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STUDY THE MECHANICAL PROPERTIES OF E-GLASS FIBER AND COCONUT SHELL PARTICLES IN EPOXY RESIN

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Abstract - *The* natural fiber reinforced composites are being developed to save environment and to reduces the cost of materials. Objective of investigation was to evaluate the physical property, density and mechanical property, tensile properties. Coconut shell powder reinforced composites are fabricated by reinforcing shell particles (size between 0-50μm) by wt% of 0, 5, &10 into epoxy matrix. Composites laminates are made by hand layup method in open mould in very easy way. Experimental results showed that the tensile strength, impact strength, & flexural strength increases with coconut shell powder the Tensile strength of 286 Mpa Flexural strength 322 Mpa& impact strength 433 Mpa were retained even after of 10% of reinforcement

Keywords: E-Glass fiber, Coconut Shell Powder (CSP) Epoxy, Hardener, etc

1. INTRODUCTION

Many Engineering materials have limitations in achieving good combination of strength, stiffness, toughness and density, to overcome these short comings and to meet the ever increasing demand of modern day technology composites are used. Composites are most promising materials of recent interest. Composite material is a combination of two or more materials on a macroscopic scale to form a useful materiel. Different materials can be combined on a macroscopic scale such as in alloying but the resulting material is macroscopically homogeneous. The advantage of composite material is that they usually exhibit the best qualities of their constituents.

Many research worked on coconut shell powder with different reinforcement.R. Udayashankar et al [1]. This analysis has made an attempt to gather information for both basic properties of coconut shell fiber based composites as well as their economic utilization. Current research on coconut shell fiber based composite using both basic as well as applied science either in terms of modification, mechano-physical, thermal and other properties.Z. Salleh et.al. [2], the mechanical properties of all samples were investigated to characterize the quality of the samples. The morphologicalstudies of reinforcedsamples were observed by using SEM machine. The results showed that the tensile stress was increased when AC is increased specifically for sample 4 wt% and 8 wt%. Maximum tensile stresses lead by sample 4 wt% with 30 MPa.

The advent of advanced fiber reinforced composite materials has been called the biggest technical revolution since the jet engine. The calm is very striking because the tremendous impact of the engine on the military aircraft performance is readily apparent. The adjective "advanced" in advanced fiber-reinforced composite material is used to distinguish composites with new ultra high strength and stiffness fibers such as carbon and graphite for some for the more families fiber such as glass. The matrix materiel can be either a plastic such as epoxy or polyamide or a metal such as alumina. Such advanced composites have two major types of advantages among many others .Improved strength and stiffness especially when compared with other materials on a unit weight basis. For example, composite can be made that have the same strength and stiffness as high as steel, yet are too percent lightest.

2. METHODOLOGY AND EXPERIMENTAL PROCEDURE

2.1 Preparation of coconut Shell Powder

The coconuts were procured from a nearby local temple. The coconuts were broken manually to drain out the water. The 40 coconut half shells were sun-dried for three days. Sun-drying was necessary to ease removal of the meat from the inner shells of the coconut pieces. After scraping the meat from the inner shells, the inner portions of the shells were cleaned using knives. The fibers on the outer shells were also scraped and cleaned. Emery paper was used to clean the outer shells. The cleaned coconut shells obtained from were cut into pieces of dimensions of 1 sq. cm. using rammer and rammering in mild steel containers till the size of 500 microns after sieve 500 microns shell powder powdered in pulverize machine and sieve for the size of 0 to 55μm. The coconut shell for ash coconut pieces rammer in the size of 1 sq cm were put in stainless steels containers. The containers were then kept into muffle furnace for carbonization carbonization is the production of charred carbon from a source material. The process is generally accomplished by heating the source material usually in the absence or limited amount of air to a temperature sufficiently high to dry and volatilize substances in the carbonaceous material. The carbonization temperature selected as1000 degrees. After a soak time of 4 hours, the sample gets carbonized. The collected char was ground to form powder using a pulverize machine. The powder was then sieved to a size of 0 to 55 μmmicrons.

2.2 Experimental procedure

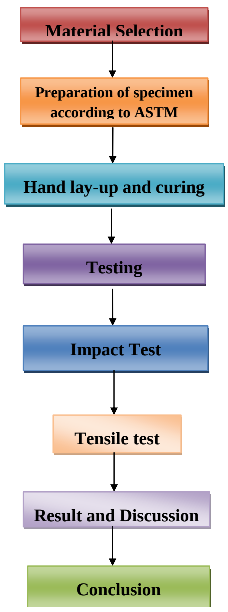

Fig -1: Work Flow Chart

2.3 Hand lay-up method

- First select the mould plate and clean it from dust & avoid the sticking of polymer to the surface.
- Thin plastic sheets are used the top & bottom of the flat plate to get good surface finish of the product.
- Reinforcement in the form of woven fabrics is cut to a dimension in cm. Then thermosetting polymer in liquid form is mixed thoroughly in suitable proportion with a prescribed hardener.
- The polymer is uniformly spread with a help of brush.
- Second layer of fiber is then placed on the polymer surface and a roller is moved with a mild pressure on the fiber. Polymer layer to remove any air trapped as well as the excess polymer present.
- The process is repeated for each layer of polymer and fiber, till the required layers are stacked.
- After placing the plastic sheet, a weight is kept on the stacked layers and the pressure is applied.
- After curing at room temperature for 48hrs, the developed composite part is taken and further processed. For epoxy based system, normal curing time at room temperature is 24-48hrs.
- The L-12 epoxy resin and K-6 hardener were mixed in the ratio 10:1 .The E-Glass Fiber were introduced into this mixture such that the fiber accounted for 60% of the weight of the mixture.
- Initially 174gm epoxy resin taken in container, then the hardener. The coconut shell powder with different weight percentages 0%, 5%,and 10%. Finally the mixture was processed by hand-lay-up method and the composite wasobtained.

Fig -2: Prepared composite materiel with 5% of coconut shell powder

2.4 Characterization of composites

Mechanical

The Ultimate tensile, flexural strength, impact, test were determined using Universal testing machine according to the ASTM D 638M/D 790 M/D4812 standards. The impact energy was measured using charpy impact test. The rectangular specimen of dimension and 280x260x3mm was prepared for this test.

3. RESULTS AND DISCUSSION

3.1 Tensile strength

The tensile test was generally performed on flat composite sample. The length of the test specimen was 150 mm as per ASTM D 638M shown in Fig 3. The test was performed for three samples of different CSP filled volume fraction and the average value is taken for analysis.

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Fig -3: Tensile test specimen

Table -1: Tensile Strength of Composites

Sl. No.	Composite Samples	Tensile Strength(Mpa)
1	0% CSP added	196
2	5% CSP added	231
3	10% CSP added	286

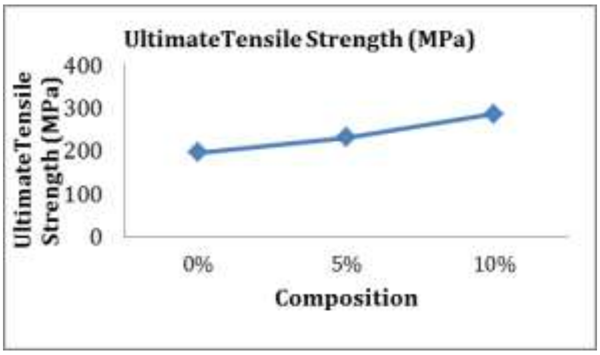

Fig -4: Tensile strength curve

The tensile strength results in table for varius samples which are prepared with CSP filler with different volume fraction were plotted in fig 4. The tensile curve illustrates that, the maximum tensile strength is obtained for the composite prepared with 10% CSP volume fraction.

It is also observed that an increase of CSP filler volume the corresponding tensile strength reduces. Then with the increase in percentage of coconut powder the tensile strength of the composition goes on increasing.

3.2 Flexural strength

Flexural test were performed using ASTM Standard D 790M as shown in fig 5. The test samle was in the form of a bar 127mm x 13mm x 3mm.

Fig -5: Flexural test specimen

Table -2: Flexural Strength of Composites

Sl. No.	Composite samples	Flexural Strength (Mpa)
1	0% CSP added	289
2	5% CSP added	318
3	10% CSP added	322

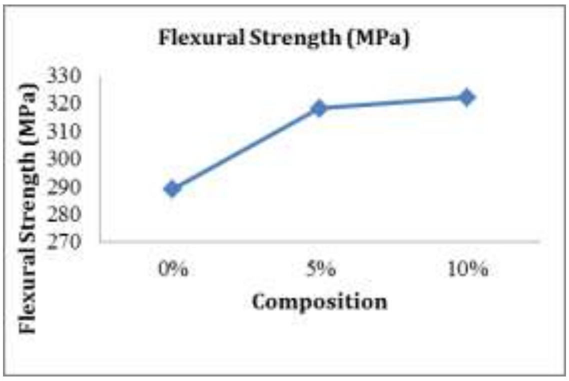

Fig -6: Flexural Strength curve

Fig-6 shows the variation in flexural strength for different volume fraction of CSP reinforced composites. The flexural strength curve illustrates that, the maximum flexural strength is obtained for the composite 10% CSP added.Then with the increase in percentage of coconut powder the flexural strength of the composition goes on increasing.

3.3 Impact Strength

The impact test was performed using ASTM Standard D4812 as shown in Fig 7. The test sample was in the form of a bar 70mm x 10mm x 3mm.

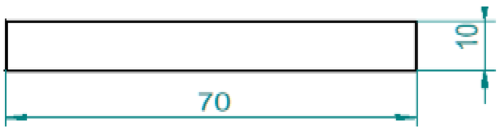

Fig -7: Impact test specimen

Fig-8 shows the variation in impact strength for different volume fraction of CSP reinforced composites. Then impact strength curve illustrates that, the maximum impact strength is obtained for the composite 10% CSP added.

Table -3: Impact Strength of Composites

Sl. No.	Composite Samples	Impact Strength(Mpa)
1	0%	243
2	5%	420
3	10%	433

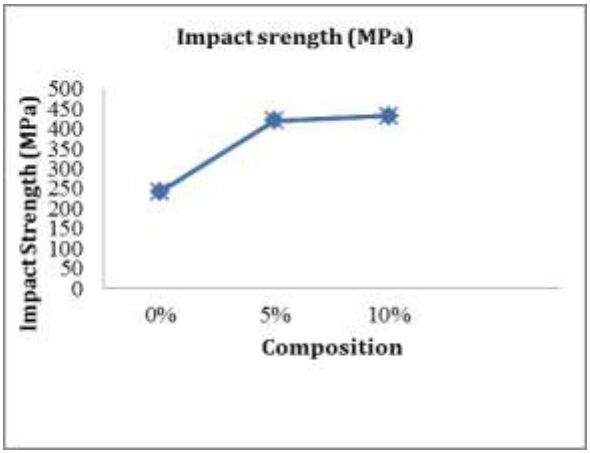

Fig -8: Impact strength curve

The tensile, flexural, impact properties of E-glass fiber and coconut shell particles composite were higher than the values of fiber. The tensile property and flexural property of 0% coconut shell powder and epoxy composite was higher when compared to 5% & 10% coconut shell powder and epoxy composite. Fiber orientation contributes to increase in tensile strength and flexural strength of same coconut shell powder composite.

4. CONCLUSTIONS

- The Experimental characterization of Coconut shell powder for composite leads to the maximum tensile strength is obtained from composite prepared with 10% volume fraction
- The lower tensile strength is obtained for the composite prepared with 0% volume fraction of coconut shell powder (CSP) and the bending strength is increases gradually for the all CSP volume fraction (i.e.0%, 5%, 10%).
- The maximum impact strength is obtained from the composite prepared with 10% CSP volume fraction and lower strength is obtained for the composite prepared with 0% volume fraction.
- The composite is prepared with 0% to 10% CSP for hybrid composite can be used as an alternative materiel for the interior of aircraft, spacecraft, ships, electronics, and automobiles.

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