Fabrication and Mechanical Properties of Calotropis and Glass Fiber Reinforced Polyester Composites

S. Padmavathy*, G. Sharmila devi
Department of Mechanical Engineering, M. Kumarasamy College of Engineering, Karur 639 113, Tamil Nadu
***Corresponding author: E-Mail: padmatnpl@yahoo.co.in**

ABSTRACT

This paper deals with sources of natural fiber along with glass fiber reinforced polyester has found to implement in overall applications in the field of medical and engineering. The availability and accessibility of natural fibers are in abundant so it is major reasons for developing innovation on this sustainable technology. Natural fibers have newly more attraction over other established materials in the research. In this summary, caltrops and glass fiber reinforced polyester composites is created and their physical properties, Rockwell hardness and Impact strength are identified. From the notification of results that the self-agency sectors of caltrops and glass fibre through GFRP can get better properties and it has been using as an alternate material for today engineering application.

KEY WORDS: Calotropis Fibre, Glass Fibre, Polyester Resin, Mechanical Properties.

1. INTRODUCTION

Calotropis is used as a traditional medicinal plant with unique properties. Calotropis yields a durable fiber which is useful for household and agricultural application. In common materials used in various applications are metal, wood and composites in day today life. The classification of composite fibre is two types' plant and animals. We are concentrating on plants which are further classified into wood and nonwood fiber. We are concentrated on soft wood fiber for the fabrication of composite. Composite material is combination of various materials to form to be better properties. It is a material which utilizes dissimilar physical properties kind of materials present on single medium to create higher substance. From this paper, we collect all the data's in this field of composite material and finally we evaluate new innovation material rather than recent technology oriented product. Simultaneously, Each and every material is varying by the common properties of strength, ductile, brittle, wear and tear properties. But, some important combination of properties will make standard product to serve to our society.

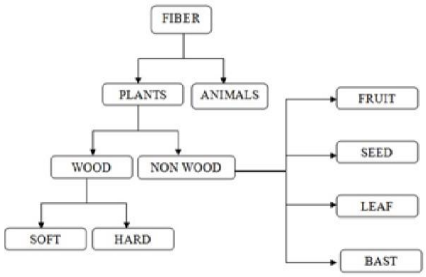

Figure.1. Classification of Fiber

Improvement of tensile and flexural strength is due to integration of natural fibers with glass fiber. The Calotropis gigantea stem fiber-polyester composites are weightless and possessed improved mechanical properties. Enhancement of mechanical properties of the composites is done by interface the matrix-fiber bonding with different chemical modifications to be done. Studies are done on banana fiber reinforced polyester composites it is found that the volume fraction of the fiber has great influence on the dynamic mechanical behavior of the composites. Critical fiber loading is evaluated from 40% fiber loading in the composite to achieve the maximum strength. The results show that, relative volume fraction of banana and sisal 3:1 lead to high tensile strength and flexural modulus in the fiber/matrix adhesion. Stress transfer was found to be good in composite used for many machinery applications. The mechanical properties of banana fibers reinforced composites are chemically treated to exhibit higher than fiber reinforced composites of chemically treated.

Table.1. physical properties of Calotropis gigantea

S. No	Physical Properties	Value
1	Density(Kg/m^3)	1240
2	young's modulus (M Pa)	610
3	Tensile strength (M Pa)	29.2
4	Elongation	4.5%

The physical properties of Calotropis gigantean are looks to be better matter than present material which have low abilities. The properties of composites are;

- High strength to weight ratio, less weight is the main advantage in the automobile application.
- Composites are Non-conductive for user friendly.
- Fatigue properties are always tends to be a higher grade than engineering metals.

- Toughness is frequently greater too.
- Low maintenance and Long life are primary advantage of composite.
- Composites are good application for non-corrosive property.
- Composite will never and ever achievable with metals such like ceramics and polymers individually.

Calotropis gigantean plant is a large shrub growing to 4 m (13 ft) tall which holds the stamens. The stems are having very strong and its physical properties are also good.

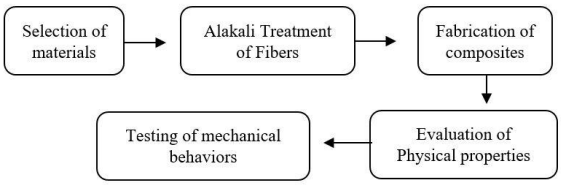

Figure.2. Flow chart for process plan

Fabrication of calotropis fiber composite: The calotropis gigentea plant are cut around 50 plants with is available plenty in Tamil Nadu. That plant stem should be dried for one day, and then remove the stem skin into small species also dry for one day. Dried plant fiber is cleanly wash with 1litre of running water with 5% of NaOH .Then washed fiber was dried for 10 hours at room temperature as shown in figure.3.

Figure.3. Raw Calotropis fiber

The Raw Calotropis fiber is are free from cellulose, so the properties are improved condition. The Raw Calotropis fiber is mixed with glass fiber polymer are mixed in different ratio. The ratio between fiber and polymer in Table.2, are mixed to prepare the work piece.

Table.2. Sample ratio preparation of Work piece

Samples	Fiber	Polymer
A	60%	40%
B	65%	35%
C	70%	30%

The composite materials are fabricated by using hand layup process. Raw Calotropis fiber are Chopped to a length of 50 mm from the raw fiber to be prepared for the specimen. Moulding box prepared to a dimension of 230 x 230 x 5 mm. The Polymer Composites are different types used in different application, were polyester are used in this work. At room temperature the amount of accelerator and catalyst added to resin of volume fraction of resin each. By using Hand lay-up technique is applicable for fill the appropriate amount of polyester resin and Calotropis gigantea stem fiber, to prepare a mould cavity with the layer of resin.

Figure.4. Fabricated calotropis Glass fiber composite laminate

The base plate is cleaned without any dust with an abrasive paper. Then the surface was allowed to dry after cleaning it with a thinner solution. Fiber should be kept undisturbed for few hours to have better quality of fiber reinforced composite specimens. At the time of curing, compressive pressure is applied on the mould and the specimens were cured for 24 hours. The specimens were prepared with three different percentage volume of Calotropis gigantea stem fibers and poymer.

3. RESULTS AND DISCUSSION

Rockwell hardness: The test is carried out using Rockwell harness testing machine for the calotropis Glass fiber composite laminate on the 1/16" ball indenter and result were obtained by applying 100kg for the B scale reading. The testing process is captured in figure and the values are found out.

Figure.5. Rockwell Hardness Machine

Tensile strength: The tensile test is prepared based on ASTM D638 standards and testing of calotropis Glass fiber composite specimens is carried out as per procedures. The tensile behavior of the specimen is tested by applying load until for the specimen its get failure and the results are observed in universal testing machine (UTM). For remaining specimen same methodologies are followed for calculating the tensile strength and comparison of results are done. The figure shows that fracture of calotropis glass fibers reinforced polyester composites are done by tensile test.

Figure.6. Tensile test specimen after fracture

Comparison of three samples for impact strength, tensile strength and Rockwell hardness of mechanical test result are been tabulated. All performance test result shows that sample C has best among them.

Impact strength: The calotropis Glass fiber composite are fabricated according to the required dimension of ASTM-A370 standard. In the impact testing machine the pendulum is allowed to pass without the specimen and with specimen allow to pass in the work piece to create a shock in them. Using the impact test, the energy absorbed can be noted while the specimen break the material and calculate the values for three different specimens.

Figure.7. Speciment after the impact test

The test specimen are prepared as per ASTM standards for the composite laminates and testing of materials has been carried out under tensile, hardness and impact loading conditions by using universal testing machine, Rockwell hardness and impact testing machine.

Table.3. Experimental results of the hybrid composite samples

Properties	Sample A	Sample B	Sample C
Impact strength (Joules)	5.36	7.56	8.35
Tensile strength (MPa)	30.485	32.596	35.145
Rockwell hardness Load (100Kgf) (HRB)	35	46	58

4. CONCLUSION

In this paper work, we correlate the different volume fraction percentage of calotropis fiber and the polymer on the mechanical properties of calotropis Glass fiber composite. The test was conducted for the mechanical properties such as tensile, hardness and impact test. It is also revealed that calotropis Glass fiber composites showed better result in mechanical properties in the sample C as compared to other sample. The calotropis Glass fiber composites have more tensile strength, hardness and impact strength than other composites for product manufacturing.

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