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PONDER AROUND MECHANICAL PROPERTIES LIKEWISE WEAR PARTS APPRAISAL FOR JUTE BESIDES GLASS FIBER REINFORCED POLYESTER MIXTURE COMPOSITES

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ABSTRACT

Hybrid materials of any class are essential for current demands. This paper deals with the hybrid effect of composites made of jute/E-Glass fibers which are fabricated by hand layup method using LY556 Epoxy resin and HY951 hardener. The properties of this hybrid composite are determined by testing like tensile, flexural, impact, and wear which are evaluated experimentally according to ASTM standards. The result of the test shows that hybrid composite of jute/ E-glass fiber has far better properties than that of jute fiber composite. However, it is found that the hybrid composite has better strength as compared to jute fiber composite fabricated separately with glass fiber.

Keywords: Jute, E-glass fiber, Epoxy resin

INTRODUCTION

The advancement in the field of material science led to many new and advanced materials. Composites are one of them, which are adopted in various engineering applications. Many authors [1–3] stated many properties of polymer reinforced plastics which makes them suitable for a variety of applications such as aerospace structures, automotive parts, and marine structures. The extensive use of composites in these industries is due to their combined properties of resilience, creep resistance, high strength and stiffness to weight ratios, corrosion resistance, and good damping properties. The study [4] showed that the use of natural fibre as reinforcement had increased many folds in recent years due to new environmental rules and customer demands. The increased demand of natural fibre is due to their low cost, low density,biodegradability, renewability, and abundance. The findings of this study [5] showed that the use of natural fibre can be enhanced by proper chemical treatment of fibres which produces better mechanical properties than untreated fibres. The properties of hybrid composites were studied by many researchers [6–8] and they concluded that hybrid composite offers greater resistance to water absorption, cost saving, weight saving, and increased properties. In present work, hybrid composites were manufactured with different weight fractions of reinforcement and with different weight percentages of different fibres. These specimens were tested according to the procedure mentioned in ASTM standards. The effect of natural fibre reinforcement on glass fibre reinforced composite was studied and mechanical properties were analyzed.

EXPERIMENTAL PROCEDURES A. Materials

Bidirectional Jute fiber mats of thickness 0.4 mm are purchased from Chandra Prakash& Co. Jaipur, India. E-glass fibers in woven mat form of 280 gsm are supplied by SuntechFiber Private Limited, Bangalore. Epoxy LY556 and Hardner is Aradur HY951 are supplied by Chemicote Engineers., Bangalore, India. Table 1 and Table 2 indicate Physical properties of Jute fiber and E-glass fiber respectively.

Physical properties of jute fiber

Physical property	Jute fiber
GSM	250gsm
Density (g/cm3)	1.4
Tensile strength (MPa)	700 - 800
Young's modulus	30 (GPa)

Physical properties of glass

Physical property	Glass fiber
GSM	600gsm
Density(g/cm^3)	2.5
Tensile strength (MPa)	3400
Young's modulus (GPa)	72

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Physical properties of Polyester Resin

Physical property	Polyester Resin
Density (g/cm^3)	1.1
Young's modulus (GPa)	4.375
Poisons ratio	0.46
Shear modulus	1.49

B.Specimen Fabrication

An attempt has been made to fabricate composites by using jute, E-glass and a hybrid of jute/E-glass fiber rein- forced epoxy. The mechanical properties like tensile, impact, flexural and wear.

Preparation of Epoxy-Hardner Mixture For each laminate nearly 400 g of epoxy-hardner mixture is taken. Hardner is taken in the ratio of 1:10 (i.e.; for every 10 g of epoxy 1 g of hardner is added). Then the mixture is thoroughly mixed for some time and is used for preparing laminates. [6] discussed about a system, GSM based AMR has low infrastructure cost and it reduces man power. The system is fully automatic, hence the probability of error is reduced. The data is highly secured and it not only solve the problem of traditional meter reading system but also provides additional features such as power disconnection, reconnection and the concept of power management. The database stores the current month and also all the previous month data for the future use. Hence the system saves a lot amount of time and energy. Due to the power fluctuations, there might be a damage in the home appliances. Hence to avoid such damages and to protect the appliances, the voltage controlling method can be implemented.

C. Fabrication Procedure

In this study, manual hand layup method is used for preparing composite laminates as shown in Figure 4.1. First of all, a release gel is sprayed on the mould surface to avoid the sticking of epoxy to the surface. Thin plastic sheets are used at the top and bottom of the mould plate to get a good surface finish of the product. Reinforce- ment in the form of woven mat jute fabrics and E-Glass fibers are cut as per the mould size and placed at the surface of mould after perspex sheet. Then epoxy in liquid form is mixed thoroughly in suitable proportion with a prescribed hardener (curing agent) and poured onto the surface of mat already placed in the mould. The epoxy is uniformly spread with the help of the brush. The second layer of mat is then placed on the epoxy surface and a roller is moved with a mild pressure on the mat- epoxy layer to remove any air trapped as well as theexcess epoxy present. The process is repeated for each layer of epoxy and mat, till the required layers are stacked. After placing the plastic sheet, release gel is sprayed on the inner surface of the top mould plate which is then kept on the stacked layers and the pressure is applied. After curing either at room temperature or at some specific tem- perature at 60˚C - 80˚C, the mould is opened and the developed composite part is taken out and further processed. For epoxy based system, normal curing time at room temperature is 24 - 48 hours.

Testing of composites

The mechanical properties are carried out by different instruments for the fabricated composites. shows laminates designations and layer sequence of each laminate are as shown in Figure The thickness of each layer of Jute is 0.56 mm and each layer of glass is 0.6 mm. As per ASTM standard, the thickness of each laminates is 3 mm, So as to maintain the ASTM standard

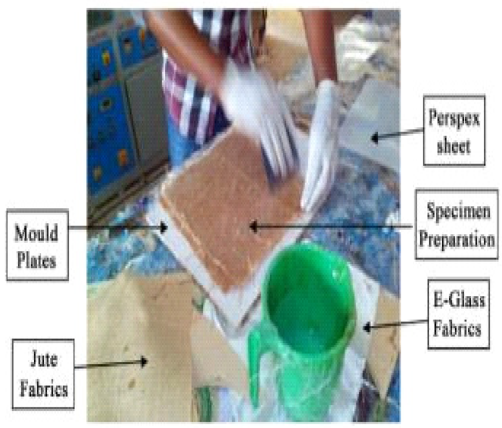

Fig1:Laminates making using hand lay-up technique.

Laminates designations

Composites	Compositions
L1	J+J+J+J+J
L2	G+G+G+G+G
L3	J+J+G+J+J
L4	G+G+J+G+G

(J-Jute, G- Glass)

D. Marking on laminates

Marking on laminates will be done according to the ASTM standards for different test example.

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Fig2 : Marking on laminates

Tensile Test The tensile test is done by cutting the composite specimen as per ASTM: D3039 standard (sample dimension is250 × 25 × 3 mm^3). A universal testing machine (UTM) (Model: KIC-2-1000-C) is used for testing with a maximum load rating of 100 KN.

Fig3: Tensile test specimen.

Flexural Test The flexural test is done in a three point flexural setup as per ASTM: D790 standard (sample dimension is 127 × 12.7 × 3 mm^3). When a load is applied at the middle of the specimen.This test is carried out in the UTM from which the breaking load is recorded and load vs length graphs are generated.

Fig4: Flexural test specimen,

Impact Test The impact test is done in a charpy impact setup as per ASTM: D256 standard (sample dimension is 65 × 12.5 × 3 mm^3).The specimen must be loaded in the testing machine and allows the pendulum until it fractures or breaks. Using the impact test, the energy needed to break the material is noted and used to measure the toughness of the material and the yield strength. The effect of strain rate on fracture and ductility of the material is analyzed.

Fig5: Impact test specimen

CONCLUSION

This paper presents the fabrication of hybrid composite using jute and E-glass fiber reinforced epoxy composite by hand layup method. From the tests, the following Conclusions are drawn:

The composite L3 of jute fiber composition Shows very poor results when compared with composite L1 of eE Glass for Fibre composition.

The hybrid composites L2 & L4 of Jute/E-Glass fiber compositions show better results than composite L3. Laminate L4 shows better than L2, because it consists of glass as outer layers.

The incorporation of glass fiber in jutefiber composites enhances the mechanical properties.

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REFERENCES

1. John, M. J., &Anandjiwala, R. D. (2008). Recent developments in chemical modification and characterization of natural fiber□reinforced composites. Polymer composites, Vol. 29(2), pp. 187-207.
2. Gowda, T. M., Naidu, A. C. B., &Chhaya, R. (1999). Some Mechanical Properties of Untreated Jute Fabric-Reinforced Polyester Composites. Composites Part A: Applied Science and Manufacturing, Vol.30(3), pp. 277-284.
3. Luo, S. & Netravali, A. N. (1999). Mechanical and thermal properties of environmentally friendly green composites made from pineapple leaf fibres and poly (hydroxybutyrate-co- valerate) resin. Polymer Composites,Vol. 20(3), pp. 367-378.
4. Amar Patnaik, AlokSatapathy, and S. S. Mahapatra, A Taguchi Approach for Investigation of Erosion of Glass Fiber – Polyester Composites, Materials and Design30 (2009), pp 251–255,pp 351–355.
5. Amkee Kim, Ilhyun Kim, Solid particle erosion of CFRP composite with different laminate orientations, Wear 267 (2009), pp 1922–1926.
6. Christo Ananth, G.Poncelina, M.Poolammal, S.Priyanka, M.Rakshana, Praghash.K., "GSM Based AMR", International Journal of Advanced Research in Biology, Ecology, Science and Technology (IJARBEST), Volume 1,Issue 4,July 2015, pp:26-28.
7. W.A. Hibbert, J. Roy, Aero, A study of erosion behavior of glass ceramic, Materials and Design 69 (1965), pp 769-776.
8. George, J., Bhagawan, S. S. & Thomas, S. (1996). Thermogravimetric and dynamic, mechanical thermal analysis of pineapple fibre reinforced polyethylene composites. Journal of Thermal Analysis and Calorimetry, Vol.47(4), pp. 1121-1140.
9. Joseph, S., Sreekala, M. S., Oommen, Z., Koshy, P. & Thomas, S. (2002). A Comparison of Mechanical Properties of Phenol Formaldehyde Composites Reinforced with Banana Fibres and Glass Fibres. Composites Science and Technology, Vol.62(14), pp. 1857-1868.
10. Pothan, L. A., Oommen, Z. & Thomas, S. (2003). Dynamic Mechanical Analysis of Banana Fiber Reinforced Polyester Composites. Composites Science and Technology, Vol.63(2), pp. 283-293.
11. Corbière-Nicollier, T., Laban, B. G., Lundquist, L., Leterrier, Y., Månson, J. -A. E. & Jolliet, O. (2001). Life Cycle Assessment of Biofibres Replacing Glass Fibers as Reinforcement in Plastics, Resources, Conservation and Recycling, Vol.33(4), pp. 267-287.
12. Pothan, L. A., Thomas, S. &Neelakantan, N. R. (1997). Short Banana Fibre Reinforced Polyester Composites: Mechanical, Failure and Aging Characteristics. Journal of Reinforced Plastics and Composites, Vol.16(8), pp. 744-765.
13. Ahmed, K. S. &Vijayarangan, S. (2008). Tensile, flexural and inter- laminar shear properties of woven jute and jute-glass fabric reinforced polyester composites. Journal of materials processing technology, Vol.207(1), pp.330-335.