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COMPARISON ANALYSIS OF MECHANICAL PROPERTIES OF NATURAL FIBRE REINFORCED POLYMER MATRIX WITH GLASS FIBRE COMPOSITE

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***Abstract*- Glass fiber reinforced plastics and Natural fibers are finding increased applications in various engineering field. In this paper, compare the specific energy absorption, tension, strain response, hardness performance of Banana fiber reinforced polymer and E-glass fiber reinforced polymer composites was studied under Impact, Tensile, Hardness test. Using Hand Layup method various shapes was fabricated with same thickness of 10 mm and tested by mechanical tests. Breaking load was found by tensile test, Hardness test was found by Rock well hardness test apparatus, impact test for specific energy absorption was compared.**

***Index Terms*- GFRP Composite, Hand Layup, Natural fibers, Impact, Tensile, and Hardness.**

I. INTRODUCTION

The attention in using natural fibers such as different plant fibers and wood fibers as reinforcement in plastics has increased melodramatically. With regard to the nearby aspects it would be very interesting, natural fibers and glass fibers reinforcements used many industry and automobile applications. Natural fibers have many gains compared to glass fibers, for example they have low density, and they are recyclable and decomposable. Additionally they are renewable raw materials and have comparatively high strength and stiffness. Their low-density values permit making composites that combine good mechanical properties with a low specific mass. In humid countries fibrous plants are existing in abundance.

FRP composites have many applications as a class of structural materials because of their easiness of construction, comparatively low price and high mechanical properties compared to polymer resins. These composites are considered as substitutes for metals where the association of metallic fiber with polymeric matrix is gorgeous material for electronic packaging and insulation applications. The combination of reinforcement with high thermal conductivity surrounded in a resin matrix with low thermal conductivity is desirable to dispelling the heat flux for electronic packaging components. Studies on the mechanical properties of short fiber reinforced polymer composites have shown that both fiber length distribution and fiber orientation distribution play very vital role in defining the mechanical properties.

II. SPECIMEN PREPARATION

Hand Layup laminate molding is used for construct the natural fiber composite. The base plate is fixed inside frame for fabricate the natural fiber composites 70% of resin hardener mixture and remaining natural fiber are used. The proper ratio of resin and hardener is filled in the pattern. The prepared natural fibers are randomly dispensed in the resin hardener mixture with no gap. The roller is used for rolling on the mould with moderate pressure. Again the resin is spread in pattern by next layer and fibers poured randomly. This process is instantaneously done till the height of the mould 10mm. the lid is fixed on the top of the frame for distribute the load regularly on the mould. The setup is kept in the dry place for 24 hours. Then the mould is take away from the pattern, finally the natural fiber composites is fabricated. Open mold shaping method which successive layers of resin and reinforcement are manually applied to an open mold to build the laminated FRP composite structure hand lay-up is the oldest and simplest way of making fiber glass resin composites.

Table 1

Sl. No.	Test	ASTM Standard	Specimen Size
1	Tensile test	D638	200×20×10
2	Impact test	D256	65×10×10
3	Hardness test	D2583	50×50×10

Fig.1. Specimen Preparation

Fig.2. Tensile Test Piece

Fig.3. Hardness Test Specimen

Fig.4. Glass Fiber Specimen

Fig.5. Impact Testing Specimen

III. EXPERIMENTAL SETUP

The Tensile test for breaking load was conducted on sample in UTM with 40 ton capacity. A tensile test also known as tension test is possibly the most important type of mechanical test that can be performed on materials. Tensile test are simple, relatively low-cost and fully uniform. By pulling on something, you will very quickly determine how the material will respond to forces being applied in tension. As the material is being pulled, you will find its strength along with how much it will elongate. As a material is continued to pull until it breaks, you will obtain a good, complete tensile profile. A curve will result showing how it reacts to the forces being applied. The point of failure is of much interest and is typically called is Ultimate Tensile Strength or Ultimate Tensile Strength or Ultimate Strength.

Fig.6. Tensile Test in UTM

Table 1 tensile test Result.

Fiber type	ultimate break load in N	area mm^2	ultimate stress n/mm^2
Banana	561	92.40	6.1
E-Glass	1161	62.40	18.5

Impact strength is definite as the ability of the material to resist the fracture under stress at high speed. Low velocity instrumented impact test are carried out on composite specimens. Impact test are used in studying the toughness of material. A material toughness is a factor of its ability to energy absorb during plastic deformation.

Fig.7. Impact Testing Machine

Table 2 Impact test Result.

Fiber Type	Sample	Impact energy in scale (joule)
Banana	1	20
	2	22
E-Glass	1	28
	2	30

The Rockwell hardness of a material involves application of the minor load followed by a major load, and then nothing the depth of diffusion from a dial on which a harder material gives a higher number. The chief advantage of Rockwell hardness is ability to display hardness values directly thus obviating tedious calculations involved in other hardness measurement techniques. The Rockwell hardness number represents the additional depth to which a test ball or sphere conical penetrator is determined by a heavy load beyond the depth of a previously applied light load. Top hardness numbers that are got from hard materials specify a shallow indentation while low number found with soft materials indicate deep indentation. The raise of penetration depth for each point of hardness.

Fig.8. Rock Well Hardness Test

Table 3 Hardness test Result.

Fiber Type	Hardness value					Average
Banana	68	74	64	78	72	71.2
E-Glass	73	70	76	68	74	72.2

IV. RESULT AND DISCUSSION

The ultimate break load has been taken by tensile test for Banana Fiber and E-Glass Fiber.E-Glass fiber will withstand triple the amount of load compare banana fiber.

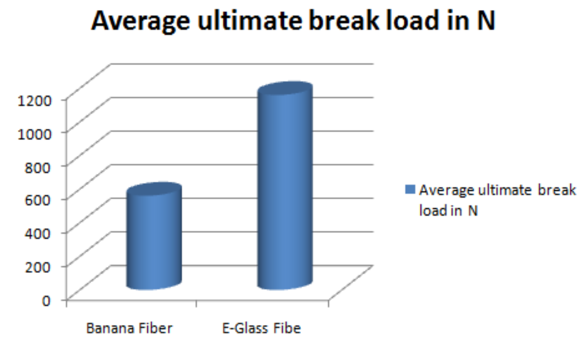

Fig.8. Ultimate break load in N

Hardness value is measured by hardness Test apparatus. Hardness value almost same in all specimen.

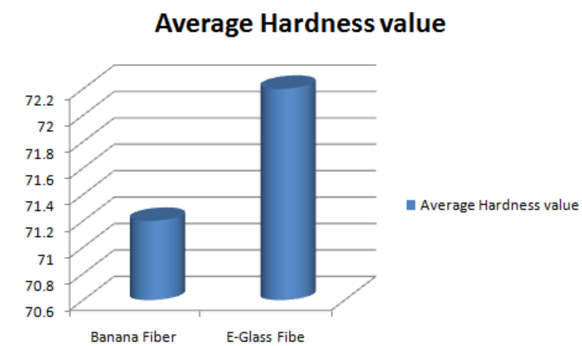

Fig.9. Average Hardness value

Impact strength has been taken by Impact Testing Machine. Deviation between both fibers is not more than 30 %.

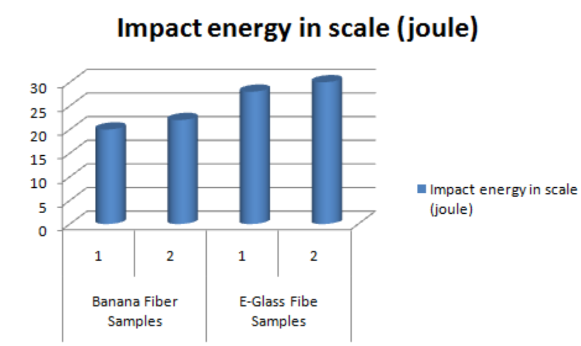

Fig.10. Impact energy

V. CONCLUSION

This work shows that successful fabrication of a banana and E-glass fiber reinforced polyester composites with constant fiber lengths is made by technique by hand lay-up. It has been noticed that the mechanical properties of the composites such strength as tensile, flexural , impact , hardness of the composites are also greatly influenced for a different weight fraction of fiber and chopped fiber reinforced composite material.

This study of mechanical properties of natural fiber reinforced composites shows that the results of banana fiber values are less than E- glass fiber values. So E- glass fiber plate are strengthened then banana fiber plate.

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