A Review on an Experimental Analysis to Determine Ultimate Tensile Strength of Jute Reinforced Glass Fibre Composite by Acousto-Ultrasonic Technique

Shilesh Kumar Dwivedi[1] Rajesh Kumar Satankar[2]
[1]M.E. Student [2]Assistant Professor
[1,2]Govt. engineering college, Jabalpur (M.P)

Abstract— From recent years, there is been substantial growth and development in field of Composites. Advanced materials and Composites are being used in almost every industry in some form or the other. Composites have found wider applicability and liking in designing industries. This has triggered researchers towards this emerging technology. Jute reinforced composites may be used in combination with biodegradable polymer or to replace conventional glass fibre reinforced composites. In this case, the main concern is their impact resistance. The production of hybrid laminates by coupling layers of glass fibre reinforced with jute reinforced laminates, proved also effective to improve the mechanical characteristics. In recent years, a number of studies have been carried out, aimed to compare properties of jute fibre reinforced laminates.

Key words: composite material, natural fiber, UTS, laminate, jute

I. INTRODUCTION

A. Composite Material

A composite material is made by combining two or more materials, which are having very different properties. These materials work together to obtain the unique properties for composite. However, within the composite we can easily tell the different materials apart as they do not dissolve or blend into each other.

B. Natural Fibre

natural fibre may be defined as a substance which are produced by animals and plants which can be spun into filament, thread or rope. The cause of increasing the popularity of natural fibres is the availability and consistent quality of a wide range of fibre. The important features of the natural fibres are their high strength and stiffness per weight along with key features such as high damping, acoustic isolation, safety management, rapid production and lower cost.

C. Jute

jute is one of the most important natural fibres that can be spun into coarse strong thread. Jute is obtained from genus corchorus.

D. Ultimate tensile strength

The ultimate strength may be define as the maximum stress that a material can with stand while being stretched or pulled before failing or breaking the specimen. Tensile strength is different from compressive strength. Some material break quickly without going plastic deformation is called a brittle failure. The material which are experiencing some plastic deformation and possibly necking before fracture are known as ductile material. The UTS is obtained by performing a tensile test and plotting a graph between engineering stress and strain. The preparation of the specimen, surface defect temperature of the material test environment affects the UTS.

E. Lamination

Lamination is the process of manufacturing a material in multiple layers to achieve improved strength, stability, sound insulation and appearance and other properties from the use of different materials. With the help of heat, pressure, and welding process laminate is permanently assembled.

II. LITRETURE SURVEY

1) Ajith gopinatha, senthil kumar was found that The composite manufacturing have priority due to properties like low density stiffness, light weight etc. technology like aerospace. Automotive are work in this application. Now composite material are mode by change its physical & chemical properties. Fibre reinforced polymer were prepared with jute fibre of fibre and the resin used in the experiment are polyester and epoxy. Tensile strength, flexural strength, impact strength and hardness were tested of composites and found that jute reinforced epoxy composites exhibited better mechanical properties than jute polyester composites.The jute polyester composite have better impact energy than jute epoxy composite. It revealed that the jute epoxy exhibited better tensile and flexural properties. Due to better mechanical properties of jute epoxy it better suited for the automotive application. Though the composite have some merits and demerits, the combination of the useful properties of two different materials, quicker processing time lower manufacturing cost etc. makes them as a versatile material in the field of technology and Engineering. It is sure that the technology shows composite is the most wanted material in the resent trand.
2) Toshihiko hojoa, Zhilan Xub were deals with several types of composites with natural fiber mat as reinforcement and unsaturated polyester as matrix, including jute/up, kenaf/up and bamboo/up, were fabricated by hand lay-up and compression molding method. The tensile properties were tested and low cycle fatigue behavior was compared with glass/up and scanning electron microscope with a focus on the fracture morphologies. After experiment they found that properties like tensile& ultimate stress of Kenaf/up is higher than Jute/p And tensile strength do not show much variation in low cycle fatigue test because in lcf test after 30 cycle modulus is comparatively same as non cycle specimens. On combing composites properties of Kenaf/up is better than Bamboo& jute & natural fibre are good than petroleum based composites.

3) M.ramesh, k. palanikumar , k. hemachandra reddy was said that Natural fibre become important in various field and its aim to calculate its mechanical and physical properties. A small experiment is carried out to analyze by SEM (scanning electron microscope and they found that sisel fiber have better tensile properties but jute have better flexural properties than sisel.
4) N.V.Rachchha, P.S. ujeniyaband was done Experiment on composite plate made from Rattan fiber and unsaturated polyester resin. A study is done about its properties to produce light weight and cheaper product. They found six types of different item made from ratten fibre and whose mechanical properties are improve up to 12. 5% but not well for transfer load between fibres.Tensile and flexural strength is increased by the rate of 12.5% up to certain limit and ten decreased and its density is low and it is light in weight because of low density of Ratten fibre.
5) Niharika Mohanta & Dr. S.K.Acharya was studied is done too make three layer composite like single, double and tipple layer of luffa cylindrical matrix by using SCM and they found that properties like tensile flexural strength are better for double layer but weak for triple layer.A new concept is come that luffa cylindrical fibre is same as epoxy resin. The double layers have strong flexural strength &tensile compare to third layer because in triple layer is wetting of fibre with matrix.
6) S.Raghavendra , Lingaraju,P balachandra was said that the Natural fibre are cheaper in cost, environment friendly and biodegradable composite are also prepared by using a technique called vulcanizing at 1500 & and its properties are studied by SCM .In this work composite are made from short banana fibre and natural rubber.On increase fibre concentration tensile strength is increase due to close packing of fibre. And by increasing surface area strength of fibre should be increase & bond between fibre and rubber is strong and increase hardness between them.
7) Gunti Rajesh Atluri v.Ratna Prasad's Composite based on thermoplastic become popular due to its processing time &jute is best biogradable fibre. The observation deals with evaluation of mechanical properties of jute fibre reinforced polypropylene composite which has been developed by injection molding process and hand lay technique.The tensile modulus and tensile strength are increased by increasing the NaoH percentage and also an increase in tensile properties with increase in the % weight fraction of fibre in the polypropylene matrix.
8) S.Hemalatha, N.ramesha said that Composite made from reinforcing sisel, coconut spathe and ridge gourd; a study is done to check its tensile properties .it has been seen that the tensile properties are increases with increase in the weight fraction of fibres to certain limit and then decreases. the tensile strength of the composite increased for approximately 25% of weight fraction and further for increase in the weight fraction of fibre the strength decreased, also it is found that for the hybrid combination of ridge guard and sisal fibre there is 65% increase In the tensile strength.
9) I.V.Surendra was investigated the mechanical properties of sisal natural fibre reinforce polymer composite and hybrid natural fibre reinforce polymer composite. To determine the mechanical properties such as tensile strength, tensile modules, flexural properties like flexural strength and flexural modules, impact strength a test was carried out.
10) N. Nanda Kumar was studied the behavior of aluminum alloy based composites, reinforced with silicon carbide particles and graphite. Mechanical properties of the sample were examined with the help of SEM for the characterization of micro structure on the surface of composite. It was seen that an increase in the percentage of graphite and silicon reinforcements in aluminum alloy in increases the ultimate tensile strength.
11) Naveenkumar was investigated that natural fibre composite such as kenaf/jute polymer composite become more attractive due to their high specific strength, light weight and biodegradability. The mechanical properties like flexural strength, impact strength and tensile strength and interfacial properties like internal cracks and internal structure of the fractured surface are determine by SEM. It is obtained that kenaf/jute polymer composites can be used as an alternate material for synthetic fiber reinforced polymer composite. These composites are fabricated by hand layup method and compressed using compression molding machine.
12) Mohd. Ruman shamim was interested in the application of munja fiber which weight is saving lower raw material prize and ecological advantages of using green resources which are renewable and biodegradable. His objective was evaluate the mechanical properties of munja fiber composite. There are many mechanical properties were evaluated by means of tensile test when fiber were mixed with the epoxy and hardener composition with 5 to 25 wt%.
13) Vithal Rao Chavan perform various characterization test were conducted over GRF-polyester-hematite ore filled hybrid composite. In general, the addition of fillers leads to cost and weight reduction of the regular glass fiber reinforced composite. The effect of the addition of natural filler has been studies and concluded that the tensile strength, hardness, impact strength of the composite.

III. CONCLUSIONS

Composite material has following features

1) Composite material has High Strength to Weight Ratio.
2) Composite materials are Lightweight.
3) They have the property of Fire Resistance.
4) They have better Electrical Properties
5) Composite material has Chemical & Weathering Resistance.
6) 6They have Translucency property.
7) Composite material has Design Flexibility.
8) They have Low Thermal Conductivity.
9) It is Manufacturing Economy.

Now, Mechanical properties of Jute Reinforced Glass Fibre Composite are obtained by Acousto-Ultrasonic Technique. The specimens were tested for UTS on UTM and the correlation factors were determined by comparing SWF (Stress Wave Factors) and UTS.

REFERENCES

[1] Ramesh Chandra Yadaw, and Sachin Chaturvedi. An Investigation of Mechanical and Sliding Wear Behavior of Glass Fiber Reinforced Polymer Composite With or Without Addition of Silica (SiO2). International Conference on PFAM XXI, IIT Guwahati, (2012).
[2] Mukul Kant Paliwal and Sachin Kumar Chaturvedi. An Experimental Investigation of TensileStrength of Glass Composite Materials with Calcium Carbonate (CaCO3) Filler. Int. J. Emerg. Trends in Eng. and Dev. 2012; 6 (2) : 303-309..
[3] Cantwell WJ and Morton J. The impact resistance of composite materials - A review. Composites Part A 1991; 22: 347–362...
[4] H.M. Akil , M.F. Omar, A.A.M. Mazuki, S. Safiee, Z.A.M. Ishak, A. Abu Bakar. Kenaf fiber reinforced composites: A review. Materials and Design 2011; 32: 4107–4121
[5] Bledzki A, Gassan J. Composites reinforced with cellulose based fibers. Prog Polym Sci 1999; 24:221–74.
[6] Kozlowski R, Mieleniak B, Helwig M, Przepiera A. Flame resistant lignocellulosic-mineral composite particleboards. Polym Degrad Stabil 1999;64:523–8.
[7] M. Jawaid , H.P.S. Abdul Khalil, A. Abu Bakar, P. Noorunnisa Khanam, Chemical resistance, void content and tensile properties of oil palm/jute fiber reinforced polymer hybrid composites, Materilas and Design;2011;12: 1014-1019.
[8] M. Jawaid, H.P.S. Abdul Khalil, Azman Hassan, Rudi Dungani, A. Hadiyane, Effect of jute fibre loading on tensile and dynamic mechanical properties of oil palm epoxy composites, Composites:Part B;2012;xx:xxx-xxx. Article in press.
[9] Kasama Jarukumjorn, Nitinat Suppakarn, Effect of glass fiber hybridization on properties of sisal fiber polypropylene composites, Composites: Part B;2009;40:623 627.
[10] Maries Idicula, S.K. Malhotra, Kuruvilla Joseph, Sabu Thomas, Dynamic mechanical analysis of randomly oriented intimately mixed short banana/sisal hybrid fiber reinforced polyester composites, Composites Science and Technology; 2005;65:1077 1087.
[11] Amar Singhsingha et al., "Fabrication and Study of Lignocellulosic Hibiscus SabdariffaFibre Reinforced Polymer Composites," BioResources, vol. 3(4), pp. 1173-1186, 2008.
[12] C. W. Nguong et al., "A Review on Natural Fibre Reinforced Polymer Composites," World Academy of Science, Engineering and Technology, p. 73, 2013.
[13] C.S. Verma et al., "Study of Some Mechanical Properties of Bamboo Laminae," International Journal of Metallurgical &Materials Science and Engineering, vol. 2, pp. 20-37, 2012.
[14] D. Chandramohan et al., "Characterization of Natural Fibres and Their Application in Bone Grafting Substitutes," Acta of Bioengineering and Biomechanics, vol. 13, p. 1, 2011.
[15] Dr. Navdeep Malhotra et al., "A Review on Mechanical Characterization of Natural Fibre Reinforced Polymer Composites," Journal of Engineering Research and Studies, vol. 3, pp. 75-80, 2012.
[16] Sha A. N. and Lakkad S.C. (). Mechanical properties of jute reinforced plastic. Fibre Sci.tech 1981; 15: 41-46
[17] S. K. Acharya, P. Mishra, S. K. Meher and V. Dikshit. Weathering behaviour of bagasse fibres reinforced polymer composite. Journal of Reinforced Plastics and Composites 2008; 27: 1839
[18] Luo S. and Netravali A.N. Interfacial and mechanical properties of environment-friendly'Green' composites made from pineapple fibres and poly (Hydyoxybutyrate-co-valerate) resin. J Mater Sci Eng 1999; 34: 3709–3719.
[19] Bisanda E. T. N. and Ansell M. P. The effect of saline treatment on the mechanical and physical properties of sisal–epoxy composites. Comp. Sci. Tech. 1991; 41: 165–178.
[20] Pothan L. A., Thomas S. and Neelakantan N. R. Short Banana Fiber- Reinforced Polyester Composites: Mechanical, Failure and Aging Characteristics. J. Reinforced Plastics1997; 16: 744–765.
[21] Olesen PO and Plackett DV, Perspectives on the Performance of Natural Plant Fibres in http://www.ienica.net, IENICA EVENTS, Natural Fibres Performance Forum, Copenhagen, May 27–28 (1999),http://www.ienica.net/fibresseminar/fibresindex .htm.
[22] Bismarck A, Mishra S, and Lampke T, Natural Fibres, Biopolymers and Biocomposites,CRC Press, Boca Raton, FL (2005).
[23] Bio-Based Polymers and Composites, Richard Wool, Xiuzhi Susan Sun - 2011 - Technology & Engineering.
[24] A.A. Collyer Rubber Toughened Engineering Plastics, 1994 Chapan & Hall.
[25] Abdollahi Alireza, Alizadeh Ali, Baharvandi Hamid Reza (2014), Dry sliding tribological behavior and mechanical properties of Al2024–5 wt.%B4C nanocomposite produced by mechanical milling and hot extrusion. Materials and Design, vol. 55 pp. 471–481.
[26] Tahamtan S., Halvaee A., Emamy M., Zabihi M.S. (2013), Fabrication of Al/A206–Al2O3 nano/micro composite by combining ball milling and stir casting technology. Materials and Design, vol. 49, pp. 347–359.
[27] Mazahery A., Abdizadeh H., Baharvandi H.R. (2009), Development of highperformance A356/nano-Al2O3 composites. Materials Science and Engineering A, vol. 518, pp. 61–64.
[28] P. Wambua, J. Ivens, and I. Verpoest, "Natural fibres: can they replace glass in fibre reinforced plastics?" Composites Science and Technology, vol. 63, no. 9, pp. 1259–1264, 2003.
[29] T. Nishino, "Natural fiber sources," in Green Composites: Polymer Composites and the Environment, CRC Press, Boca Raton, Fla, USA, 2004.

