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Investigation on Glass Fibre with Banana Fibre as Reinforced Polymer Composite

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I. INTRODUCTION

Increasing concern about the global warming, primarily due to deforestation has led to the ban on use of wood in government buildings. Subsequently, a large action plan for the development of wood substitute has resulted in creation of more awareness about the use of natural fibre based building materials. In the past one decade or so the joint efforts by R & D organizations, private industries and funding agencies provided the much needed thrust for the actual transfer of technical know-how and product to the end users.

From centuries, mankind has used the natural fibre for various types of application including building materials. In most of the countries,

Most of the developing countries are very rich in agricultural and natural fibre. Except a few exceptions, a large part of agricultural waste is being used as a fuel. India alone produces more than 400 million tonnes of agricultural waste annually. It has got a very large percentage of the total world production of rice husk, jute, stalk, baggase and coconut fibre. All these natural fibres have excellent physical and mechanical properties and can be utilized more effectively in the development of composite materials for various building applications.

Users have explored the possibilities of using the natural fibre from different plant cereal straw, corn stalk, cotton stalk, kenaf, rice husk/rice straw etc. which includes bagasse, cereal straw, corn stalk, cotton stalk, kenaf, rice husk/rice straw etc.

II. ABOUT COMPOSITE MATERIALS

In recent times laminate composites have been increasingly utilized in such lightweight and high strength structured as ground transportation vehicles, aerospace and space structure. However composite material suffers from some serious limitation. The most significant among them is their response to impact loading. A structure is subjected to an impact force when a foreign object hits it. For instance, the loads imparted by dropped tool on the bonnet cover of car body, bird hit and runway debris on an aircraft engine are typical example of impact loads.

The manner in which composite material respond to impact loading and dissipate the incident kinetic energy of the projectile is very different to that of metals. For low and intermediate incident energies of projectile, metals absorb energy through elastic and plastic deformation; its consequences on the load carrying capacity of the components are small. In case of composites the elastic deformations are the major outcome of the energy absorption while the plastic deformation is very minimal. But at high incident impact energies, target perforations may occur and the passages of the impact will generally result in cracking, debonding and spalling. Such damage will degrade the load bearing ability of the composite structure. The impact property of a material is the capacity of the material to absorb and dissipate energies under shock loading. Impact condition may range from the accidental dropping of hand tools to high speed collisions and the response of the structure may range from localized damage to total disintegration of the structure.

III. MATERIAL SELECTION

The raw materials selected for the current work are

A. *Glass Fibre*

Glass fibre is a material made up of several fine fibres of glass. The product is one of the most versatile industrial materials known today. It has comparable mechanical properties to other fibres such as carbon fibre and polymers. Glass fibre is used as a reinforcing agent for many polymer products in order to form a very durable and lightweight material, known as fibreglass. Fibreglass offers some unique advantages over other materials due to its thickness, weight and strength. With such a wide range of properties, the material can satisfy design and project objectives in many industrial applications.

B. Banana Fibre
Banana fibre is a natural fibre with high strength, which can be blended easily with cotton fibre or other synthetic fibres to produce blended fabric & textiles. Banana Fibre also finds use in high- quality security/ currency paper, packing cloth for agriculture produce, ships towing ropes, wet drilling cables etc. Banana fibre, a lignocellulosic fibre, obtained from the pseudo-stem of banana plant (Musa sepientum), is a bast fibre with relatively good mechanical properties. Plant fibres are sclerenchymatous cells with heavily lignified cell walls having a narrow lumen in cross section. Fibre cells are dead at maturity and serve as a support tissue. Natural fibres possess several advantages over synthetic fibres such as low density, appropriate stiffness and mechanical properties and also high disposability and renewability. Also, they are recyclable and biodegradable.

C. Epoxy Resin
Epoxy resin refers to a type of reactive prepolymer and polymer containing epoxide groups. These resins react either with themselves in the presence of catalysts, or with many co- reactants like amines, phenols, thiols, etc.

Epoxy resin has many industrial applications for a variety of purposes. It possesses higher mechanical properties and more thermal and chemical resistance than other types of resin. Therefore, it has exclusive use in making aircraft components.

Epoxy resin is also called polyepoxides

Epoxy resin also finds uses in caulking and casting compounds, sealants, varnishes and paints, and other industrial applications. Epoxy resin is superior to other types of resins because it has low shrink during cure, and excellent moisture and chemical resistance. It is impact resistant, it has good electrical and insulating properties, and a long shelf life. The various combinations of epoxy resins and reinforcements gives a wider range of properties obtainable in molded parts. Epoxy resin is different from polyester resins with regard to curing.

IV. RESIN USED FOR FABRICATION
Resin is a solidified resin from which the volatile terpenes have been removed by distillation.

Typical rosin is a transparent or translucent mass, with a vitreous fracture and a faintly yellow or brown colour, non- odorous or having only a slight turpentine odour and taste. Rosin is insoluble in water, mostly soluble in alcohol, essential oils, ether, and hot fatty oils. Resin softens and melts when heated and burns with a bright but smoky flame.

A. Hand Layup Method
Hand Layup technique was employed for the preparation of the natural fibre reinforced polymer composite mold made of wood wasused with dimensions of 300×300×10mm for tensile test, flexural test and for compressive test. This method is the cheapest method of manufacturing but it has some disadvantages such as long curing time, low production rate and further the quality of the composite depends on the skill of the worker.Mold release agent is applied all over them old surface. And a thin layer of laminated sheet is placed on the mold for removing the fibres easily. A brush or rolleris used to wrap layering process ofthe fibres. Layers of the fibres impregnated with there are used to build up the required thickness. Curing waiting for the thermo setting polymer bond of network normally at room temperature.

B. Moulding Preparation
1) Two rectangular mild steel plate having dimensions of 100mm × 100mm x 4 mm.
2) Chromium plated to give a smooth finished as well as to protect from rusting.
3) Four beading are used to cover compress the fibre after the epoxy is applied.
4) Bolt and nuts are usedto lock the plate.

C. Tensile Testing
Introduce the students to the topic of tensile testing of metals, polymers and composites using the Computer Controlled Universal Testing Machine. These sets of tensile tests on materials of widely differing tensile properties (e.g., soft and hard steel, soft aluminium, brass, copper, plastics, Rubber and etc.) Show the use of the tensile testing machine in the various ranges of loads and extensions necessary to obtain valid mechanical properties on materials. Since tensile properties of materials are used as a primary method of material acceptance, quality control, and design limits, this laboratory emphasizes data collection, presentation in tabular and graphical form and report writing.

D. Compression Test

A compression test is any test in which a material experiences opposing forces that push inward upon the specimen from opposite sides or is otherwise compressed, squashed, crushed, or flattened A compression test is essentially the opposite of the more common tension test. A compression test involves mounting the specimen in a machine and subjecting it to the compression. The compression process involves placing fractures.During the application of compression, the elongation of the gauge section is recorded against the applied force.

E. Charpy Impact Test

The charpy impact test, also known as the charpy V-notch test, is a high strain-rate test that involves striking a standard notched specimen with a controlled weight pendulum swung from a set height. The impact test helps measure the amount of energy absorbed by the specimen during fracture.

Pretreatment enables the creation of increased roughness on the surfaces, which contributes to better adhesion to the polymer matrix. Among the different techniques for pretreating to produce NLFs surface modification, one of the most used is the alkaline treatment, also known as mercerization. The mercerization removes both the waxes and greases as a portion of hemicellulose and lignin, enhancing the packing of the cellulose molecules and increasing crystallinity of the fibres. This results in a rougher surface with larger contact surface, aiding in mechanical anchoring and promoting an increase in both the elastic modulus and the tensile strength.

V. CONCLUSION

From the obtained result it was found that the well laminated GFRP reinforced with natural fibre like banana-based bumper having more strength also lesser weight when compared to that of existing materials like steel and plastic.

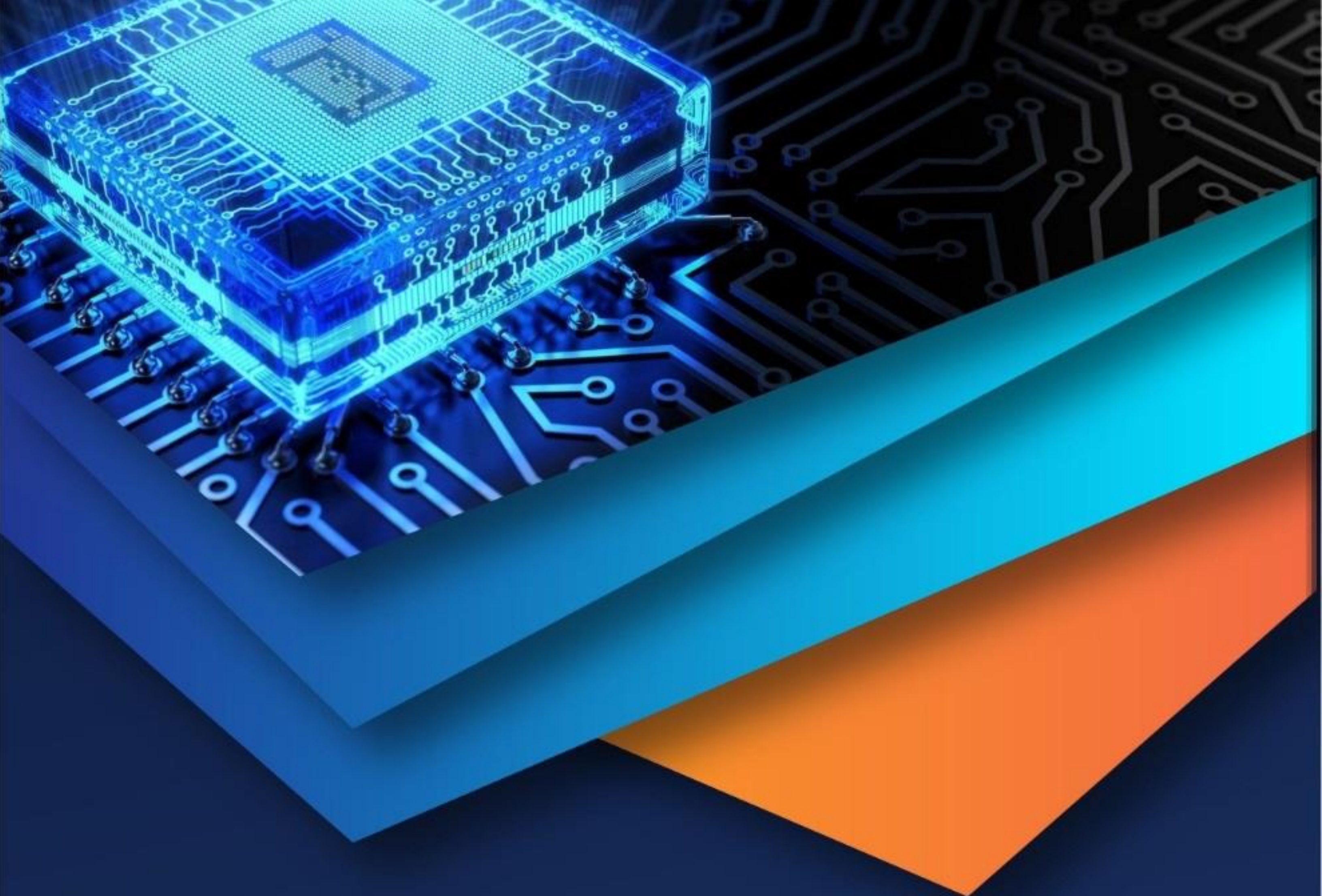
According to the availability of the GFRP it is proposed to use the natural fibre like banana materials. When banana reinforced with the GFRP materials the bonding and as well as strength also increased. The banana is readily available materials so it can be used in full-fledged manner for the automotive application like bumper and etc. Also, from the observed result it was found that displacement was higher than the GFRP and plastic materials. This result causes the increasing failure duration. Strain rating has increased. The glass with banana fibre laminated bumper materials absorb more stresses.

Finally it is conclude that glass with banana fibre reinforced composite material based bumper material suitable for automotive application such as car bumper and etc.

AUTHOR BIOGRAPHY

[1] M. S. Found. (1997) Impact behaviour of stiffened CFRP sections, ELSEVIERPII:SO263- 8223(97)00117-7
[2] A.P. Mouritzas. (1997) A review of the effect of stitching on the in-plane mechanical properties of fibre-reinforced polymer composites. ELSEVIER PII: S1359-835X (97)00057-2
[3] Giovanni Belingardi. (2003) Influence of the laminate thickness in low velocity impact behavior of composite material plate.ELSEVIER Composite Structures 61 (2003) 27–38
[4] Tien-Wei Shyr.2003) Impact resistance and damage characteristics of composite laminates. ELSEVIER Composite Structures 62 (2003) 193–203
[5] Tien-Wei Shyr, et al (2003) Impact resistance and damage characteristics of composite laminates. ELSEVIER Composite Structures 62 (2003) 193–203
[6] F. Aymerich. (2006) Effect of stitching on the low-velocity impact response of [03/903] s graphite/epoxy laminates. ELSEVIER Composites: Part A 38 (2007) 1174–1182
[7] V. Lopresto. (2006) Effect of stitches on the impact behaviour of graphite/epoxy composites. Sciencedirect.com Composites Science and Technology 66 (2006) 206– 214
[8] F. Aymerich. (2007) Damage response of stitched cross-ply laminates under impact loadings. ELSEVIER Engineering Fracture Mechanics 74 (2007) 500– 514
[9] Mishra, H.K., Dash, B.N., Tripathy, S.S., & Padhi, (2000) “A Study on mechanical performance of jute –epoxy composites”, Poly.-Plast.Technol. Eng., Vol. 39, No. 1, pp.(187–198)
[10] Dipa ray, B K Sarkar, A KRana and N R Bose(April 2001) ,”Effect of alkali treated jute fibres on composite properties”, Bull. Mater. Sci., Vol. 24, No. 2, , pp. 129–135.
[11] Gassan J, Bledzki A K, (1997) “Influence of fibre surface treatment on the mechanical properties of jute propylene composites-part A”, Applied science and manufacturing vol-28 no.12 pp.1001-1005.
[12] Pusit Lertwattanaruk, Anchisa Suntijitto, (2015), Properties of natural fibre cement material containing coconut coir and oil palm fibers for residential building application. Construction and building materials.Vol94 pg.664-669.
[13] Ashish Kumre, R.S.Rana, Rajesh Purohit, (2017), A Review on mechanical property of sisal glass fibre reinforced polymer composites. Material today: Proceedings.Vol-4 pg.3466- 3476.
[14] Juliana Cruz, Raul Fangueiro, (2016), Surface modification of natural fibre: a review. Procedia Engineering.Vol-155pg.285-288.

[15] C.Galan Marin, C.Rivera Gomez, J.Petric, (2010), Clay based composite stabilized with natural polymer and fibre. Construction and building materials. Vol-24 pg.1462- 1468.
[16] Ning Pan, (1994), Analytical Characterization of the Anisotropy and Local Heterogeneity of Short Fibre Composites: Fibre Fraction as a Variable. Journal of Composite Materials. Vol-28 pg.1500-1531.
[17] M.R.Bambach , (2017), Compression strength of natural fibre composite plates and sections of flax, jute and hemp. Thin-Walled Structures. Vol119pg.103– 113.
[18] P.Ganeshan and K.Raja,(2016),Improvement on the mechanical properties of madar fibre reinforced polyester composites. Vol- 7(2) pg.261–264.
[19] Axel Nechwatal, Klaus- Peter, Thomas Reubmann, (2003), Developments in the characterization of natural fibre properties and in the use of natural fibers for composites. Composites science and techonology. Vol-63 pg.1273-1279.



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