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FABRICATION OF HYBRID COCONUT FIBRE WITH EPOXY COMPOSITE

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***Abstract*—** Coconut fibers are gaining importance in the manufacturing of hybrid Fiber laminates. Coconut coir fibers should be chemically treated with diluted sodium hydroxide solution before using it to manufacture the composite material. The effect of surface modification on chemically treated fiber for mechanical properties such as tensile strength, flexural strength, impact strength and hardness of the composites were evaluated. Compared with the untreated coir composite and treated epoxy composites it was found that the tensile strength increased by 33% and elongation at break was found to be 20% greater. The flexural strength increased by 35% and impact strength doubled compared to the untreated coir composite material, The Scanning Electron Microscope was used to analyze the fractured surface feature as well as interfacial bonding strength of the composites. The results showed that the chemical modification in the coir fiber led to easier permeating of the coir fiber and epoxy resin and promoted effective interfacial adhesion. It was concluded that the mechanical properties enhanced after chemical treatment and improved the formation of chemical bonds between the coir/nylon epoxy resins with the coupling agent.

Keyword: Hybrid composites, Coconut fiber and Hand layup method.

I. INTRODUCTION

The field of composite materials has progressed considerably over the last few decades. Properties like low density, high strength and stiffness, chemical and corrosion resistance, etc. make composite materials an attractive alternative to metals and alloys. The abundant availability of natural fibre gives attention on the development of natural fibre composites primarily to explore value-added application avenues. Reinforcement with natural fiber in composites has recently gained attention due to low cost, easy availability, low density, acceptable specific properties, ease of separation, enhanced energy recovery [1-5]. Natural fibers such as ramie, hemp, jute, sisal, bamboo, banana, oil palm fibers, etc. are used as reinforcements in place of glass fibers. Composite mechanical properties are improved with the increase in fiber weight fraction. But when the fiber weight fraction is too large, the composite fiber bundle strength and ultimate strength gets reduced. Also it depends on the way in which the fibers are aligned with matrix [6-10]. Coir fibers areused as reinforcement in this work, as it is non-toxic, low cost, high lignin content, low density, easy availability and less tool wear. The studies revealed that fiber weight fractions have significant effects on mechanical properties of composite such as strength, stiffness and toughness. Hence the objective of this work is to investigate the mechanical properties of coir fiber reinforced composites with different weight fraction of fiber.

II. RELATED WORK

J. Sahari and S. M. Sapaun, et al, examined currently, numerous research groups have explored the production and properties of biocomposite where the polymer matrices are derived from renewable resources such as poly lactide (PLA), thermoplastic starch (TPS), cellulose and polyhydroxyalkanoates (PHAs). Natural fiber reinforced biodegradable polymer composites appear to have very bright future for wide range of applications. These bio composite materials with various interesting properties may soon be competitive with the existing fossil plastic materials.

P. Zakikhani, R. Zahari, M. T. H. Sultan, D. L. Majid et al reported each extraction method has been done based on the application of bamboo. In addition bamboo fiber is compared with glass fiber from various aspects and in some parts it has advantages over the glass. Bamboo fiber has several advantages over other plant natural fibers such as high growth rate, strength, and fixing the

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carbon monoxide. It also can be compared with glass fiber because of its light weight, biodegradability and low cost.

III. METHODOLOGY

a) Hand Lay-Up Method

The least complex assembling procedure took on is setting down unidirectional glass meandering over a cleaned form surface recently treated with a delivering specialist: after this, a fluid thermosetting tar is worked into the support by hand with a brush or roller. The cycle is rehashed various times equivalent to the quantity of layers expected for the last composite. Epoxy pitches are generally normally utilized with glass strands as a result of their great strength properties. Sap and restoring specialists are pre-blended and typically intended to cross-connect and solidify at room temperature. The significant benefit of this assembling system is its incredible adaptability, since it suits most normal form sizes and complex shapes. In spite of the fact that tooling is ordinarily costly, it tends to be re-utilized for a few runs and the genuine expense of the unrefined components make this cycle monetarily practical.

b) Vacuum Bagging Method

Otherwise called vacuum forming, it requires a siphon that will utilize air strain to unite the material while restoring by applying vacuum to the shape hole. Normally the filaments are put on a solitary shape surface and covered by an adaptable film, fixed around the edges of the form. The space between the form and the film is then cleared with a siphon and the vacuum held until the tar has relieved. Figure shows an illustration of vacuum packing as given by Kornmann et al (3005) where a few layers of glass texture were set intercalated with epoxy pitch.

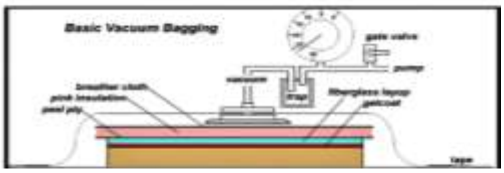

Fig: Vacuum Bagging Technique

c) Composite Specimen Preparation

The hand rest up is one of the most seasoned, least difficult and most normally involved strategies for composite parts' development. The example is created in layer stacking, and each layer is arranged to accomplish the greatest usage of its properties. Layers of various materials can be joined to additional improve the general presentation of the overlaid composite examples. Saps are impregnated by hand into strands, which are as woven, weaved, sewed or fortified textures. This is generally achieved by rollers or brushes, with a rising utilization of nip-roller type impregnators for compelling the pitch into the textures, through turning rollers. Then the composite covers are permitted to fix under ordinary air conditions and dried under the blistering sun for more than 34 hours.

The composite examples utilized for the current examination comprise of five layers, and manufactured by the hand layup strategy. In the five layers, the glass fiber layers are mounted on the top, center and lower part of the example. Add 10% impetus by weight with sap for speedy setting, prompt blending, and decrease the intensity created because of exothermic response. Prior to creating the composite example the glass strands are dried in the hot air stove at 80ºC for 8 hours to totally eliminate the dampness. At first, the delivering specialist is covered over the plain even table for simple expulsion of the example, and the primary layer of the example, i.e., the glass fiber mat is put over the covered surface after the delivering specialist gets dried.

Then, at that point, the gum is applied over the glass fiber mat and the pitch is uniformly conveyed on the whole surface by utilizing a roller. The gum is permitted 10-30 minutes for getting totally blended; from that point onward, the second layer of the example. The air holes framed between the layers during handling are tenderly pressed out. Then, at that point, these examples are taken to the water driven press to eliminate the air hole between the layers, and any overabundance air present in the gum, by applying a power of around 70 to 100N for 48 hours, to get wonderful examples. After the examples get solidified totally, they are taken out from the water powered press, and the unpleasant

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edges are conveniently cut according to the necessary aspects.

Table: Compositions with respect to Fiber percentage

NAME	COMPOSITION
C1	184gms Epoxy + 116gm Hardener
C2	184gms Epoxy + 116gm Hardener + 5gm coconut fiber
C3	184gms Epoxy + 116gm Hardener + 10gm coconut fiber
C4	184gms Epoxy + 116gm Hardener + 15gm coconut fiber

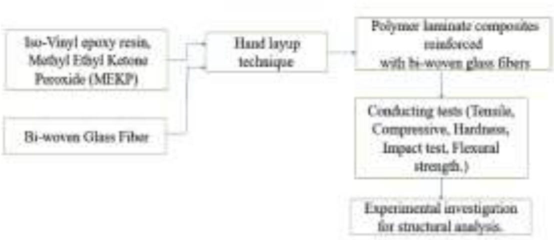

Fig: Block diagram of process involved

Fig: 184gms Epoxy + 116gm Hardener + 5gm coconut fiber **Pictures** representing the formation of the composite


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Fig: 184gms Epoxy + 116gm Hardener + 10gm coconut fiber **Pictures** representing the formation of the composite

Fig: 184gms Epoxy + 116gm Hardener + 15gm coconut fiber **Pictures** representing the formation

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of the composite

IV. MATERIALS

In this undertaking glass filaments are utilized for creating the composite example. The glass strands were gotten from Dharmapuri Area, Tamil Nadu, and India.

Polyester sap and the impetus Methyl Ethyl Ketone Peroxide (MEKP) were bought from M/s. Sakthi fiber glass Ltd., Chennai, India. 10% of impetus is added with the sap for the amount taken. The are various sorts of filaments the glass strands utilized for the composite creation are introduced in Figure.

Fig: Epoxy resin

Fig: MEKP catalyst

Fig: Coconut fibbers

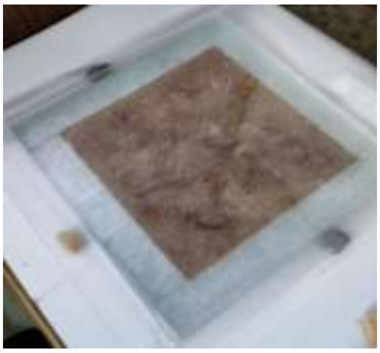

Fig: Mould preparation

V. RESULTS

The subsequent covers is permitted to fix in the shape minus any additional treatment. In pack forming process, overlaid filaments are laid inside a shape, covered with an adaptable sack and afterward relieved with intensity and tension. After the determined restoring time, the composites turns into a coordinated part framed into an ideal shapes. It is partitioned into three, to be specific: pressure pack, vacuum sack and autoclave. Pultrusion is a robotized interaction utilized for assembling ceaseless cross segment profiles. In this items are pulled out of the bite the dust as opposed to being constrained by pressure. Lines, tubes and underlying lines are fabricated from this method utilizing a suitable mould.Filament winding is utilized for delivering revolted surfaces e.g pipes, tubes, chambers, huge and pipe work. Preformed forming process is partitioned into three, to be specific pregreg, sheet and batter moldings.

It can done wet or dry. Tar move forming includes use of gum to preform put in a pre-arranged shape. Gum is brought into the form at high tension from the absolute bottom and fills the shape in the vertical bearing to diminish entangled air. Cinching is important to forestall sap misfortune through the snare. When the form vent is topped off with gum, tar stream is halted and the relieving starts right away. This is partitioned into tar move implantation (RTI), vacuum air sap move form (vacuum helped gum move shape). Infusion forming includes warming the polymer matrixand filler in a barrel and the liquid mix is taken care of at high tension into a pit of a pre-arranged shape. This technique is utilized for the creation of thermoplastic and thermoset based composites.

Mechanical properties of composites were assessed by tractable and hardness estimations. The examples were ready from the created composites and edges of the example are done by utilizing record and emery paper for tractable testing. Tractable tests were inspected by ASTM D638.

Fig: 184gms Epoxy + 116gm Hardener + 5gm coconut fiber **Pictures** representing the formation of the composite

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Fig: 184gms Epoxy + 116gm Hardener + 10gm coconut fiber **Pictures** representing the formation of the composite

Fig: 184gms Epoxy + 116gm Hardener + 15gm coconut fiber **Pictures** representing the formation of the composite

Tensile Strength

After the strands built up composite was dried, it was sliced utilizing a saw shaper to get the element of example for mechanical testing. The elastic test example was ready as per ASTM D3039; the most well-known example for ASTM D3039 has a consistent rectangular cross segment, 25 mm (1 in) wide and 250 mm (10 in) long.

Compression Test

After the strands built up composite was dried, it was sliced utilizing a saw shaper to get the element of example for mechanical testing. The pressure test example was ready as per ASTM D3039; the most well-known example for ASTM D3039 has a steady rectangular cross segment, 1.90 mm wide and 7.14 mm long.

Impact Test

Influence is a solitary guide test that actions a materials opposition toward influence from a swinging pendulum. Influence is characterized as the need might have arisen to start crack and proceed with the break until the example is broken. This test can be utilized as a speedy and simple quality control check to decide whether a material meets explicit effect properties or to look at materials for general sturdiness. The standard example for ASTM is 64 x 12.7 x 3 mm .The most well-known example thickness is 3 mm, since it isn't as liable to curve or pulverize.

VI. CONCLUSION

The hybrid coconuts coir fiber with epoxy composite materials were prepared using hand layup technique successfully and it is a natural hybrid fiber and it very eco friendly and it is biodegradable and have high mechanical properties.

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