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Fabrication and Study of Mechanical Properties of Composite Panel Using Sisal/Glass/Basalt Fibres

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Abstract: Environmental awareness, increasing concern with the greenhouse effect and bio-degradation has hastened the construction industry to look forward for sustainable materials with least impact on the existing surroundings. Natural fibre reinforced composites seems to be a good alternative because of their eco-friendly nature. Natural fibre reinforced composites are widely used for different application such as building industry, automotive industry, aerospace industry, furniture industry, bio-medical industry. In this present investigation a natural and synthetic fibre composite with vinyl ester as resin is made by using glass fibre, sisal fibre, basalt fibre and prosopis juliflora fibre. The weight percentage of the fibre reinforcement varied as 50%, 25% ,25%. 6 numbers of different composite specimens are prepared. The samples are analyzed for their tensile, flexural and impact strength.

Keywords: glass fibre, sisal fibre, basalt fibre, prosopis juliflora fibre.

I. INTRODUCTION

A. General

The sustainable tomorrow for future generation lies with the present industrial development towards eco efficiency of industrial products and their process of manufacturing. High performance, biodegradable materials and renewable plant materials can form new platform for sustainable and eco-efficient advance technology products. Biocomposites reinforced with natural fibers and/or biopolymers have developed significantly over the past years because of their significant processing, advantages, biodegradability, low cost, low relative density, high specific strength and renewable nature. These composites are predestined to find more and more application in the near future.

B. Natural Fibre Composites

A composite material is a 'material system' composed of a combination of two or more micro or macro constituents that differ in form, chemical composition and which are essentially insoluble in each other. Composites are one of the most advanced and adaptable engineering materials. Progress in the field of materials science and technology has given birth to these fascinating and wonderful materials. A composite material can provide superior and unique mechanical and physical properties, because it combines the most desirable properties of its constituents while suppressing their least desirable properties.

II. LITERATURE VIEW

Economic and other related factors in many developing countries where natural fibres are abundant demand that scientists and engineers apply appropriate technology to utilize these natural fibres as effectively and economically as possible to produce good quality fibre reinforced polymer composites for housing and other needs. Among the various natural fibres, sisal is of particular interest in that its composites have high impact strength besides having moderate tensile and flexural properties compared to other lignocellulosic fibres. The present paper surveys the research work published in the field of sisal fibre reinforced polymer composites with special reference to the structure and properties of sisal fibre, processing techniques, and the physical and mechanical properties of the composites. Kuruvilla joseph et al., (1999)

Basalt is a natural material that is found in volcanic rocks. It is mainly used (as crushed rock) in construction, industrial and high way engineering. One can also melt basalt (1300-1700°C) and spin it into fine fibres. When used as (continuous) fibres, basalt can reinforce a new range of (plastic and concrete matrix) composites. It can also be used in combination with other reinforcements (e.g. basalt/carbon). Some possible applications of basalt fibres and basalt-based composites are: thermal and sound insulation/protection (e.g. basalt wool, engine insulation), pipes, bars, fittings, fabrics, structural plastics, automotive parts, concrete reinforcement (constructions), insulating plastics and frictional materials. Van de velde k et al., (1995).

Glass fibers are among the most versatile industrial materials known today. They are readily produced from raw materials, which are available in virtually unlimited supply all glass fibers described in this article are derived from compositions containing silica.

They exhibit useful bulk properties such as hardness, transparency, resistance to chemical attack, stability, and inertness, as well as desirable fiber properties such as strength, flexibility, and stiffness Glass fibers are used in the manufacture of structural composites, printed circuit boards and a wide range of special-purpose products. Frederick t. Wallenberger, james c. Watson (2001).

Alkali-treated sisal fibres were used as novel reinforcement to obtain composites with self-synthesized urea formaldehyde resin as matrix phase. The composites were prepared by means of compression molding, and then the effects of sisal loading on mechanical properties such as impact strength, flexural strength, and wear resistance were investigated. In addition, water uptake was studied and structural features were revealed by the scanning electron microscopy (SEM).The composite with 30 wt% sisal fibres gives excellent flexural strength, water absorption, and especially the wear resistance showing that it has the most superior bonding and adhesion of all the composites. In particular, the highest value 9.42 kJ/m2 of charpy impact strength is observed in the composite with 50 wt% sisal fibre. SEM micrographs of impact fractured and worn surfaces clearly demonstrate the interfacial adhesion between fibre and matrix. This work shows the potential of sisal fibre (SF) to improve the composite wear resistance and to be used in fibreboard. J. B. Zhong, j. Lv, c. Wei (2007).

During the last few years, natural fibres have received much more attention than ever before from the research community all over the world. These natural fibres offer a number of advantages over traditional synthetic fibres. In the present communication, a study on the synthesis and mechanical properties of new series of green composites involving Hibiscus sabdariffa fibre as a reinforcing material in urea–formaldehyde (UF) resin based polymer matrix has been reported. Static mechanical properties of randomly oriented intimately mixed Hibiscus sabdariffa fibre reinforced polymer composites such as tensile, compressive and wear properties were investigated as a function of fibre loading. Initially urea–formaldehyde resin prepared was subjected to evaluation of its optimum mechanical properties. Then reinforcing of the resin with Hibiscus sabdariffa fibre was accomplished in three different forms: particle size, short fibre and long fibre by employing optimized resin. Present work reveals that mechanical properties such as tensile strength, compressive strength and wear resistance etc of the urea–formaldehyde resin increases to considerable extent when reinforced with the fibre. Thermal (TGA/DTA/DTG) and morphological studies (SEM) of the resin and biocomposites have also been carried out. A S singha and vijay kumar thakur(2008).

This study examined the effects of wood pulp fiber length (short, medium, and long), and fiber loading (27%,37%, 47%, and 0% [non-reinforced PP]) with 3% maleic anhydride-grafted polypropylene on the mechanical properties of wood-plastic composites (WPCs). Polypropylene and fibers were compounded into pellets using a counter-rotating twin-screw extruder and test specimens were prepared by injection molding. The results show that increases in fiber length and fiber loading significantly increased ($P < 0.05$) the mechanical properties of the WPCs (MOE and tensile modulus). The behavior of the composites against MOR and impact strength varied according to fiber length and loading level. In general, the tensile strength was observed to be the same. Farshid basiji, et al., (2009)

As an engineered material, similar with synthetic fiber composites, the properties of NFC can be tailored to meet certain requirements. The challenge in working with NFC is the large variation in properties and characteristics. The properties of NFC to a large extent influenced by the type of fibers, environmental condition where the plant fibers are sourced and the type of fiber treatments. However, with their unique and wide range of variability, natural fiber composites could emerge as a new alternative engineering material which can substitute the use of synthetic fiber composites. A. Ticoalu, t. Aravinthan & f. Cardona(2010).

Over the last thirty years composite materials, plastics and ceramics have been the dominant emerging materials. The volume and number of applications of composite materials have grown steadily, penetrating and conquering new markets relentlessly. Modern composite materials constitute a significant proportion of the engineered materials market ranging from everyday products to sophisticated niche applications. While composites have already proven their worth as weight-saving materials, the current challenge is to make them cost effective. This review paper discuss about worldwide review report on natural fibers and its applications. Also, this paper concentrates on biomaterials progress in the field of orthopaedics. An effort to utilize the advantages offered by renewable resources for the development of biocomposite materials based on bio epoxy resin and natural fibers such as Agave sisalana; Musa sepientum; Hibiscus sabdariffa and its application in bone grafting substitutes. D. Chandramohan& .k. Marimuthu (2011).

The paper presents some experimental research results from testing composite materials reinforced with natural fibres fabrics, subjected to tensile stress. The research aims to determine the main mechanical properties of new materials necessary to simulate the behaviour of structures made of these natural fibre reinforced materials. Aspects regarding influence of layers orientation of natural fibres fabrics are presented. Terciu, et al., (2011).

Mechanical properties of composites are strongly influenced by the quality of the fiber/matrix interface. The objective of this study

was to evaluate the mechanical properties of polylactide (PLA) composites as a function of modification of sisal fiber with two different macromolecular coupling agents. Sisal fiber reinforced polylactide composites were prepared by injection molding, and the properties of composites were studied by static/dynamic mechanical analysis (DMA). The results from mechanical testing revealed that surface-treated sisal fiber reinforced composite offered superior mechanical properties compared to untreated fiber reinforced polylactide composite, which indicated that better adhesion between sisal fiber and PLA matrix was achieved. Scanning electron microscopy (SEM) investigations also showed that surface modifications improved the adhesion of the sisal fiber/polylactide matrix. Zhaoqian li et al., 2011

Application of composite materials to structures has presented the need for the engineering analysis the present work focuses on the fabrication of polymer matrix composites by using natural fibres like coir, banana and sisal which are abundant nature in desired shape by the help of various structures of patterns and calculating its material characteristics(flexural modulus, flexural rigidity, hardness number,% gain of water) by conducting tests like flexural test, hardness test, water absorption test, impact test, density test, and their results are measured on sections of the material and make use of the natural fibre reinforced polymer composite material for automotive seat shell manufacturing. M.Sakthivel, S.Ramesh, (2013)

III. CONCLUSION

Based on the studies conducted it is observed that the natural fibre composites are good alternative for the conventional construction materials. They are renewable ,cheap , recyclable, and biodegradable. Sisal fibre possesses high specific strength and modulus, low price, recyclability, easy availability. Glass fibres bulk and weight properties are also very favourable when compared to metal. Basalt is the natural material that is found in volcanic rocks. It possesses high thermal and sound insulation production. Vinyl ester resin is becoming increasingly important for fibre reinforced composites. By using these materials the composites are prepared and analysed for its tensile, flexural, impact strength.

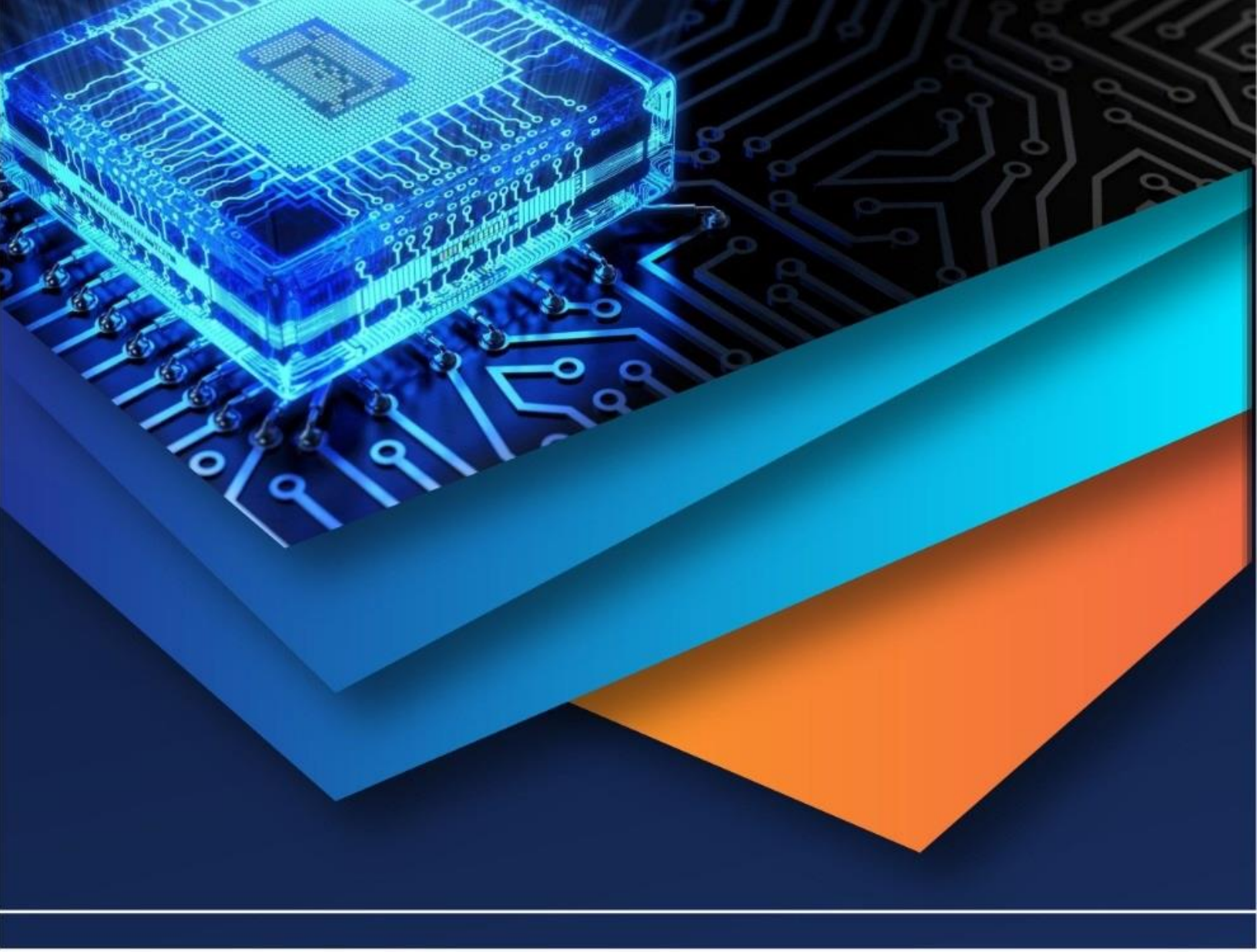
REFERENCES

[1] Keerthi, V Devender, V Mahesh (2014) “Mechanical Characterization of Biodegradable Linen Fiber Composites”, International Journal Of Modern Engineering Research (IJMER), Vol. 4, Iss.11, pp. 39-46.
[2] U S Bongarde, V D Shinde, (2014) “Review on natural fiber reinforcement polymer composites”, International Journal of Engineering Science and Innovative Technology (IJESIT), Volume 3, Issue 2, pp 431-436.
[3] Avinash S, H G Hanumantharaju, Vignesh M, Akash S, (2014) “Investigation Of Mechanical Properties On Vinylester Based Bio-Composite With Gelatin As Randomly Distributed Filler Material” , International Journal of Research in Engineering and Technology , Volume 03 ,Issue 11, pp 252-258.
[4] D. Chandramohan ,K Marimuthu (2011),“ A Review On Natural Fibers” ,IJRRAS ,Vol 8, Issue 2, pp 194 -206 .
[5] Arpitha G R, Sanjay M R, L Laxmana Naik, B Yogesha, “Mechanical Properties of Epoxy Based Hybrid Composites Reinforced with Sisal/SIC/Glass Fibers”, International Journal of Engineering Research and General Science ,Volume 2, Issue 5,pp 398-405.
[6] Farshid Basiji, Vahidreza Safdari, Amir Nourbakhsh, Srikanth Pilla (2009) “The effects of fiber length and fiber loading on the mechanical properties of wood-plastic (polypropylene) composites”, Research Article, pp 191-196.
[7] Oladele, I O Omotoyinbo , J A Adewuyi, B O And Kavishe F.P.L.(2013) “The Effects of Production Processes on the Mechanical Properties of Sisal Fibre Reinforced Polypropylene Composites”, Philippine Journal of Science vol 142 (2): 189-198. Pp 189-198.
[8] Ticoalu, T Aravinthan & F Cardona (2010) “A review of current development in natural fiber composites for structural and infrastructure applications”, Southern Region Engineering Conference ,pp 1-5.
[9] Truc T Ngo, James G Kohl, Tawni Paradise ,Autumn Khalily, Duane L. Simonson(2015), “Improving Mechanical Properties of Thermoset Biocomposites by Fiber Coating or Organic Oil Addition”,International Journal of Polymer Science ,pp 1-7.
[10] A S Singha Vijay Kumar Thakur (2008),“Mechanical properties of natural fibre reinforced polymer composites” ,National Institute of Technology, Vol. 31, No.5 pp 791–799.
[11] Terciu, O M Curtu, I Stanciu, M D Cerbu, C(2011) “Mechanical Properties Of Composites Reinforced With Natural Fibre Fabrics”, DAAAM International, Volume 22, No. 1, pp 607-608.
[12] Kuruvilla Joseph Romildo Dias ,Tolêdo Filho Beena James , Sabu Thomas Laura Hecker De Carvalho (1999), “A Review On Sisal Fiber Reinforced Polymer Composites” ,v.3, n.3, pp.367-379.
[13] Frederick T. Wallenberger, James C. Watson (2001), “Glass Fibers” ASM International ,Vol. 2.
[14] Van De Velde K., Kiekens P., Van Langenhove L ,(1995), “Basalt Fibres As Reinforcement For Composites”, Ghent University Belgium (1995).
[15] Zhaoqian Li,Xiaodong Zhou, And Chonghua Pei (2011), “Effect of Sisal Fiber Surface Treatment on Properties of Sisal Fiber Reinforced Polylactide Composites” nternational Journal of Polymer Science, pp 1-7.
[16] J. B. Zhong, J. Lv, C. Wei (2007), “Mechanical properties of sisal fibre reinforced ureaformaldehyde resin composites”, eXPRESS Polymer Letters Vol.1, No.10 pp 681–687.
[17] Seethalakshmi, A., 1subramanian, S.Muthuchelian, K.(2013), “Thermal, Structural, Mechanical And Electrical Properties Of Biomaterial Prosopis Juliflora”, International Journal of Current ResearchVol. 5, Issue, 10, pp.3116-3120.
[18] Avinash R. Pai*, Ramanand N. Jagtap (2014), “Surface Morphology & Mechanical properties of some unique Natural Fiber Reinforced Polymer Composites-A Review”, J. Mater. Environ. Sci. 6 vol(4) pp 902-917.
[19] Elba Helen George1, B. Bhuvaneshwari2, G. S. Palani3,P. Eapen Sakaria4, Nagesh R. Iyer (2014), “Effect Of Basalt Fibre On Mechanical Properties Of

Concrete Containing Fly Ash And Metakaolin",International Conference On Innovations & Advances In Science, Engineering And Technology, Volume 3, Special Issue 5pp 444-451.

[20] M.Sakthivel1, S.RAMESH2 (2013), "Mechanical Properties of Natural Fibre (Banana,Coir, Sisal) Polymer Composites", science park, vol-1, Issue-1, pp 1-6.

[21] R Gopinath, K Ganesan, S.S Saravana Kumar and 4R Poopathi (2015), "Mechanical Properties of sandwich Composites made using Prosopis juliflora, sisal and Glass fibers", Australian Journal of Basic and Applied Sciences, vol 9(35), Pages: 1-9



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