Effect of Rice Husk and Rice Husk Ash on Coconut Fiber Reinforced Polyester Composites

Sadhu.Prasanth[1] T.Suseela[2]
[1]PG Student [2]Assistant Professor
[1,2]Acharya Nagarjuna University, Guntur, Andhra Pradesh, India

Abstract— Fiber-reinforced polymer composites played a dominant role for a long time in a variety of applications for their high specific strength. The fiber which serves as reinforcement in reinforced plastics may be synthetic or natural. Past studies show that only synthetic fibers such as glass, carbon etc., have been used in fiber-reinforced plastics. Although glass and other synthetic fiber-reinforced plastics possess high specific strength, it is very limited application. In this connection, an investigation has been carried out to make use of coconut, a natural fiber abundantly available in India. Natural fibers are not only strong and lightweight but also relatively very cheap. The present work describes the development and characterization of a new set of natural fiber based polymer composites consisting of coconut fiber as reinforcement, polyester resin, some materials like rice husk and rice husk ash. Experiments are carried out to study the effect of different fiber composition such as coconut fiber, rice husk and rice husk ash and polyester composites. In the present work, polyester and rice husk ash composition gives more tensile strength and composition of coconut fiber, rice husk and rice husk ash and polyester gives the more impact strength. This work can be further extended to study other aspects of such composites like effect of fiber content, fiber orientation, loading pattern, fiber treatment on mechanical behaviour of coconut fiber, rice husk and rice husk ash and polyester composites.

Key words: Rice Husk, coconut fiber

I. INTRODUCTION

The bio fibers are cellulose in nature and are included of lignin, cellulose, hemicellulose, pectin and wax. Therefore, all natural fibers are hydrophilic in nature. Normally, the bio fibers are found better the synthetic fibers (i.e. glass and carbon fiber) with the properties such as low density, bio-degradable non-abrasive, eco-friendly, low cost, high toughness and so on . However, it has some of the disadvantages as a quality variation, more moisture absorption, poor surface characteristic, etc.

Now, newer the various synthetic fibers like glass, nylon, rayon, acrylic, carbon etc. are used as reinforcement in a polymer matrix which are getting a mechanical properties. However, they are entirely high price materials. For this, bio fibers are coconut, hemp, flux, sisal, jute, kenaf, coir, banana, etc. It can be alternatively used to reduce the cost of the composite materials. Various mechanical properties of natural composites such as tensile strength flexural modulus, impact strength and Young's modulus can be improved by treating it by Sodium Hydroxide (Naoh).

The surface treated bio fibers showed better efficiency than the untreated. Alkaline treatment (mercerization process) is illustrious. Chemical treatment of surface modification of natural fibers reinforced composites. This alkaline treatment removes wax, hemicellulose and lignin hiding the surface of the fiber.it is accepted that the alkaline treatment result from increases surface roughness which create better mechanical interlocking between hydrophilic fibers and hydrophobic matrices .

Among the bio fibers, coconut fiber is nowadays widely used in many industrial applications. Coconut fiber possesses elongation at break highest among typical bio fibres. Besides, it is high failure strain, which provides a better contact between the fiber and matrix in reinforced composites. The high lignin content in coconut fiber is responsible for other beneficial properties such as weather resistance. The lignin content in coconut fiber is quite high, so the fiber becomes stiffer and tougher.

Bio fibers are used in different forms as reinforcement in composite materials, such as random, continuous unidirectional and weaving patterns. In weaving patterns are found to be more excellent adhesion reinforcement as they can be applied in the development of the structure of the material. Thus, weaving bio fiber in different forms is significant in defining their final properties. Weaving patterns such as knitting are used for various bio fibers using fabric technologies to make bio fiber reinforced composites with better mechanical properties.

In the present work describes the development and characterization of a new set of natural fiber based polymer composites consisting of coconut fiber as reinforcement, polyester resin, some additional materials like rice husk and rice husk ash. Experiments are carried out to study the effect of different fiber composition such as coconut fiber, rice husk and rice husk ash and polyester composites.

II. MATERIALS AND METHOD

The purpose of this research is to represent the essential information on the main mechanical properties such as tensile strength and impact strength .this part experimental work a fiber- reinforced composite material prepared from raw coconut coir.

A. Raw Material:

In this present work, rice husk and rice husk ash on coconut fiber and polyester resin are used as natural fiber and matrix, respectively. The coconut fibers were collected from Ravi industry, Andhra Pradesh. Coconut can be extracted from the husk of coconut using the process of pulling out and it used to rang in diameter between 200-300µm is shown Fig 1

Fig. 1: raw material

B. Surface Treatment Of Coconut Fiber

Coconut fiber through surface treatment with Naoh solution for 60 minute at room temperature. Then after, fibers were washed with fibers were then heated at 80 c for 30 min to remove moisture.

C. Preparation Of Composite And Test Specimen:

The fiber sample and polyester were weighed using the electronic balance. The fiber was mixed with the polyester at room temperature and stirred continuously for 3 minutes until a homogenous mixture was observed. 1% (by weight of polyester) of the accelerator; cobalt was added and stirred for another 3 minutes. Finally, 2% (by weight of polyester) of the catalyst, methyl ethyl ketone peroxide (MEKP) was added using the syringe and stirred continuously for another 3 minutes The reaction temperature was taken and the different composite was cast in the moulds and allowed to cure for one hour..

The composites prepared by a hand layup process with different composite specimen, as shown in Fig 2.

Number of samples composition

1) Work piece S1= 95% polyester, 5% rice husk
2) Work piece S2= 90% polyester, 10% rice husk
3) Work piece S3= 80% polyester, 20% rice husk
4) Work piece S4= 95% polyester, 5%rice husk ash
5) Work piece S5= 90% polyester, 10%rice husk ash
6) Work piece S6= 85% polyester, 15% rice husk ash
7) Work piece S7= 95% polyester, 0.5%coconut fiber
8) Work piece S8= 90% polyester, 1% coconut fiber
9) work piece S9=89% polyester, 1%coconut fiber,5%rice husk ash,5% rice husk

Fig. 2: different composite specimens

The mixture was poured slowly into the zinc sheet mould. It was executed according to the ASTM test (ASTM D 638 type 1 for tensile test and ASTM D 256 for impact test). Sample production to obtain a smooth surface can by using a sheet of Mylar on the upper and the lower part of the sample. Then, leaving some composite for curing at room temperature for 2 days and then removed from the mould. Finally, take a sample to test the mechanical properties survey

III. RESULTS

All the type composites prepared in this work are presented in the mechanical properties values of composites reinforced with coconut fiber at different oriented forms are tabulated in table 1.

Type composites	Brake load (N)	Tensile strength (MPa)	Impact strength (KJ/Sq.m)
Work piece S1= 95% polyester, 5%rice husk ash	1196.53	35.2	32.419
Work piece S2= 90% polyester, 10% rice husk ash	608.84	22.7	25.581
Work piece S3= 80% polyester, 20% rice husk ash	578.45	16.5	22.630
Work piece S4= 95% polyester, 5%rice husk	588.91	13.9	29.372
Work piece S5= 90% polyester, 10%rice husk	324.78	9.3	18.298
Work piece S6= 85% polyester, 15% rice husk	245.19	7.8	10.359
Work piece S7=95% polyester ,0.5%coconut fiber	686.47	19.4	15.916
Work piece S8= 90% polyester, 1% coconut fiber	774.32	26.7	24.437
Work piece S9=89% polyester, 1%coconut fiber, 5% rice husk ash,5% rice husk	764.81	21.3	35.784

Table 1: Result of composites tested the mechanical properties

A. Tensile Test Result:

The strength of the rice husk and rice husk ash on coconut fiber reinforced with polyester composite depends on the orientation of fibers and the interfacial adhesion between the fiber and the matrix. Fig1 illustrates the tensile strength and elasticity of modulus of composites for different fiber orientation.

The effect of different fiber orientation on the tensile strength of coconut fiber reinforced polyester composites is shown in Fig 3.

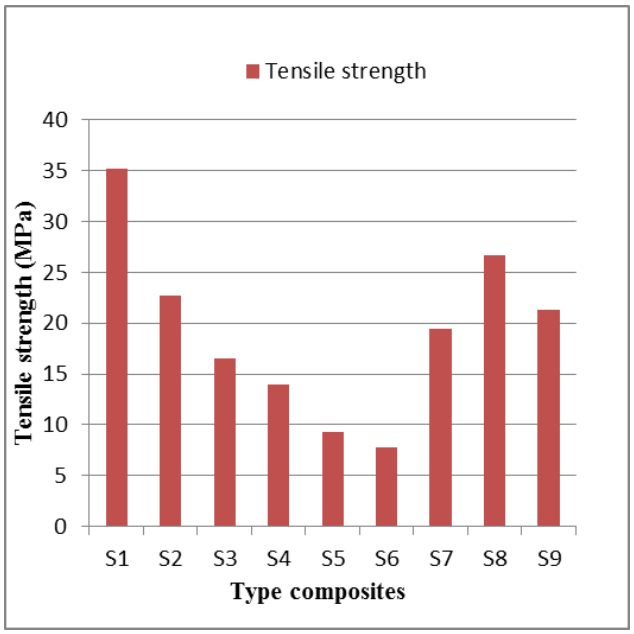

Fig. 3: tensile test result

The results indicated that the highest impact strength is obtained for The tensile strength for the composition of 95%polyester and 5% rice husk gives the better result i.e. Break load=1147.4 and Ultimate tensile strength =35Mpa.

Impact test result

The effect of different fiber orientation on the impact strength of coconut fiber reinforced polyester composites is shown in Fig 4.

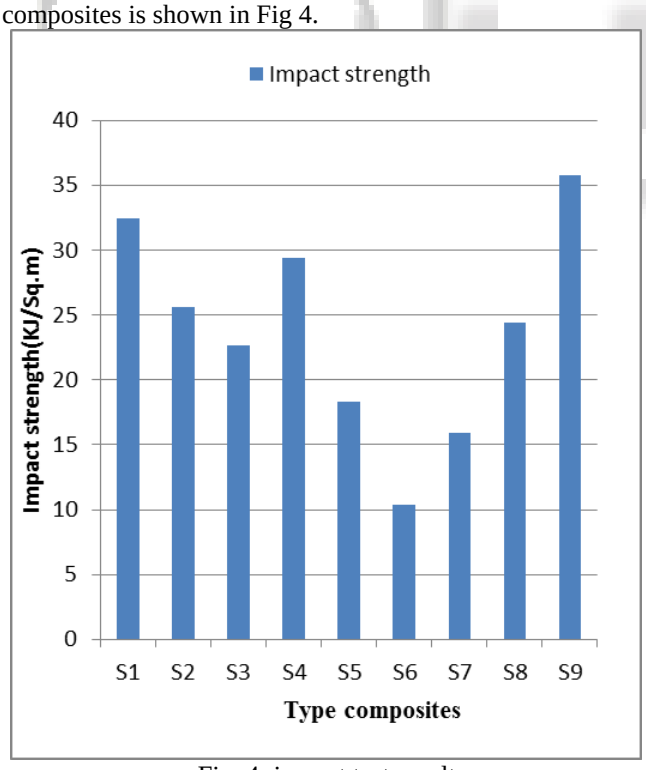

Fig. 4: impact test result

The results indicated that the highest impact strength is obtained for The impact strength for the composition of 89%polyester and 5% rice husk, 5% rice husk ash, 1% coconut fiber gives the result i.e. Break load=764.6N, Ultimate tensile strength =19.2Mpa and Impact strength =35.887 KJ/Sq.m.

IV. Conclusions

This paper the fabrication of natural composite using difference oriented rice husk and rice husk ash on coconut fiber reinforced polyester composites by hand layup technique. In this study the mechanical properties (tensile strength and impact strength). Based on the test results, the following conclusion are observed

As the fiber present increases the tensile strength increases, impact strength of composite is increased with increment of coconut fiber, it is free from acidic and basic reaction occur in nature.

Acknowledgement

It give me immense pleasure to take this opportunity to express my sincere and heartfelt to thanks to T.suseela Asst.prof department of mechanical engineering, Acharya nagarjuna University College of engineering & technology, Guntur, Andhra Pradesh, India. for his able and continual guidance help throughout the entire period of investigation.

References

[1] Reza Mahjoub, Jamaludin Mohamad Yatim, Abdul Rahman Mohd Sam, Mehdi Raftari. "Characteristics of continuous unidirectional kenaf fiber reinforced epoxy composites." Materials and Design.pp.640-649, August 2014.

[2] M. Ramesh, T. Sri Ananda Atreya, U.S.Aswin, H. Eashwar, C. Deepa, "Processing and Mechanical Property Evaluation of Banana Fiber Reinforced Polymer Composites," Science Direct. Pp.563-572,2014.

[3] V.P. Arthanarieswaran, A. Kumaravel, M. Kathirselvam, "Evaluation of mechanical properties of banana and sisal fiber reinforced epoxy composites: Influence of glass fiber hybridization," Materials and Design. pp. 194-202, August 2014.

[4] H.M.M.A. Rashed, M. A. Islam and F. B. Rizvi. " Effects of process parameters on tensile strength of jute fiber reinformoplastic compositses." Journal of Naval Architecture and Marine Engineering. pp.1- 6, June 2006.

[5] Samai Sultana Mir, Nazia Nafsin, Mahbub Hasan, Najib Hasan, Azman Hassan, "Improvement of physic-mechanical properties of coir-polypropylene bio composites by fiber chemical treatment." Materials and Design. pp.251- 257, May 2013.

[6] V.S. Srinivasan, R. Boopathy, D. Sangeetha, B. V. Ramnath, "Evaluation of mechanical and thermal properties of banana-flex based natural fiber composites." Materials and Design. pp.620-627, 2014.

[7] Rahman MR, Huque MM, Islam MN, Hasan M. "Improvement of physic mechanical properties of jute fiber reinforced polypropylent composites by post-treatment." Composite Science Technology. Vol.39, pp.1739-47, 2003. [8] Janusz Datta, Patrycja Kopczynska. "Effect of kenaf fibre modification on morphology and mechanical properties of thermoplastic polyurethane materials." Industrial Crops and Products. pp. 566-576, May 2015.

[8] V. Fiore, G. Di Bella, A. valenza, "The effect of alkaline treatment on mechanical properties of kenaf fibers

and their epoxy composites." Composites: Part B. pp. 14-21, August 2015

[9] R. Bhoopathi, M. Ramesh, C. Deepa, "Fabrication and Property Evaluation of Banana-Hemp-Glass Fiber Reinforced Composites." Science Direct. pp. 2032-41, 2014.

[10] Brahma Kumar M, Pavithran C, Pilai CM. Coconut fiber reinforced polyethylene composites: effect of natural waxy surface layer of the fiber on fiber/ matrix interfacial bonding and strength of composites. Compos Sci-Technol . Vol. 65, pp.563-9, 2005.

[11] Malkapuram R, Kumar V, Yuvraj SN. Recent development in natural fiber reinforced polypropylene composites. J. Reinf plast Compos.Vol.28, pp.1169-89, 2008.

[12] Roe, P., & Ansell, M. "Reinforced polyester composites." Journal of Materials Science . pp.374-378, 1985.

[13] Satyanarayana KG, Kulkarni AG, Rohatgi PK. "Potential of natural fibres as a resource for industrial material in Kerala." J Sci Ind Res.Vol.40, pp.222-37, 1981.

[14] V.S. Srinivasan, S. Rajendra Boopathy, D. Sangeetha, B.Vijaya Ramnath. "Evaluation of mechanical and thermal properties of banana-flax based natural fibre composits." Materials and Design. pp. 620-627, April 2014.

