the material behaves more and more like a thermoplastic.

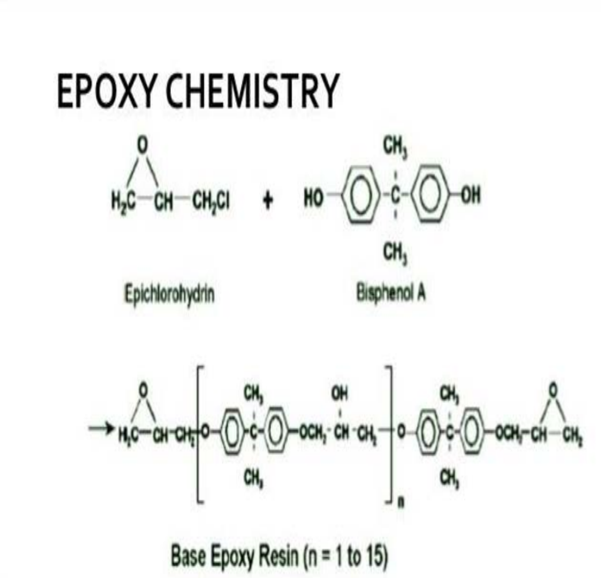

Figure 2.1 epoxy chemistry

2.2hardener:

To convert epoxy resin to epoxy plastic, a reaction takes place with a suitable substances called HARDNER. Amines are primarily used to certain Mercaptans. The other hardeners require temperatures above 151℃ to react with the epoxy.

2.3rice husk:

Rice husk isprotecting the grains of rice. In addition to protecting rice during the growing season, rice husks can be put to use as building material, fertilizer, and fuel. Rice husks are the coatings of seeds. The husk protects the seed in the growing season, since it is formed from hard materials, including opaline silica and lignin. The husk is mostly indigestible to humans.

Rice husk is a potential material and is mostly used in its raw form or in ash form. The exterior of rice husks are composed of dentate rectangular elements, which themselves are composed mostly of silica coated with a cuticle and surface hairs. The mid region contain little silica. The chemical composition of rice husk is similar to that of the organic fibers. It is consist of cellulose 40-50 percent, lignin 25-30 percent, ash 15-20 percent and moisture 8-15 percent. It has high heat resistant property. It is used mostly in ash format due to high silica content present in it. The table given below shows the physical properties of rice husk.

Figure 2.3 Rice husk formats

2.3.1 properties of rice husk:

s.no	properties	Range
1	Bulk density	96-160
2	Length of husk	2.0-5.0
3	hardness	5.0-6.0
4	Carbon	35
5	hydrogen	4.0-5.0
6	oxygen	31.0-37.0
7	nitrogen	0.23-0.32
8	sulphur	0.04-0.08
9	moisture	8.0-9.0
10	ash	22.0-29.0

Table 1: properties of rice husk

2.3.2 reason to choose rice husk:

Rice Husk, the agricultural waste generated from milling paddy can be successfully used as a reinforcing material to produce AluminiumMetalMatrix Composite. It can be successfully perform in place of conventional aluminium material. The use RH for the production of composites can turn agricultural waste into industrial wealth. This can also solve the problem of storage and disposal of RH. There was good dispersibility of RH particles in aluminium matrix which improves the hardness of the matrix material and also the tensile behavior of the composite. The effect is increase in interfacial area between the matrix material and the RH particles leading to increase in strength appreciably. and ductility is decrease with increase in the weight fraction of reinforced rice husk. The enhancement in the mechanical properties can be performin the high dislocation density. However, for composites with more than 12% weight fraction of rice husk particles, the tensile strength was seen to be decreasing.

2.3.3 rice husk as a reinforcement:

developing composite material using environmentally friendly agro-wastes as reinforcing fillers.Rice Husk Ash (RHA) is an agriculture waste. During milling about 78 % of weight is received as rice, broken rice and grain. Rest 23 % of the weight of paddy is producedfrom husk .This husk is used as fuel in the rice mills to generate steam. This husk contains about 74 % organic volatile matter and the balance 26 % of the weight of this husk is converted into ash during the firing process, is known as rice husk ash (RHA).For every 500 kgs of paddy milled , about 110 kgs (22 %) of husk is produced , and when this husk is burn in the boilers , about 55 kgs (25 %) of RHA is produced. about 70 million tons of RHA is produced worldwide. This RHA is make a environment threat causing damage to the land and the surrounding area in which it is dumped. the researcher for effective utilization of this bio waste. Therefore the environment is protected from these huge volume of wastes. The recent research studies reported that RHA in turn contains around 84 % - 91 % amorphous silica. On thermal treatment, the silica converts with crystobalite, which is a crystalline produced form of silica. under burning conditions, amorphous silica with high reactivity, ultra-fine size and large surface area is produced. This micro silica can be a source for preparing advanced materials like SiC, Si_3N_4 and Si.

2.4 mixing ratio:

In order to achieve the proper curing state we should use this ratio10:1. 10% of epoxy resin to 1% of hardener used. The change in the mixing ratio of epoxy resin and hardener may cause misalignment of interface between the matrix and reinforcement.

3.Preparation of Composites:

3.1grinding:

Grinding process is the important process in the milling system. In this operation , energy is expended to break apart the bran and endosperm and reduce the endosperm to flour. This uses about 50% of the power connected with the milling system and results in heat generation and moisture loss inthe ground material.The principle forces of grinding are compression, shear, friction, impact.

Figure 3.1 Grinding process

3.2blending:

10 grams of prepared rice husk powder is taken in a vessel and then 100grams of epoxy resin is taken and this epoxy resin will act as an binder and the reinforcement particle will be distributed evenly and this resin is converted in to plastic with the help of adding 10 grams of hardener in it. Hardeners are acting as an curing agent. Lewis acids work as polymerisation catalysts for linear and alicyclic epoxy resins. They are vigorously react with epoxy at room temperature. For a normal and proper curing 10% of added epoxy resin.These process takes place under the room temperature and exothermic reaction takes place between the epoxy resin and hardener.The specimen with dispersed husk particle is the output that is left in the vessel.

Figure3.2 Blending process

3.3 Open molding:

The composite in a semi fluid state. The composite is transferred in to the mold cavityof a molding plate manually and then pressed to form plate specimens. The specimen prepared as a blow holes at the centre. This can be partly reduced by preheating the mold plates.As this process produce more number of blow holes in the specimen. Due to low cost and effectiveness, we have proceedonthis process. However more blow holes defects were observed. Quenching was tried. The mould plates are tightened to maximum levels and then carefully immersed in a liquid bath containing water for a few minutes. The quenched specimens were allowed to cool slowly for a day and then removed. After quenching, a high stiffened, defect free specimen with smooth surface were obtained.

Figure 3.3 open molding set up

3.4Specimen Composition:

The most successfuland efficient technique identified as mentioned above was followed for the fabrications of specimen with different composite reinforcement.

composition	Rice husk	epoxy	Hardener
10%	10 g	100 g	10 g
20%	20 g	100 g	10 g
30%	30 g	100 g	10 g
40%	40 g	100 g	10 g

Table 2: Specimen compositions

4.Results and discussion:

The nanofiber composite material in this investigation contain randomly distributed nanofibers with small dimension and volume. so the macro-scale mechanical properties of the nanocomposite materials are effectively isotropic. Hence, a test standard for polymeric materials is used to evaluate the mechanical properties of nanocomposite materials.

4.1Tensile characteristics:

Tensile testing is a fundamental material science and engineering test in which a sample is subjected to a controlled tension until failure. Properties that are directly measured via a tensile test are ultimate tensile stress, breaking strength, maximum elongation and reduction in area. From these measurements the following properties can also be determined young's modulus, poisson's ratio, yield strength characteristics. The tensile test is carried out in a universal testing machine. Using this machine we can test the tensile strength of the material. The main aim was to study the tensile strength and young's modulus on the composition of the composite material. There is an increase in the young's modulus when increase in the maximum force and if it decreases then the young's modulus also tends to decrease on further increase in the composition of the specimens. Stiffness of the material is the ratio between the maximum force to the maximum deflection made on the material. The stiffness of the material increases with increasing the composition's percent.

4.2Hardness characteristics:

Durometer ismeasure the hardness of a material. Highnumber of value indicate harder materials; lower number of value indicate softer materials. Hardness defined as a material's resistance to indentation. The durometer scale value is defined by Albert Ferdinand Shore, who developed a device to measure Shore hardness. Durometer is typically used as a measure of hardness value in polymers, elastomers, and rubbers. the increase in the composition of the specimen increase the hardness of the material. From tensile strength and hardness number we can specify the nature of the material. As there is a increase in the hardness number and decrease in tensile strength specifies that the material has brittle property in nature.

4.3Differential Scanning Calorimetry:

It is a thermo-analytic technique in which the difference in the amount of heat required to increase the temperature of a sample and reference is measured as a function of temperature. reference are maintained at nearly at the same temperature throughout the experiment. Generally, the temperature program for a DSC analysis is designed from the sample holder temperature increases linearly as a function of time. The sample have a well-defined heat capacity over the range of temperatures to be scanned. It was done with cell constant calibration method at amrita university.

4.4Thermo-gravimetry analysis:

Thermo-gravimetry analysis measures the amount of weight change of a material, either as a function of increasing temperature, or isothermally as a function of time, in an atmosphere of nitrogen, helium, air, other gas, or in vacuum. the increase in the percentage of compositions decreases the temperature at which the decomposition takes place.

4.5 flexural test:

Flexural test is used to determine the flex or bending properties of a material. It involves placing a sample between two points or supports and initiating a load using a third point or with two points which are respectively call 3-Point Bend testing. common purpose of a flexure test is to measure flexural strength and flexural modulus of the material. The flexural test is carried out in a universal testing machine. Using this machine we can test the flexural strength of the material. The main aim was to study the flexural strength on the composition of the composite material.

5.Conclusion:

- develop a natural particulate composite material with better strength and to study the physical and mechanical characteristics of the composite material. This process leads to finding the optimum composition and methodology to manufacture such a composite material.

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