Pak. J. Biotechnol. Vol. 15 (Special Issue ICRAME 17) Pp. 98-101 (2018) R. Thamilarasan, K. Purushothaman
www.pjbt.org PISSN: 1812-1837, EISSN 2312-7791

COMPARATIVE MECHANICAL CHARACTERIZATION OF SPJ (SISAL-PALM-JUTE)-KPC(KENAF-PALM-COIR) -JPJ (JUTE-PALM-JUTE) HYBRID FIBER REINFORCED COMPOSITES

R. Thamilarasan[1]*, K. Purushothaman[2]

[1]Research Scholar, Department of Mechanical Engineering, St. Peter's University, Avadi, Chennai-54.
[2]Professor, Department of Mechanical Engineering, St.Peter's Engg College, Avadi, Chennai-54.

ABSTRACT:

Development of natural composites were in use over a long time. Researchers are working to provide green materials due to emission and scarcity issues. This article deals the mechanical characteristics of Sisal-Palmyara-Jute (SPJ), Kenaf-Palmyra-Coir (KPC) and Jute-Palm fruit -Jute (JPJ) fibers at different orientation is prepared with polymer resin. Natural fibers are collected from local farmers and extracted by stem explosion method and are cleaned, treated as per our requirement. Specimens were prepared with ASTM Standards and are tested to evaluate tensile strength, Flexural strength and Impact strength. Woven mat technique and Hand lay-up technique is followed at room temperature to mould the specimen. The weight fractions of fibers are equal 50:50% for all the fibers used in the experimental analysis. The result shows the energy absorbed by the jute-palm-jute composite is more than the other for equal weight fractions.

Key words: Jute, Palmyra, Sisal, polymer resin, Hardener, Woven mat, tensile strength, Flexural strength and Impact strength

1. INTRODUCTION

Increasing demand and interest in using natural fibers from different area has throwing the research in the field to innovate for the application of more kind. Natural fibers have more advantages to use in engineering applications. Automotive sector plays major role to adopt green materials in its different parts (Ashok Kumar et al., 2016). Focusing Emission phenomenon by the world to follow Zero emission norms, scarcity of raw material and environmental friendly status emphasis the use of natural fibers (Warenyou et al., 2005). However, deforestation and scarcity in agriculture field we need to renew the future. Natural fiber composites have many applications because of their ease of fabrication, low prize, high mechanical properties and environment friendly as compared with metal and plastic materials (Vinoth et al., 2016).

The purpose of this work is to develop the material with biodegradability, high strength and excellent mechanical properties of palmyra fibers at different configuration and hybridization. Palmyra fruit fibers is reinforced between the woven jute mats (JPJ) and are molded with vinyl Easter by hand lay up technique. Sisal palmyra Jute (SPJ) fibers are laid as layer, on each stage vinyl ester is applied to mold the material. The same technique is followed to mold (KPC) kenaf palmyra coir fiber composite (Thamilarasan et al., 2016).

Use of natural fiber composite with polyester receiving attention because of biodegradability, renewability, less weight, improved properties and low cost etc., Researchers having investigated the development of various natural fiber composites. Mechanical and water absorption properties of woven jute/banana hybrid composites. Kandeepan et al., 2016 discussed the effect of epoxy coated kenaf fiber. Pulping and Paper properties of palmyra palm fruit fibers (Hafsatsaliu et al., 2015). Mechanical properties of Glass/Palmyra fiber waste sandwich composites (Gupta et al., 2015) Green composites, (Velmurugan et al., 2016) Mechanical characterization of palmyra fruit fiber Reinforced Epoxy composites were discussed.

2. MATERIALS AND METHODS

2.1. FIBERS: After the aforementioned process sisal leaves are soaked in the normal water for 14 days. After two weeks the leaves are taken out from the water and dried under sun light for another two weeks. Then the dried leaves are soaked in to water for two days. Now the fiber is easily extracted from the processed leaves by hand.

In this research, various fibers such as sisal, coir, jute, kenaf and palmyra were extracted by Stem explosion method and are treated by NaOH solution is made by mixing 6% of NaOH and 94% of distilled water in a container. Fibers are lost its old strength due to the extraction process. To retain its strength, they are soaked in the NaOH solution for few hours. We are making the process for 2 hrs. Now the fibers are washed in running water which removes the unwanted particles from the fibers.

Figure 1: Jute Fiber

Figure 2: Palmyra Fiber

Figure 3. Sisal Fiber

Figure 4. Kenaf Fiber

2.3. MOLDING OF SPJ-KPC-JPJ COMPOSITES: First, preliminary composites were produced by putting the biodegradable resin on the surface of fibers and drying at atmospheric pressure. Next biodegradable composite specimens were fabricated by applying pressure through a roller. Equal weight proportions are taken to weigh the fibers such as Sisal, Palm, Jute, Kenaf and coir.

2.3.1. SPJ: Sisal fibers are placed (Spreader) on the polythene sheet which is present on the table. Resin (Vinyl Ester) is applied as a layer on the fiber using brush. Secondly palmyra fiber is spreaded and the resin is applied on it. Thirdly Jute fiber is spreaded on the resin and fourth layer of resin is applied on it. Finally, a polythene sheet is placed on it then the pressure is applied through hand roller. Polythene sheet is placed on the material to remove the air bubbles by applying roller force. The set up is left as it is for 24 hours for curing.

2.3.2.KPC: Kenaf fibers are placed (Spreader) on the polythene sheet which is present on the table. Resin (Vinyl Ester) is applied as a layer on the fiber using brush. Secondly palmyra fiber is spreaded and the resin is applied on it. Thirdly coir fiber is spreaded on the resin and fourth layer of resin is applied on it. Finally, a polythene sheet is placed on it then the pressure is applied through hand roller. Polythene sheet is placed on the material to remove the air bubbles by applying roller force. The set up is left as it is for 24 hours for curing.

2.3.3.JPJ: Two layers of woven jute mats (Bilateral) are placed on the molding bench and are arranged Uni- directionally, in between these mats treated palm fruit fibers are laid. While keeping each and every layer of fiber the application of resin is mandatory to reduce the blow holes which will form during molding. The resin (Vinyl-Ester) is applied in each step. Finally, a polythene plate is placed on it and a roller is used to press over it. This set up is left for 24 hours as it is. It is cut by standard dimensions later on to meet the ASTM standards. After removing the material from the mould it is cut to the required dimensions to carry Tensile, Flexural and Impact tests.

Figure -5: SPJ Composite

Figure -6: KPC Composite

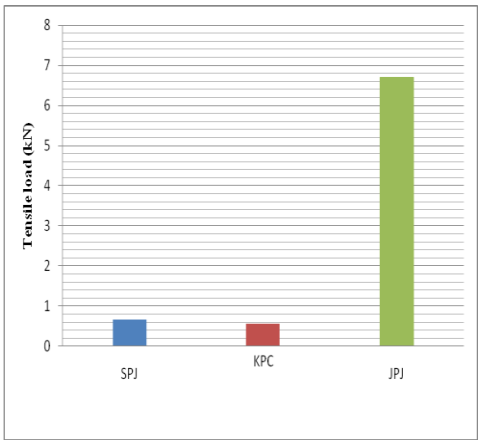
2.4 RESIN-VINYL ESTER:

Vinyl ester is a resin produced by the esterification of an epoxy resin with an unsaturated monocarboxilic acid. The reaction product is then dissolved in a reactive solvent such as styrene to 35-45 percent content by weight. It can be used as an alternate to polyester and epoxy materials in matrix or composite materials. Vinyl ester is lower resin viscosity (200 cps approx) than polyester (500 cps approx) and epoxy (900 cps approx). As with polyesters, strength to weight ratio is very good and because of its low density (1.80 grams/ cc approx).

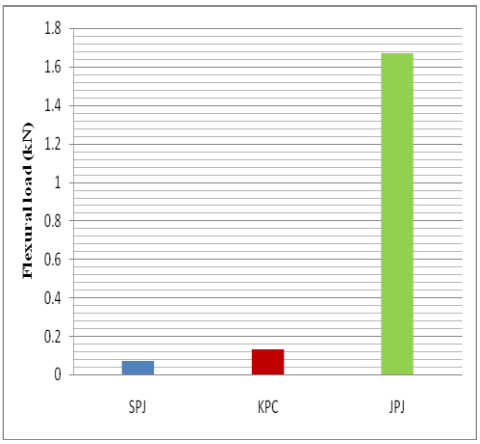
Vinyl ester provides excellent resistance to water, organic solvents and alkalis but less resistance to acids than polyesters. It is stronger than polyesters and more resilient than epoxies. The double bonded vinyl groups give the entire matrix a toughness that exceeds polyesters. As with polyesters, vinyl esters are not practical without additives, reinforcements and fillers (Ganeshan et al., 2016).

3. RESULT AND DISCUSSION

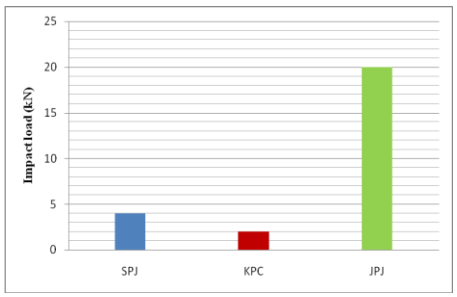
The following graph shows the loads (Flexural, Tensile and Impact) on composites of JPJ, SPJ and KPC



(a)



(b)



(c)

Figure 1a-c: Mechanical properties of the composite Specimen.

From the observed test result it is considerably found that the results of SPJ and KPC composites. JPJ composite absorbs more energy when compared to SPJ and KPC composites. Above graphs shows the flexural, tensile and impact loads and strengths. JPJ composite is possess quite high val-ues (Yoganandam et al., 2016).

4. CONCLUSION:

The mechanical properties of S-P-J fiber, K-P-C fiber and J-P-J fiber were studied, and the tested values are tabulated. High strength bio degradable composite properties such as flexural, tensile and impact strengths of S-P-J and K-P-C fiber hybrid composite is tested, and the results were compared with the J-P-J fiber composite, the second one posse's high toughness. The comparative table shows the results of SPJ and KPC composites. JPJ composite absorbs more energy when compared to SPJ and KPC composites. Above graphs shows the flexural, tensile and impact loads and strengths. JPJ composite is posses quite high values.

REFERENCES

Ashok K.B., Lingadurai, K., Raja, K. and P. Ganeshan, Prediction Effect of Fiber Content on Mechanical Properties of Banana and Madar Fiber Hybrid Polyester Composites. Advances in Natural and Applied Sciences 10: 180-183 (2016)

Ganeshan, P., Raja, K., Lingadurai. K. and M. Kaliappan, Design and Development Of Alternate Composite Material For An Automobile Drive Shaft. International Journal of Applied Engineering Research 10: 12051 - 12057 (2015)

Ganeshan, P. and K. Raja, Improvement on the Mechanical Properties of Madar Fiber Reinforced Polyester Composites. Int. J. Adv. Engg. Tech. 7(2): 261-264 (2016)

Gupta, M.K., Srivastava, R.K. and H. Bisaria, Potential of Jute Fibre Reinforced Polymer Composites: A Re- view. International Journal of Fiber and Textile Research 5: 30-38 (2015)

HafsatSaliu, R., Ishiaku, U. and S. Yakubu, The effect of epoxy concentration and fiber loading on the mechanical properties of ABS/ Epoxy coated kenaf fiber composites Open Journal of Composite Materials 5: 41-48 (2015)

Kandeepan, C., Raja, K. and P. Ganeshan, Investigation On The Mechanical Properties Of Madar Fiber Reinforced In Polymer Matrix Composites, International Conference on Current Research in Engineering Science and Technology PP. 110 -116 (2016)

Thamilarasan, R. and K. Purushothaman, Proceedings of First international conference on recent innovations in Engineering and technology (ICRIEAT) Edupedia publications pvt ltd Newdelhi (2016).

Velmurugan, R. and V. Manikandan, Mechanical properties of Glass/Palmyara fiber waste sandwich composites-Indian Journal of Engineering and Material Sciences 12: 563-570 (2005)

Vinoth, D., Raja, K., Ashok K.B. and P. Ganeshan, Tensile Properties of Madar Fiber Reinforced Polyester Composites. Advances in Natural and Applied Sciences 10: 257-261 (2016)

Warenyou, Sridash and Songklanakarin. Pulping and Paper properties of palmyara palm fruit fibers. J. Sci. Technol. 32(2): 201-205 (2005)

Yoganandam, K., Raja, K., Ganeshan, P. and V. Mohanavel, Mechanical Properties of Calotropis Procera/Agave Fiber Hybrid Rein-forced Polyester Composites, International Jounal of Printing, Packaging & Allied Sciences 4: 3669 – 3673 (2016)