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# FABRICATION OF COMPOSITE PLATE USING PALM TREE FIBER REINFORCED WITH GLASS FIBER AND TESTING ITS MECHANICAL PROPERTIES

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**Abstract -** *In this paper has been carried to investigate the mechanical properties of composites made by reinforcing, date palm tree fiber as the new natural fiber into epoxy resin matrix. The development of natural fiber reinforced composite based products to substitute traditional engineering materials is becoming a trend in engineering application. The natural fiber was extracted by manual process. The composites are fabricated using date palm tree fiber reinforcements. In this work epoxy is used as a matrix and date palm tree fiber is used as a reinforcing material. The composites were prepared using palm tree fiber .After preparation of composite material some of the physical properties, tests has been conducted for samples preparation; they were tensile test, impact test, deflection test. The tensile, impact, deflection properties and chemical resistance of palm tree fibers reinforced matrix blend composites with compared to the other natural fiber.*

***Key Words*: *Composites, Natural Fiber, Palm tree and Testing***

## 1. INTRODUCTION

The advantage of composite materials over conventional materials stem largely from their higher specific strength, stiffness and fatigue characteristics, which enables structural design to be more versatile. By definition, composite materials consist of two or more constituents with physically separable phases. They are many situations in engineering where no single material will be suitable to meet a particular design requirement. For example, aerospace applications need materials that should have low densities, high strengthened stiffness, good abrasive, and impact and corrosion resistance. Such combinations of characteristics are not met by conventional metals, alloys, ceramics and polymeric materials. Frequently, strong materials are relatively dense also, increasing the strength or stiffness generally result in a decrease in flexural strength.

Composite materials are commonly used in structures which require lightweight, yet strength components. However there is an increased interest in the use of date palm fiber in composites to structural performance, either in vibration control, or shape control. In such situations, two materials in combination may possess the desired properties, and a feasible solution to a materials selection problem. These materials are referred as composites. The reinforcement may be platelets, particles or fibers and are usually added to improve mechanical properties such as stiffness, strength and toughness of the matrix material.

In a fiber reinforced polymer, the fibers serve as a reinforcement and show high tensile strength and stiffness, while the matrix holds the fibers together, transmits the shear forces, and also functions as a coating. The materials behavior of matrices is usually characterized by a functional relationship of time and temperature, a considerably lower tensile strength, and a comparatively higher elongation. Therefore, the mechanical properties of fibers determine the stiffness and tensile strength of the composite.

## 2. EXPERIMENTAL STUDY

Unique to the composites industries is the ability to create a product from many different manufacturing processes. There are a wide variety of processes available to the composite manufacturer to produce cost efficient products. Each of the fabrication processes has characteristics that define the type of products to be produced. This is advantageous because this expertise allow the manufacturer to provide the best solution for customer.

Since the date palm is to be produced unidirectional winding method is selected to fabricate such a thin plate. This method utilizes the winding of the reinforcement and the matrix together a plate which can be cured and the sized into required dimensions. The date palm fiber has high potential as reinforcing fiber in polymer composites. Palm tree is a common home and office house tree, but in the Wild forests, it's a giant tree of Indian jungles. Palm tree starts out life as an epiphyte growing on another tree where some fig-eating bird deposited a seed.

Palm tree can get 100 inch tall and, with its massive limbs supported by prop roots, spread over an area of several acres. The Palm tree is native to India; hence the objective of the present paper is to instigate the tensile properties of date palm tree fiber reinforced composites. Epoxy resin has been chosen as the matrix material because

it is relatively cheap, having lower shrinkage and can be moulded at room temperature.

Composite was made using a stainless steel mould having dimensions (30x30x1) cm length, width respectively. The composites were prepared by varying the relative volume fraction of fibers .The ratio of hardener which was added to epoxy is (10:2), every 98 gm from epoxy adding 2 gm hardener, then mixed the solution very well before poured it to obtain homogeneity. The composite samples were fabricated by hand lay-up technique. Two open molds were used. At first, a melt paper was placed on dried bottom part. Then some of the prepared resin mixture with or without filler was spread evenly on the paper.

After that, a piece of date palm fiber pate was placed on the resin mixture and a part of resin mixture was spread on the mat. Another piece of pate fiber was placed and similarly rest of the resin mixture spread on the mat. A melt paper was placed on the mat following which top part of the open mold was kept on the paper. The prepared samples were allowed to cure under pressure at room temperature. It requires one day for curing.

The resin for sample 1 is epoxy LY556 with hardener XY 54. First the reinforcement used for the fabrication of the sample 1 is weight and the required amount of resin is taken such that the fiber to resin ratio 1:1 in this case, the weight of the reinforcement we get 80gms. Hence we took the resin 240gms of resin beaker. The amount of hardener is taken such that the resin to hardener ratio is 10:1. Hence we took 24gms of hardener and mixed to the resin using stirrer thoroughly.

The resin and hardener layer is poured in the mould after the surface preparation of the mould is made. Palm tree fiber is placed as the first layer, the above applied acts as a good surface to the specimen. A sheet of Bidirectional E-Glass giber is placed as a middle layer and the resin hardener is coated over it. Apply releasing agent to lamination sheet, so that the resin should not stick to the lamination sheet. Apply epoxy resin over the lamination sheet using brush. Again a layer is built-up on the surface with the palm tree fiber and the resin mixture is thoroughly coated to it. On top and bottom of the mould a laminated sheet with non stick coating is applied, so that the specimen comes off from the mould easily. Let the material be in a room temperature with a load of 25kg to make compacting of the sandwich specimen.

After the completion of hand lay-up, the top plate of the mold that is protected with the releasing wax is kept over prepared and set the hydraulic press. Then the pressure of the press is set to 100 bars and then allowed to cure. This process liquid resin becomes a solid and bonds to the fiber. The cure can be heat or the addition of a catalyst. The curing time required for this type of resin is to 24 hours and to be kept in room temperature. The laminate is allowed to cure in room temperature for 24 hours in hydraulic press itself, which is set to a presser of 100 bars. Then after the completion of curing process, the fabrication laminate is released the mold.

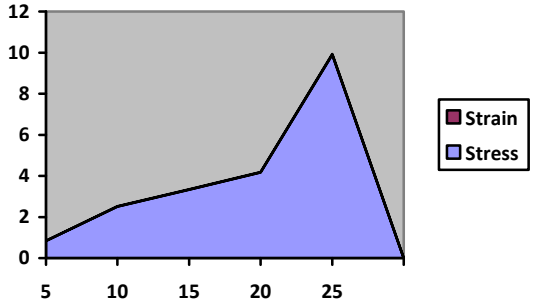
The material embedded method are the resin transfer method as followed here LY951 type hardener and resin both as mixed on particular ratio in between GFRP and copper wires gaps different pitch's on kept it room temperature are 3 to 4 days. From the laminate each specimen as separated. Allow the completed mould to cure for 24 hours before attempting to remove it from the mould. Care and time required to get the mould off the plug. Soft plastic wedges can be drive in between the plug mould to facilitate the release. Once free of the plug, replace the mould on the plug and bracing to the mould using wood or metal to prevent distortion of the mould. Wait 24 hours before removing from the plug. The mould edges should be trimmed and the PVA washed out with warm soapy water.

## 3. RESULTS AND DISCUSSION

### 3.1 Tensile test

**Fig 3.1** tensile test specimen

**Chart 1** Tensile test Result

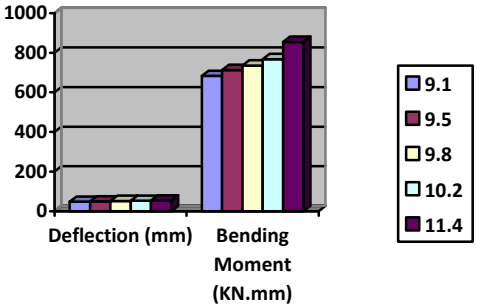



For Tensile test conducted on the Palm tree fiber Reinforced with glass fiber were found to be 9.9 N/mm2.

### 3.2 Deflection Test

**Fig 3.2** tensile test specimen

**Chart 3** Deflection test Result




For Deflection test conducted on the Palm tree fiber Reinforced with glass fiber were found to be 855 x 103 N/mm.

### 3.3 Hardness Test

Hardness is the measure of how resistant solid matter is to various kinds of permanent shape change when a force is applied. Here Brinell hardness test was used to calculate the hardness of the three samples.

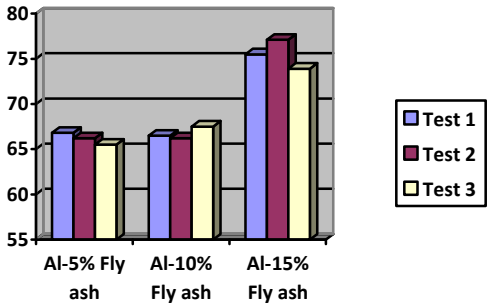
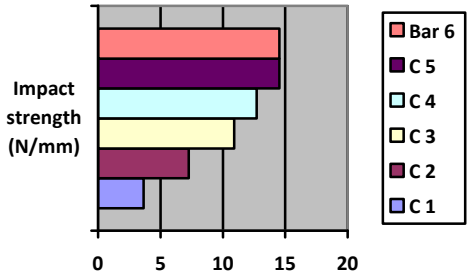
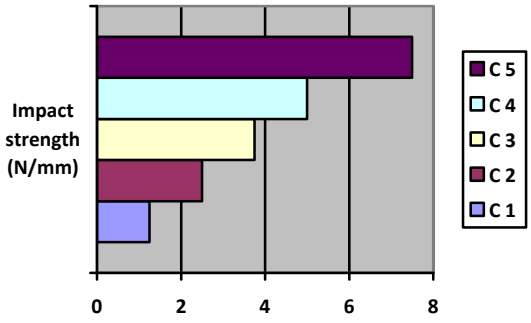



**Chart 4** Hardness Performance Graph

### 3.4 Impact Test




For Charpy test conducted on the Palm tree fiber Reinforced with glass fiber were found to be 14.54 N/mm.




For Izod test conducted on the Palm tree fiber Reinforced with glass fiber were found to be 7.5 N/mm

## 4. CONCLUSIONS

Hence, the fabrication of composite plate Using palm tree fiber is completed and the test laminates are made ready for the mechanical testing process. Testing the mechanical properties of the laminates such as tensile test, impact test, hardness test, and Deflection test were carried out and test results were verified.

These tests show that the strength of the composite plate increases due to the addition of the glass fiber which acts as a reinforcement of the Laminate It is used in wide range of applications in the field of engineering and consumer products, they are as follows Building and construction industry: panels for partition and false ceiling, partition boards, wall, floor, window and door frames, roof tiles, mobile or pre-fabricated buildings which can be used in times of natural calamities such as floods, cyclones, earthquakes.

Natural fiber composites are being used for manufacturing many components in the automotive sector. Boot lining, hat rack, spare tyre lining, seat backs and back door panels. Furniture: chair, table, shower, bath units. Electric devices: electrical appliances, pipes, Everyday applications: lampshades, suitcases, helmets. Transportation: automobile and railway coach interior, boat and Ceiling tiles etc.

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