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EXPERIMENTAL ANLYSIS OF GLASS FIBRE AND GLASS FIBRE WITH SUGAR CANE FIBER

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ABSTRACT

Nowadays the composites plays an one of important role as material in engineering and day by day their uses has been increasing due to their specific properties such as high strength to weight ratios , high modulus to wear ratio , corrosion resistance , and wear resistance . In the present work , we made an attempt to hybrid the material using the glass fiber and sugarcane fiber as natural fiber , to enhance the mechanical properties and to reduce the overall cost . The hand layup method is used here to made the composite material and the testing was done by using ASTM standards. The experimental results reveals that the synthetic fiber (Glass fiber) shows the enhanced impact strength , tensile strength , flexural strength and tensile strength than the hybridization of synthetic fiber (Glass fiber) with natural giber (sugarcane fiber) .Two compositions such as glass fiber and glass fiber with Sugarcane fiber . The performance of the glass fiber is higher the composition of glass fiber with natural fiber , it has been used in many application which requires high strength.

Key Words: Composite , sugarcane fiber, glass fibre ,epoxy resin , Hand layup method and Natural fiber .

1. INTRODUCTION

A composite material is made by combining two or more dissimilar materials. They are combined in such a way that the resulting composite material or composite possesses superior properties. Which are not obtainable with a single constituent material.

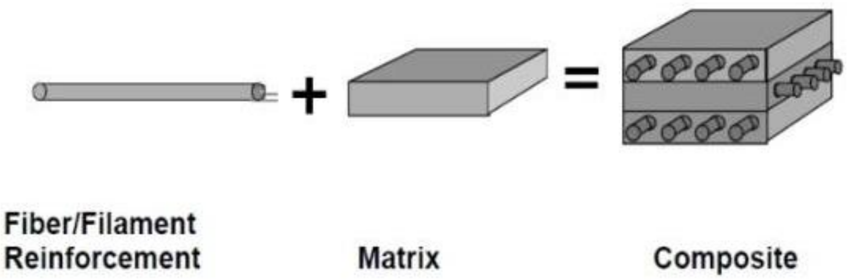

Figure 1

The components do not dissolve or completely merge. They maintain an interface between each other and ad in concert to provide improved, specific or synergistic characteristics not obtainable by any of the original components acting singly. Bone is a simple example of a natural composite material having the best properties of its constituents. Bone must be strong and rigid; yet flexible enough to resist breaking under normal use. These requiste properties are contributed by its components. gives the required softness. The inorganic component, made up of calcium phosphate, gives it the required strength and rigidity. The most common synthetic composite material is glass fibre reinforced plastics (GRP) which is made out of plastics and glass fibre.

1.1. Matrix

Matrix is also known as binder material. It (i) provides shape to the composite material, (ii) makes the composite material generally resistant to adverse environments and (iii) protects reinforcement material from adverse environments. The materials which constitute matrix of composite materials are plastics, metals, ceramics
and rubber.

1.2. Fibres

The fibres are the load carrying members in the composite material.They are bonded together by using matrix material. Based on formation and the they are classified into two types.

NATURAL FIBER

Natural fibres are used as conventional reinforcement materials. Natural fibres are low-cost fibres with low density and high specific properties. These are biodegradable and nonabrasive, unlike other reinforcing fibres. Natural fibres include those produced by plants, animals, and geological processes. They are biodegradable over time. The various types of natural fibres are sisal,banana,palm,bamboo,etc…

1.3. Man-Made Fibres

Man-made fibre,fibre whose chemical composition, structure, and properties are significantly modified during the manufacturing process. The chemical Ncompounds from which man-made fibres are produced are known as polymers, a class of compounds characterized by long, chainlike molecules of great size and molecular weight. Some of the inorganic fibres are aramid,boron,carbon,glass,etc…

1.4. Resin

The resins are used as the bonding material in the composite.The resins are chemical composition,which forms the adhesive bonding. The resin affects the physical properties, fabrication and ultimate properties of composite materials. Variations in the composition, physical state, or morphology of a resin and the presence of impurities or
contaminants in a resin may affect handleability and processability, lamina/ laminate properties, and composite material performance and long-term durability.Primary Function is “To transfer stress between reinforcing fibres and to protect them from mechanical and environmental damage”.

2. MATERIAL DETAILS

The materials are in two composition one of glass fiber and another one is glass fiber with sugarcane fiber (natural fiber).

2.1. GLASS FIBER

Glass fiber is a material consisting of numerous extremely fine fibers of glass. Glass fiber has roughly comparable mechanical properties to other fibers such as polymers and carbon fiber. Although not as rigid as carbon fiber, it is much cheaper and significantly less brittle when used in composites. Glass fibers are therefore used as a reinforcing agent for many polymer products; to form a very strong and relatively lightweight fiber-reinforced polymer (FRP) composite material called glass-reinforced plastic (GRP), also popularly known as "fiberglass". Unlike glass wool, GRP contains little or no air or gas, is more dense, and thus is a poor thermal insulator compared to glass wool; it is instead used structurally due to its strength and relatively low weight.

Figure 2 GLASS FIBER

3. PHYSICAL PROPERTIES

Tenacity	6.9 gm/den
Density	2.5 gm/c.c
Elongation at break	3%
Elasticity	Bad
Moisture Regain	0%
Resiliency	Excellent
Ability to protest friction	Not good
Colour	White or color less
Ability to protest friction	It can protect up to 315ºC
Lusture	Bright to Light

3.1. SUGARCANE FIBER

Sugarcane fiber is the dry pulpy fibrous material that remains after crushing sugarcane or sorghum stalks to extract their juice. It is used as a biofuel for the production of heat, energy, and electricity, and in the manufacture of pulp and building materials. Agave bagasse is similar, but is the material remnants after extracting blue agave sap. Numerous research efforts have explored using bagasse in the production of bio-based materials and as a biofuel in renewable power generation.

Figure 3 SUGARCANE FIBER

4. PHYSICAL PROPERTIES

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5. EPOXY RESIN

Epoxy is a general description of a family of polymers which are based on molecules that contain epoxide groups. An epoxide group is an oxidant structure, a three-member ring with one oxygen and two carbon atoms.

Figure 4 EPOXY RESIN

Epoxies are used widely in resins for prepares and structural adhesives. The advantages of epoxies are high strength and modulus, low levels of volatiles, excellent adhesion, low shrinkage, good chemical resistance, and ease of processing.Processing techniques include autoclave molding, filament winding, press molding, vacuum bag molding, resin transfer molding, and pultrusion. Curing temperatures vary from room temperature to approximately 350°F (180°C). The most common cure temperatures range between 250° and 350°F (120° and 180°C). The use temperatures of the cured structure will also vary with the cure temperature. Higher temperature cures generally yield greater temperature resistance. Cure pressures are generally considered as low pressure molding from vacuum to approximately 100 psi (700 kPa).

6. FABRICATION DETAILS

6.1. PREPARING THE MOLD

Remove any dust and dirt from mold. The mold is of new fibreglass was applied with soft wax and buff with soft towel. Spray or brush with PVA, parting compound and allow it to dry. The mold material is well-cured fibre glass, so apply three coats of hard wax, carnauba type, buffing between each coat.

Figure 5 MOLD SPECIMEN OF 30 X 30 CM

In this mold there are several orientation of fibre has been prepared for several testing and also to analysis which orientation is best for the tests like tensile, impact and flexural strengths. The hand lay-up process is used for fabrication.

6.2. HANDLAY UP METHOD

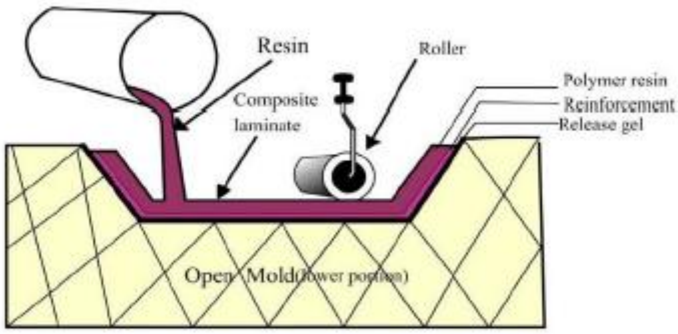

Figure 6 HANDLAYUP PROCESS

Hand lay-up technique is the simplest method of composite processing. The infrastructural requirement for this method is also minimal. First of all, a release gel is sprayed on the mold surface to avoid the sticking of polymer to the surface. Thin plastic sheets are used at the top and bottom of the mold plate to get good surface finish of the product. Reinforcement in the form of woven mats or chopped strand mats is cut as per the mold size and placed at the surface of mold after Perspex sheet. Then thermosetting polymer in liquid form is mixed thoroughly in suitable proportion with a prescribed hardener (curing agent) and poured onto the surface of mat already placed in the mold. The polymer is uniformly spread with the help of brush. Second layer of mat is then placed on the polymer surface and a roller is moved with a mild pressure on the mat-polymer layer to remove any air trapped as well as the excess polymer present. The process is repeated for each layer of polymer and mat, till the required layers are stacked. After placing the plastic sheet, release gel is sprayed on the inner surface of the top mold plate which is then kept on the stacked layers and the pressure is applied. After curing either at room temperature or at some specific temperature, mold is opened and the developed composite part is taken out and further processed.

6.3. APPLYING THE GEL-COAT

The gel-coat is to be brushed on the layers from 1 to 10 layers, allow first coat to cure and then apply the second coat to make sure there are no light spots. When gel-coat has cured long enough that your fingernail cannot easily scrape it free (test at edge of mold where damage will not show on part) then proceed with next step.

6.4. LAY-UP SKIN COAT

Brushes catalysed resin over gel-coat, and then apply the mat. Work with roller adding more resin where necessary until all white areas in mat fibres have disappeared and all air bubbles have escaped. Resin-rich areas weaken the part. Where rollers will not reach, brushes must be used. When this step is complete clean all tools in acetone. Allow skin coat to cure before next step.

6.5. REINFORCEMENT OF NATURAL AND GLASS FIBERS

Apply each layer as in step 3, but it will not be necessary to wait for curing between these layers. Be sure to shake all acetone out of brushes and rollers before applying resin. Acetone drips can result in uncured spots in the lay-up.

6.6. TRIM

The natural (sisal and banana) and glass fibre laminate which hangs over the edge of the mold can be trimmed off easily with razor knife on the trim stage, of the period after the lay-up has gelled but before it has hardened.

6.7. CURING

It take time for curing from 24 hours to 48 hours, depending upon turnover desired, temperature, canalization, and nature of the part. In a female mold, longer cure will affect shrinkage and easier parting. In the case of the male mold, the part comes off more easily before it shrinks appreciably.

7. MECHANICAL TESTING

7.1. IMPACT TEST (IZOD)

Izod impact testing is an ASTM standard method of determining the impact resistance of materials. A pivoting arm is raised to a specific height (constant potential energy) and then released. The arm swings down hitting the sample, breaking the specimen. The energy absorbed by the sample is calculated from the height the arm swings to after hitting the sample. A notched sample is generally used to determine impact energy and notch sensitivity. The test is similar to the Charpy impact test but uses a different arrangement of the specimen under test. The Izod impact test differs from the Charpy impact test in that the sample is held in a cantilevered beam configuration as opposed to a three-point bending configuration. The test is named after the English engineer Edwin Gilbert Izod (1876–1946), who described it in his 1903 address to the British Association, subsequently published in Engineering.

Figure 7 IMPACT TESTING MACHINE

8. TENSILE TEST

Tensile testing, is also known as tension testing, is a fundamental materials science test in which a sample is subjected to a controlled tension until failure. The results from the test are commonly used to select a material for an application, for quality control, and to predict how a material will react under other types of forces. Properties that are directly measured via a tensile test are ultimate tensile 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, and strain-hardening characteristics. Uniaxial tensile testing is the most commonly used for obtaining the mechanical characteristics of isotropic materials. For anisotropic materials, such as composite materials and textiles, biaxial tensile testing is required.

Figure 9 TENSILE TESTING MACHINE

9. ROCKWELL HARDNESS

The Rockwell scale is a hardness scale based on indentation hardness of a material. The Rockwell test measuring the depth of penetration of an indenter under a large load (major load) compared to the penetration made by a preload (minor load). There are different scales, denoted by a single letter, that use different loads or indenters. The result is a dimensionless number noted as HRA, HRB, HRC, etc., where the last letter is the respective Rockwell scale (see below). When testing metals, indentation hardness correlates linearly with tensile strength.

Figure 10 ROCKWELL HARDNESS TESTING

10. SPECIMENS

Figure 11 GLASS FIBER **Figure 12** GLASS FIBER WITH

11. RESULT

TEST	GLASS FIBER	GLASS FIBER WITH SUGARCANE FIBER
TENSILE STRENGTH	25.336 MPa	21.698
IMPACT VALUE	16 J	14.5 J
HARDNESS	28 HRB	21 HRB

12. CONCLUSION

The glass fiber and glass fiber with sugar cane fiber composite material are subjected to test of tensile strength, impact strength and hardness test. From the experiment we derived, that the glass fiber samples possess the tensile strength of 25.336MPa this value is higher than the tensile strength of glass fiber with sugarcane fiber. The impact strength and hardness value of glass fiber is also higher than the glass fiber with sugarcane fiber. From this result it can be concluded that glass fiber is performing better than the galss fiber with natural fiber. The glass fiber has been used in many application which requires high strength.

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