FABRICATION AND COMPARISION OF MECHANICAL PROPERTIES IN NFRC's WASHER

R.Balaji[1], S.Gabriel[2*], Azhagiri Pon[2], P.G.Karuppanna Raja[1]
[1] SBM College of Engineering and technology, Dindigul.
[2] University college of engineering (BIT campus), Trichy.
***Corresponding author: Email: dsgabdass@gmail.com**

ABSTRACT

Natural fibers are abundant and represent a significant cost reduction compared to wholly synthetic composite materials. The present work focuses on the prediction of tensile property of the natural fiber reinforced composite materials, and the values were compared. In this investigation the banana composite washer and the zea mays composite washer was fabricated using hand-lay-up method. For tensile test, Specimens were cut from the fabricated laminate according to the ASTM D 638 standards. After that experiment is performed under Universal testing machine (UTM). From the test results, the tensile property of banana fiber composite material and zea mays fiber composite material were compared. The banana fiber have excellent properties and are being extensively used in Varity of automobile engineering applications and suitable alternative material due to their advantage like low cost, low density, high strength and stiffness to weight ratio, low energy consumption, a lesser amount of pollutant emissions and biodegradable materials.

Key words: NFRC, zea mays fiber, banana fiber, hand-lay-up method, tensile Property, UTM

INTRODUCTION

Material types and applications of new materials technologies have been developed day by day. Composites or hybrid designs which constitute the basis of these materials consist of at least two different materials. Composite materials offer superior properties and formed by joining at least two different materials at the macro level. Increasing the world's population is leading to large amounts of waste of natural or synthetic material. These waste materials result in environmental problems.

The environmental problems are caused by waste plastics, metals and some other lignocelluloses materials. Parallel to the increase in population, the demand for the forest products needed by the people grows, and the necessity of finding new sources appears. For a better environment, there is a need to reduce environmental pollution through effective waste recycling and finding new ways. Plastic waste and agricultural wastes are leading environmental problems. If we evaluate the production of composite materials, a new alternative source of raw materials consists. So that wood materials need will be reduced and this is thought to be important for the forest products industry. Sugarcane, bamboo, jute, kenaf, cotton, rice straw, rice husks, banana, areca nut, wheat, tobacco, pineapple, sunflower stalk, corn stalk, hemp, oat straw, cotton straw, hay, rye, barley, flax and so on over fifty vegetable-based, research has been done to produce composite materials from hundreds of lignocellulosic material in the laboratory. In their study, Samal and colleagues produced a mixture of short banana and glass fiber reinforced polypropylene (PP) hybrid composites through compression molding technique using a twin screw extruder. The composites were produced with and without maleic anhydride (MAPP). For the both composition, an increase as seen in the tensile, bending and impact strengths up to 30 % by increasing weight of banana fibers& areca nut fibers . Mukhopadhyay and colleagues examined the behavior of banana fibers, areca nut fibers and their fracture behavior.

Characteristics of the composites: Composites consist of one or more discontinuous phases embedded in a continuous phase. The discontinuous phase is usually harder and stronger than the continuous phase and is called the 'reinforcement' or 'reinforcing material', whereas the continuous phase is termed as the ' matrix'. Properties of composites are strongly dependent on the properties of their constituent materials, their distribution and the interaction among them.

The composite properties may be the volume fraction sum of the properties of the instatements or the constituents may interact in a synergistic way resulting in improved or better properties. Apart from the nature of the constituent materials, the geometry of the reinforcement (shape, size and size distribution) influences the properties of the composite to a great extent.

The concentration distribution and orientation of the reinforcement also affect the properties. The shape of the discontinuous phase (which may by spherical, cylindrical, or rectangular cross-sanctioned prisms or platelets), the size and size distribution (which controls the texture of the material) and volume fraction determine the interfacial area, which plays an important role in determining the extent of the interaction between the reinforcement and the matrix. Concentration, usually measured as volume or weight fraction, determines the contribution of a single constituent to the overall properties of the composites. It is not only the single most important parameter influencing the properties of the composites, but also an easily controllable manufacturing variable used to alter its properties.

LITERATURE REVIEW

Roger. Rowell, et.al presented a paper on Utilization of natural fibers in plastic composites. Results suggest that agro-based fibers are a viable alternative to inorganic/material based reinforcing fibers in commodity fiber-thermoplastic. Composite materials as long as the right processing conditions are used. These renewable fibers have low densities and high specific properties. Sisal fibers, for example, have excellent specific properties and have potential to be outstanding reinforcing fillers in plastics. In our experiments, several types of natural fibers were blended with polypropylene (PP) and then injection molded, with the fiber weight fractions to 60%. The specific tensile and flexural moduli of a 50% by weight (39% by volume) of Sisal-PP composites compare favorably with 40% by weight of glass fiber (19% by volume)-PP injection molded composites.

Johnson presented a paper on Agro-Plastic Composites. Fillers, primarily talc, mica, calcium carbonate and a small amount of flour, have been used in the plastic industry for almost 90 years. Agro-Fibers have several advantages over conventional fillers in improving the general characteristics of the polypropylene. Agro-Plastic benefits include: reduced processing temperatures there by reducing

Satyanarayana, et.al (2003) presented a paper on fabrication and properties of natural fiber composites .An attempt has been made to find new uses for natural fibers — one renewable resource which is otherwise under-utilized. The structure and properties of the fibers and fabrication and physical and mechanical properties of their polyester-based composites are described. The performance of these composites is evaluated after exposure to indoor and outdoor weathering by both destructive and non-destructive testing methods. The preparation of various consumer articles such as a voltage stabilizer cover, mirror casing, a projector cover and roofing are also reported. This study demonstrates the potential of natural fibers for non-conventional applications and points out some of their limitations.

HAND LAY-UP METHOD

Hand lay-up molding is used for the production of parts of any dimensions such as technical parts with a surface area of a few square feet. But this method is generally limited to the manufacture of parts with relatively simple shapes that require only one face to have a smooth appearance (the other face being rough from the molding operation). It is recommended for small and medium volumes requiring minimal investment in molds and equipment.

The contact molding method consists of applying these elements successively onto a mold surface release agent,a gel coat,a layer of liquid thermosetting resin , of viscosity between 0.3 and 0.4 Pa.s, and of medium reactivity. Impregnation of the reinforcement is done by hand using a roller or a brush. This operation is repeated for each layer of reinforcement in order to obtain the desired Thickness of the structure.

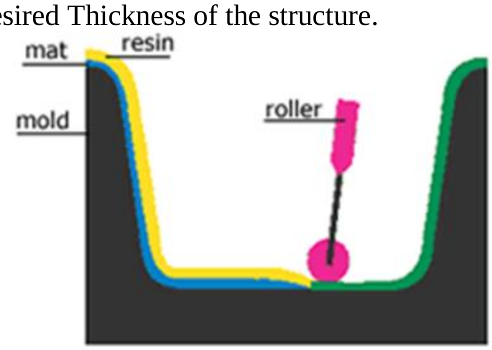

Figure.1.Hand Lay-Up Method

FABRICATION PROCESS

Fabrication procedure: The steps followed during fabrication are

- The Natural Fiber Reinforced polymer matrix composites were fabricated using hand lay-up method.
- banana fiber & Zea mays fiber was cleaned
- We prepared the mould of size.
- A 100 ml quantity of polyester resin was mixed with 10 gm of fiber
- Stirring was carried out to achieve homogeneous condition.
- Catalyst of 10 ml was added to mixture to increase recrystalisation temperature.
- Poly vinyl was applied inside the mould to prevent rubbing.
- The mixture was poured into the mould

Banana fiber was cleaned we prepared the mould of size. A 100 ml quantity of polyester resin was mixed with 10 gm of fiber. Stirring was carried out to achieve homogeneous condition. Catalyst of 10 ml was added to mixture to increase recrystalisation temperature. Poly vinyl was applied inside the mould to prevent rubbing. The mixture was poured into the mould.

Figure.2.Fabricated Banana Fiber composite washer

Figure.3.Fabricated Zea mays Fiber composite washer

Zea mays fiber was cleaned we prepared the mould of size. A 100 ml quantity of polyester resin was mixed with 10 gm of fiber. Stirring was carried out to achieve homogeneous condition. Catalyst of 10 ml was added to mixture to increase recrystalisation temperature. Poly vinyl was applied inside the mould to prevent rubbing. The mixture was poured into the mould.

Tensile strength test: Tensile tests were conducted using universal testing machine with across head speed of 2mm/min. In each case, both samples were tested and corresponding values are tabulated. Tensile test samples were cut as per ASTMD 638 test procedure. Tests were carried out at room temperature and each test was performed until tensile failure occurred.

RESULT AND DISCUSSION

Banana and Zea mays particulates composites had been successfully developed in this paper. The mechanical property of the composite had been studied and discussed here. The following conclusion had been drawn from this study.

- This work shows that successful fabrication of Banana and Zea mays fibers reinforced composites by simple hand lay-up method.
- Composite samples are suitable for analyse mechanical property of tensile tests.
- It has given information about the suitability of Banana and Zea mays particles as a source of reinforcement in polymer matrix composites.
- This project has added another agro waste biodegradable material to the several types used for reinforcement.
- NFRC have higher fiber content for equivalent performance which reduces the amount of more polluting base polymer.
- The tensile property of banana fiber composite material is higher than the Zea mays fiber composite material

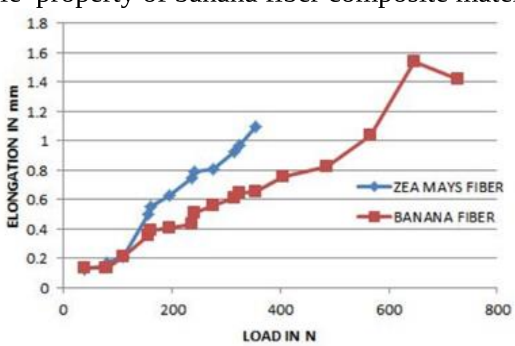

Figure.4.Comparison of NFRC Materials

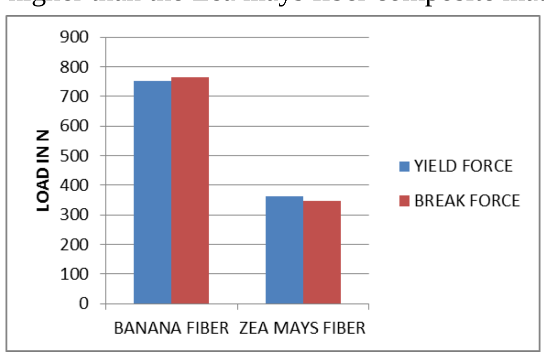

Figure.4.Comparison of Forces

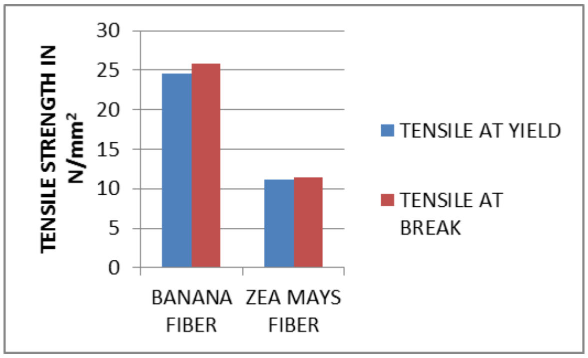

Figure.5.Comparison of Tensile Strength

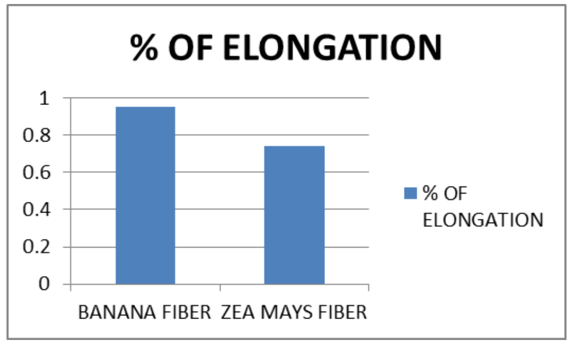

Figure.4.Comparison of % of Elongation

REFERENCES

C. A. Arnold, P. M. Hergenrother, and J. E. McGrath, An Overview of Organic Polymeric Matrix Resins for Composites, in Composite Applications: The Role of Matrix, Fiber, and Interface, T. L. Vigo and B. J. Kinzig (eds.), VCH, New York, 1992.

D.A. Johnson, Agro-Plastic Composites, in Making a Business from Biomass in Energy, Environment, Chemicals, Fibers, and Materials. 1997, 925-932

G. B. Nando and B. R. Gupta(1993), Short Fiber-Thermoplastic Elastomer Composites, in Short Fiber-Polymer Composites, J. R. White and S. K. De (eds.), Woodhead Publishing, Cambridge, 1996.

G. M. Newaz, Polymer-Matrix Composites, in Materials Science and Technology, Vol, 13, T. W. Chou (ed.), VCH, New York, 1993.

Gayer U. and Schuh. Th. (1996). Automotive Application of Natural Fibers Composite, First International Symposium on Lignocellulosic Composites, UNESP-Sao Paulo State University Schlösser Th., Gayer U. and Karrer G. (1999). Technischer Bericht 0003-98 Daimler-Chrysler.

H.Y.Sastra, Flexural Properties of Agenta Fiber Reinforced Composites", in American Journal of Applied Sciences, (Special Issue), 2005, 21-24,

J. R. White and S. K. De, Survey of Short Fiber-Polymer Composites, in Short Fiber-Polymer Composites, J. R. White and S. K. De (eds.), Woodhead Publishing, Cambridge, 1996.

M. G. Brader and A. R. Hill, Short-Fiber Composites, in Materials Science and Technology, Vol. 13, T. W. Chou (ed.), VCH, New York, 1993.

Mikko Hautala, Agro Fiber Research and Industrial Development, Harvesting and processing of fibre hemp as raw material for pulp, mft -products and strong composites. Potsdam, Deutschland, 2002.

Roger M. Powell, Utilization of Natural Fibers in Plastic Composites" in Lignocellulosic: Plastic Composites, 1994, 4(27).

T. W. Clyne, and D. Hull, in An Introduction to Composite Materials, 2nd ed.,Cambridge University Press, Cambridge, 1996, 1-3.