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MECHANICAL CHARACTERIZATION OF SISAL-PALM-JUTE AND KENAF-PALM-COIR HYBRID FIBER REINFORCED COMPOSITES

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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) and Kenaf-Palmyara-Coir (KPC). 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. 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 composite SPJ is more than the other for equal weight fractions.

Key words: Jute, Palmyara, Sisal, polymer resin, Hardener, Woven mat, tensile strength, Flexural strength and Impact strength.J-Jute,S-Sisal,P-Palm.

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 fiber has more advantages to use in engineering applications. Automotive sector plays major role to adopt green materials in its different parts. 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. 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.

Studies on the mechanical properties of natural fiber reinforced polymer resin have shown that fiber length distribution, orientation, type of resin, curing time/method and use of hybrid composites plays major role in determining the mechanical properties. Present study investigates whether the palmyara and its hybrid fibers with polymer binder can be effectively used to replace the plastics in the automotive sector-v. The purpose of this work is to develop the material with biodegradebility, high strength and excellent mechanical properties of palmyara fibers at different configuration and hybridization. Sisal palmyara Jute (SP-J) fibers are laid as layer, on each stage vinylester is applied to mold the maerial. The same technique is followed to mold (KPC) kenaf-palmyara-coir fiber composite.

Use of natural fiber composite with polyester receiving attention because of biodegradability, renewability, less weight, improved properties and low cost etc., Researchers are having investigated the development of various natural fiber composites such as banana (Gupta et al., 2015). The Banana fiber reinforced polymer composite (Thamilarasan et al., 2016). The Mechanical and water absorption properties of woven jute/ banana hybrid composites (Velmurugan et al., 2016). The Mechanical properties of Natural fiber (Banana, Coir,Sisal) (Hafsatsaliu et al., 2015). The effect of epoxy coated kenaf fiber. The mechanical properties of long Bamboo fiber/PLA composite. Pulping and Paper properties of palmyara palm fruit fibers. Mechanical properties of Glass/ Palmyara fiber waste sandwich composites and green composites. Mechanical characterization of palmyara fruit fiber Reinforced Epoxy composites were discussed (Kandeepan et al., 2016).

2. MATERIALS AND METHODS:

2.1. FIBERS: 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 (Ganeshan et al., 2016). In this research, various fibers such as sisal, coir, jute, kenaf and palmyara 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 (Vinoth et al., 2016).

2.2. WEAVING OF JUTE FIBER: For applications where more than one fiber orientation is required, a fabric combining 0º and 90º fiber orientation is useful. Woven fabrics are produced by the Interlacing of warp (0º) fibers and weft (90º) in a regular pattern. The fabric's integrity is maintained by the mechanical interlocking of fibers.

Fibers are combined together to form a thread which makes it very stronger compared to individual fibers. These threads are forming a mat by weaving them. Plain weaving method is used in our project, in plain weaving method each warp fiber passes alternately under and over each weft fiber. Symmetrical fabrics with good stability and porosity (Warenyou et al., 2005). With large fibers this weave style gives excessive crimp and therefore it tends not to be used for very heavy fabrics. It gives nice grip to individual threads (Yoganandam et al., 2016).

2.3. MOLDING OF SPJ-KPC 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 (Ashok Kumar et al., 2016). 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 (Spreaded) on the polythene sheet which is present on the table. Resin (Vinyl Ester) is applied as a layer on the fiber using brush. Secondly palmyara 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 (Spreaded) on the polythene sheet which is present on the table. Resin (Vinyl Ester) is applied as a layer on the fiber using brush. Secondly palmyara 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.

2.3.2 RESIN-VINYL ESTER: Vinyl ester is a resin produced by the etherification 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. As with polyesters, vinyl esters are not practical without additives, reinforcements and fillers.

3. RESULT AND DISCUSSION

Table -5.1 Flexural, Tensile & Impact test values of composite samples

Tensile Test		
Test Parameter	**Values SPJ**	**Values KPC**
Ultimate tensile Load	0.67 KN	0.56
Ultimate tensile strength	4MPa	2 MPa
Impact test Charpy		
Test Parameter	**Values SPJ**	**Values KPC**
Test temp	24ºC	24ºC
Absorbed energy	4 J	2 J

Flexural Test		
Test Parameter	**Values SPJ**	**Values KPC**
Guage width mm	27.57T 15.55F	26.09T 14.50F
Guage Thickness mm	6.36T 5.14F	11.76T 12.14F
Org cross Sec area mm^2	175.3T 79.93F	306.8T 176F
Flexural Load	0.07KN	0.13
Flexural strength MPa	20.44	7.29

From the above result it is observed that the comparative table shows the results of SPJ and KPC composites, KPC posses high value in carrying flexural load only. SPJ composite absorbs more energy when compared KPC composite

4. CONCLUSION

The mechanical properties of S-P-J fiber and K-P-C 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 each other. The First one possesses high toughness. The comparative table shows the results of SPJ and KPC composites, KPC posses high value in carrying flexural load only. SPJ composite absorbs more energy when compared KPC composite. Above graphs shows the flexural, tensile and impact loads and strengths.

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