IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

Experimental Study of Composite Fiber with Epoxy Resin

[1]Joshi Laxmikant, [2]Kadam Mahesh, [3]Londhe Vikram

[1]Lecturer, [2]Lecturer, [3] Principal
[1]Mechanical Engineering,
[1]New Satara College of Engineering & Management (Polytechnic), Pandharpur, India

Abstract : In this paper, study is related to the composite natural fiber when it is treated with the help of bleaching treatment i.e. by chemical treatment like hydrogen peroxide method and after this preparation of laminate by mold to get fiber orientation such as 0^0, 45^0, 90^0 orientation to get matrix structure

Index Terms **– Composite fiber, Sisal fiber, Epoxy Resin**

INTRODUCTION

Metals, ceramics, polymers, and natural fibres are the four basic classes in the history of composite materials. Since 10000 BC, composite materials have been used.

"Composite material can be defined as, material made from two or more material which having significantly different properties". Reinforced polymer and matrix composites are two types of composite materials. This material typically saves a significant amount of weight.

The current experimental study seeks to learn about the mechanical properties and behaviour of natural fibre composites. Natural fibre composites are attracting the attention of researchers, engineers, and scientists all over the world as an alternative reinforcement due to superior properties such as low weight, high strength, fairly good mechanical properties, non-abrasive, eco-friendly,and bio-degradable characteristics.

NEED OF THE STUDY.

Natural fibre composite materials are gaining popularity in both industrial applications and fundamental research. Plants such as Hemp, Sisal, Banana, Jute, Kenaf, Bamboo, and others are used as sources of lingo cellulose fibres. Their appealing properties make them ecological alternatives to glass, carbon, and man-made fibres for composites manufacturing.

Since from last two decades, study of natural fiber composites has lot of scope in various sectors of engineering field such as Mechanical, automobile, civil engineering departments. Now a days NFC are also used in defense equipment, due to the light weight properties with good mechanical and physical properties and having bio degradable properties as they are natural fiber composite.

Gholampour et al. [1] The carbon footprint and greenhouse gas emissions of composites have decreased as a result of an increase in the usage of natural materials in composites. In addition to the advantages of using green materials, there are certain difficulties in doing so, such as the relatively high moisture absorption of natural fiber and the poor compatibility of the reinforcing natural fiber and matrix. Green composites can be a good replacement for materials made from petroleum.

P Peças et al. [2] The majority of studies focus on the mechanical behavior and application performance of natural fibers in comparison to conventional composites. There are numerous varieties of natural fibers, each with unique characteristics that affect whether or not they are used in particular industrial applications. It might be challenging to choose the right fiber for a given application because of the natural origin of these materials, which generally results in a wide range of variances in attributes dependent mostly on the harvesting area and conditions.

MR Sanjay et al. [3] Polymer matrix composite research has grown in importance as a field of study in both academic and industrial circles. Researchers have been focusing on alternatives to synthetic materials as a result of the current trend toward environmentally friendly and biodegradable materials.

K Muthukumar et al. [4] By using a hand layup technique, banana, pineapple, and jute fibre were combined in various volume percentages. Six different sorts of combinations were used during this study.

C Elanchezhian et al.[5] The objective of the current experimental study is to understand how natural fiber composites behave mechanically. Because of their superior qualities, such as high specific strength, low weight, low cost, reasonably good mechanical properties, non-abrasive, eco-friendly, and biodegradable characteristics, natural fibers are attracting the interest of engineers, researchers, professionals, and scientists from all over the world as a substitute reinforcement.

KR Sumesh et al. [6] Banana and coir natural fibers from the southern region of India were used as the reinforcement material. To maximize the elements impacting the tensile, flexural, and impact strength of banana/coir composites, grey relational analysis based on Taguchi was applied. The five main variables employed to optimize the mechanical strengths of epoxy-based composites throughout the compression molding process were banana weight percentage, coir weight percentage, alkali treatment percentage, pressure, and temperature.

So the hand layup method was used to make laminated boards after researching all research on natural fiber. Because of this, it is possible to develop a different process for making laminating boards. The purpose of this study is to fabricate laminating boards utilizing a wooden mold and fiber stitching.

Methodology

1. Selection of Composite Fiber.

Natural fiber composites are made up of a variety of natural fibers from around the world. Some of them have excellent reinforcement as well as mechanical properties. We chose natural fibers with good mechanical properties, such as Sisal and jute, for our laminate preparation. These fibers are also widely available in surrounding areas, and they are inexpensive and have good properties.

2. Chemical Treatment.

Bleaching treatment is very important for removing lignin from the fiber as well as improving the strength of the fibers. Alkali with sodium hydroxide and Peroxide treatment were chosen for chemical treatment. These fibers are effectively treated for one day with a 5% by weight NaOh solution and then washed with distilled water.

3. Fiber Extraction

After chemical treatment next step was the extraction of treated natural fibers for separation purpose. This extraction isdone by using hand. Separated all bananas as well as sisal fibers in single fibers. Due to this process extracted fibers are lignin free.

4. Mold laminate method

Up till now for the preparation of laminate from the composite fiber hand lay- up method is used but to get the fiber orientation we use fiber stitching method. However, for our project, we used a wooden mold fiber stitching method. Small nails were inserted on the upper side of a mold for the purpose of stitching sisal and banana fibers.

5. Laminate Preparation

Following the preparation of the wooden mold, the laminate was prepared using epoxy resin with grades of LY556 and HY917 as Araldite and hardener, respectively. For two plates, orientations such as 0-90 (degree) and 45-45 (degree) were used. Mold nails were used to secure the fibers to the mold. After one 00 layer, there is a 900 layer. Following the completion of all layers, epoxy was applied as a combination of araldite and hardener (epoxy resin) over the layers. Some weight is placed over the plate to ensure uniform thickness, and the plate is ready after 8 hours. In a similar manner, another laminate was created with a 45-45 (degrees) orientation.

6. Testing

Tensile and flexural tests were performed on the prepared laminating plate to analyse its behaviour under loading conditions. The tensile test is performed in accordance with ASTM D638-2003. The specimen for this tensile test was made in the shape of a dumbbell, and the specimen for the flexural test was made in accordance with ASTM D790-2003.

Result

As previously stated, laminate testing was done using ASTM D 638-2003 for tensile and ASTM D 790-2003 for flexural. The figures below depict the behaviour of specimens under loading conditions.

Table 1 summarises the results of all tests, including tensile and flexural tests for 0-90 and 45-45 orientations.

Table 1

No.	Sample no.		Tensile Strength (MPa)	Flexural Strength (MPa)
1	0^0-90^0	No. 1	22.12	64.60
	0^0-90^0	No. 2	68.30	84.18
2	45^0-45^0	No. 1	29.30	50.10
	45^0-45^0	No. 2	15.77	48.02

According to Table No. 1, the material behavior is better for Flexural tests than Tensile tests for orientations 45-45 and 0-90.

REFERENCES

1. Gholampour, A.and Ozbakkaloglu, T.,2020. A review of natural fiber composites: Properties, modification and processing techniques, characterization, applications.*Journal of Materials Science*, *55*(3), pp.829-892.

2. Peças, P.,Carvalho, H., Salman, H. and Leite, M., 2018. Natural fibre composites and their applications: a review.*Journal of composites science*, *2*(4), p.66.

3. Yashas Gowda, T.G., Sanjay, M.R., Subrahmanya Bhat, K., Madhu, P., Senthamaraikannan, P. and Yogesha, B., 2018. Polymer matrix-natural fiber composites: An overview. *Cogent Engineering*, *5*(1), p.1446667.

4. Muthukumar, K., Sabariraj, R.V.,Kumar, S.D. and Sathish, T.2020.Investigation of thermal conductivity and thermal resistance analysis on different combination of natural fiber composites of banana, pineapple and jute. *Materials Today: Proceedings*, *21*, pp.976-980.

5. Elanchezhian,C., Ramnath,B.V., Ramakrishnan, G., Rajendrakumar, M., Naveenkumar, V.and Saravanakumar, M.K., 2018. Review on mechanical properties of natural fiber composites. *Materials Today: Proceedings*, *5*(1), pp.1785-1790.

6. Sumesh, K.R. and Kanthavel, K. 2022.Optimizing various parameters influencing mechanical properties of banana/coir natural fiber composites using grey relational analysis and artificial neural network models. *Journal of Industrial Textiles*, *51*(4_suppl), pp.6705S-6727S.

7. Vigneshwaran, S., Sundarakannan, R., John, K.M., Johnson, R.D.J., Prasath, K.A., Ajith, S., Arumugaprabu, V. and Uthayakumar, M., 2020. Recent advancement in the natural fiber polymer composites: A comprehensive review. *Journal of Cleaner Production*, *277*, p.124109.

8. Khan, T., Hameed Sultan, M.T.B. and Ariffin, A.H.,2018. The challenges of natural fiber in manufacturing, material selection, and technology application: A review.*Journal of Reinforced Plastics and Composites*, *37*(11), pp.770-779.

9. Lau, K.T., Hung, P.Y., Zhu, M.H. and Hui, D., 2018.Properties of natural fibre composites for structural engineering applications. *Composites Part B: Engineering*, *136*, pp.222-233.