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Experimental Analysis of Indian Wild Almond Fruit Fiber Reinforced Polymer Composite

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Abstract: ***Fibre-reinforced polymer composites have played a dominant role for a long time in a variety of applications for their high specific strength and modulus. Past studies show that only synthetic fibers such as glass, carbon, etc., have been used in fiber-reinforced plastics The present work describes the development and characterization of a new set of natural fiber based polyester composites consisting of wild almond fiber as reinforcement. Wild almond fruit fiber composites are developed and their mechanical properties are evaluated, at five different volume fractions. The tests were carried out and the results were presented. Experimental results showed tensile, impact strength properties of the composites are greatly influenced by the increasing percentage of reinforcement of the fiber and indicate wild almond fiber can be used as potential reinforcing material for many structural and non-structural applications formatting.***
Keywords: Tensile Strength, Impact strength, wild almond fiber.

I. INTRODUCTION

The composite material has been used from centuries ago, and it all started with natural fibers. Natural fibers have become important items in the economy and in fact, they have turn out to be a significant source of jobs for developing countries. Today, these fibers are assessed as environmentally correct materials composites in these regimes as it offers an economical and environmental advantage over traditional inorganic reinforcements. In searching for such new material, a study has been made where wild almond fruit fibre is compounded with composite material. Wild almond fruit is the natural fiber from wild almond fruit. This present work addresses the characterization and performance of natural fiber reinforced composite by analysing the effect of fiber volume (%) on composite mechanical properties.

II. REVIEW OF LITERATURE

Muralidharan.et.al [1] (2017) He has studided that Natural fibers are used to reinforce the materials. Many types of natural fibers are investigated for use in plastics, including flax, hemp, jute, sisal and banana. Hybrid fibers have the highest strength they are renewable resources and have marketing appeal.

P N E Naveen, M Yasaswi. [2] (2013) In this project work the results found that the mechanical properties have a strong association with the dynamic characteristics. Both of the properties are greatly dependent on the volume percentage of fibers. The composite having a coir fibers volume of 5% showed a significant result compared to high fiber loading composites due to the effect of material stiffness

Ronald W.Armstrong. [3] (2011) The industrially-important WC-Co composite materials provide a useful, albeit complicated materials system for understanding the combined influences on hardness and strength properties of the constituent WC particle strengths, the particle sizes, their contiguities, and of Co binder hardness and mean free paths, and in total, the volume fraction of constituents.

C.V. Srinivasa.et.al [4] (2011) He has extracted areca fibers from areca husk were chemically treated to get better interfacial bonding between fiber and matrix. Composite were prepared with randomly orientated fibers with different proportions of fibers and matrix ratio.

III. PROBLEM IDENTIFICATION

The main disadvantage of natural fibers in reinforcement to composites is the poor compatibility between fiber and matrix due to the hydrophilic nature of fibers and hydrophobic nature of polymer macromolecules. This is very important issue, since the simple addition of natural–organic fibers to a polymer matrix may lead to poor mechanical properties . Therefore, natural fiber modification is considered in modifying the fiber surface properties to improve their adhesion with different matrices.

IV. PROPOSED METHOLOGY

Fabrication of Indian wild almond fiber reinforced fiber reinforced polyester composites by using hand lay up process to evaluation of mechanical properties such as tensile strength, impact strength of composites and to study the influence the percentage of fiber on the mechanical behaviour of composites the process of the project is explained below step by step process

1) Extracts the wild almond Fiber

Wild Almond fiber is extracted by a process known as decortication where fruits are soaked in water ,crushed and beaten, so that only fibers will remain.

2) Surface Treatment of wild almond fiber. (Alkaline Treated)

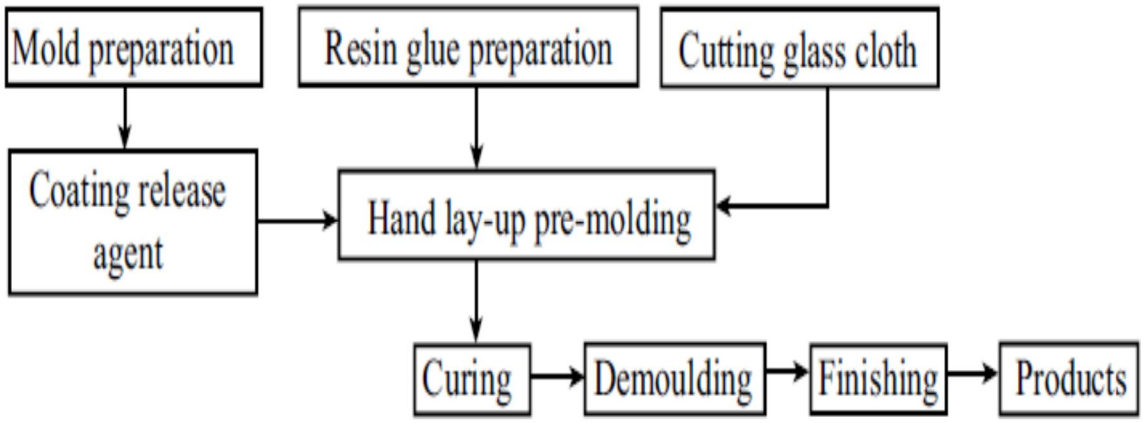
It is one of the most used chemical methods for natural fibers when used to reinforce thermoplastics and thermosets. It removes a certain amount of Lignin, wax and oils covering the external surface of the fiber cell wall. The important modification achieved with alkaline treatment is the disruption of the hydrogen bonding in the network structure, thereby increasing the surface roughness.

3) Preparation of chemical composition.

First, the wild almond fibers were treated in a solution of 10% KOH (Potassium Hydroxide) . The fibers were kept in this alkaline solution for 36 hours at a temperature of 30° C; it was then thoroughly washed in running water then neutralized with a 2% acetic acid solution. Lastly, it was again washed in running water to remove the last traces of acid sticking to it, so that the pH of the fibers is approximately 7 (neutral). Then, they were dried at room temperature for 48 hrs to get alkali treated fibers

4) Preparing the samples using hand lay-up method

Hand lay-up fiber reinforced plastics (FRP) is a typical process of preparing thermosetting polymer matrix composites. We see that there are many manual labours in process. Compounding of fibers and resins and curing reaction process of resin system are the forming processes of composite materials and at the same time, the formation processes of composite material products.



5) Cutting according to the ASTM models.

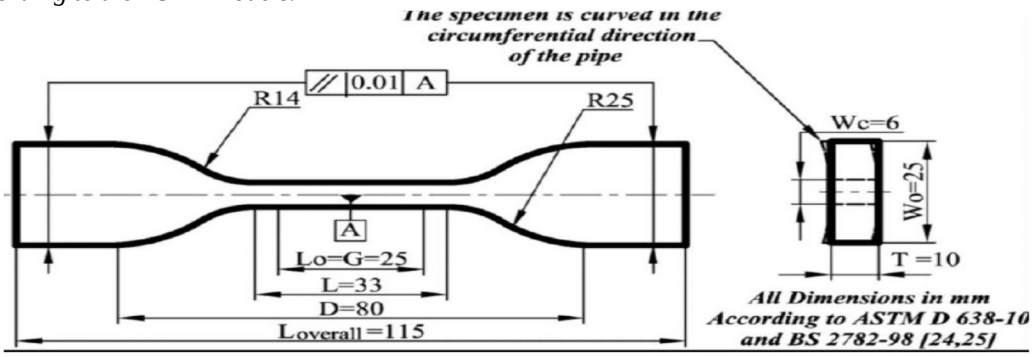


Fig 3.7 ASTM Standard Specimen

6) Testing on the Tensometer and impact test machine.

Tensile test : Test for tensile properties were carried out as described in American Standard Testing and Measurement (ASTM) method D638, using the In the universal testing machine at crosshead speed of 10mm/min using dumbbell test piece. Each tensile specimen was positioned in the universal tester and then subjected to tensile load, as the specimen stretched the computer generated the graph as well as all the desired parameters until the specimen fractured. A graph of tensile stress versus tensile strain was plotted automatically by the computer

A. Steps Fallowed on Tensometer:

1) Switch on the electronic Tensometer
2) Fixing the specimen
3) Start the tes
4) Removing the specimen after print of results

Number of Composite Samples

- Work piece S1= 100% polyester, 0% wild almond fibre
- Work piece S2= 99% polyester, 1% wild almond fibre
- Work piece S3= 98% polyester, 2% wild almond fibre
- Work piece S4= 97% polyester, 3% wild almond fibre
- Work piece S5= 96% polyester, 4% wild almond fibre
- Work piece S6= 95% polyester, 5% wild almond fibre

B. Impact Test

The Izod test is clamped vertically in Izod support fitted on the base of the machine. The support is provided with a machined vertical groove to suit the test piece size. The front clamp piece and the Allen screw enable clamping of the test piece in correct height with the help of Izod setting gauge supplied.

Number of Composite Samples

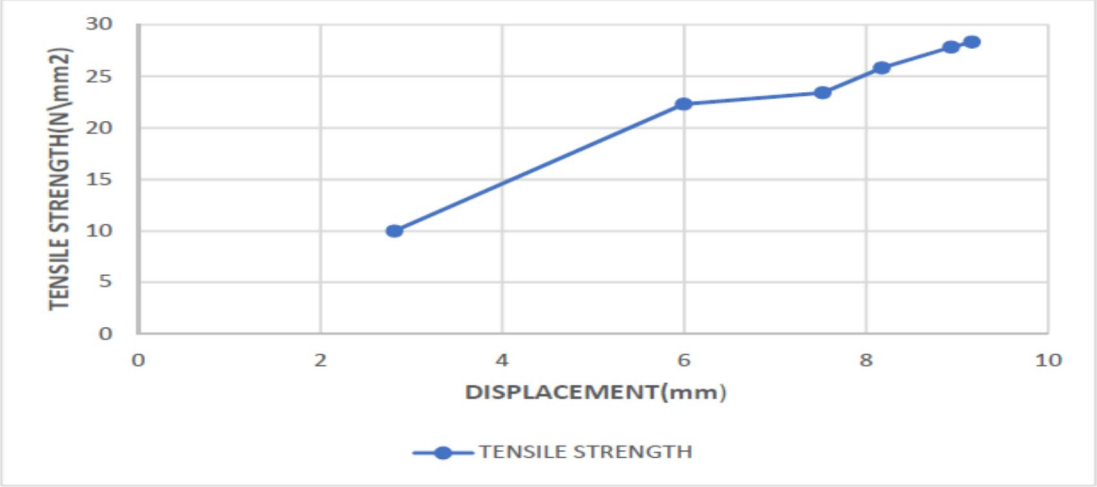
- Work piece S1= 100% polyester, 0% wild almond fibre
- Work piece S2= 99% polyester, 1% wild almond fibre
- Work piece S3= 98% polyester, 2% wild almond fibre
- Work piece S4= 97% polyester, 3% wild almond fibre
- Work piece S5= 96% polyester, 4% wild almond fibre
- Work piece S6= 95% polyester, 5% wild almond fibre

V. RESULTS AND DICUSSION

Tensile tests are simple, relatively inexpensive, and fully ASTM D638 standardized specimen size 165mm×13mm×50mm. As the material is being pulled, we can establish its strength together with how much it will elongate. The point of failure of the material is of significant interest and it is typically called its Ultimate Tensile Strength.

S.NO	Specimen	Break Load(N)	Ultimate Tensile Strength.(N/mm^2)
1	S1	608	10
2	S2	1343	22.3
3	S3	1343.7	23.4
4	S4	1549	25.8
5	S5	1667	27.8
6	S6	1669	28.3

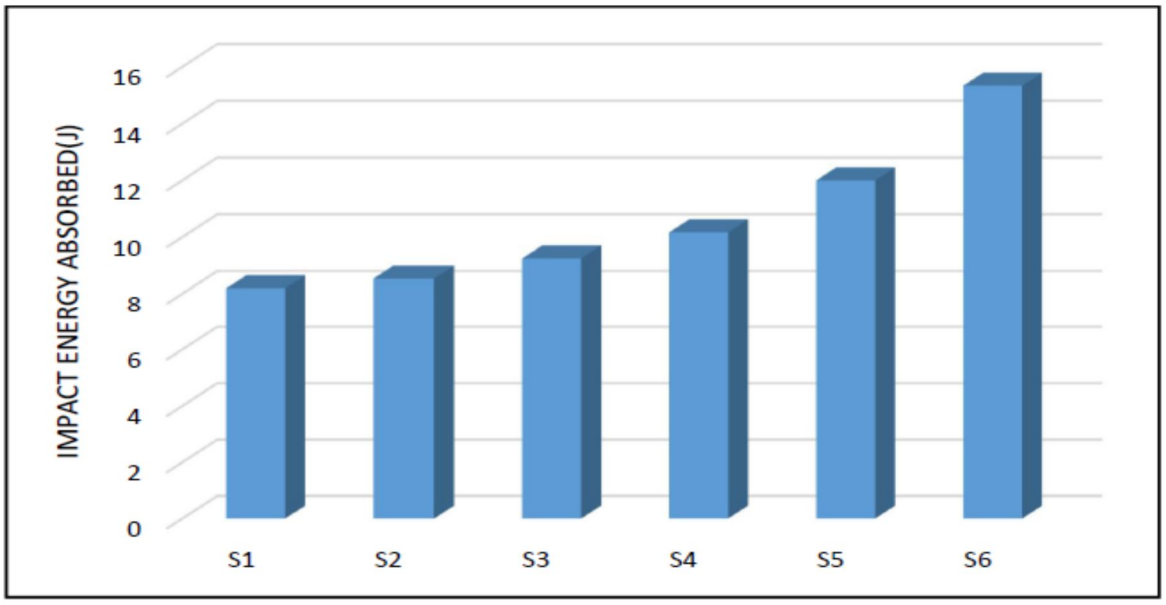
Hence the tensile strength for the composition of 95%polyester and 5%wild almond fiber composition gives the better result as showen in below figure i.e. Break load=1669.7 and Ultimate tensile strength =30.5Mpa.



The impact test specimens are prepared according to the required dimension following the ASTM-D638 standard specimen size 165mm×13mm×3.2mm. During the testing process, the specimen must be loaded on the testing machine and allows the pendulum until it fractures or breaks.

S.NO	Specimen	Impact strength
1	S1	8.2
2	S2	8.5
3	S3	9.3
4	S4	10.5
5	S5	12
6	S6	15.34

Hence the impact strength for the composition of 95%polyester and 5%wild almond fiber composition gives the better result as showen in below figure i.e.,Impact strength =15.34 J



VI. CONCLUSION

The following results obtained for the project work are listed below

1) With the results obtained from the experimental procedure, the following conclusions are observed.
2) As the fibre percent increases the tensile strength increases.
3) The ultimate tensile strength of polyester composite increases with fiber because of
4) formation of proper adhesion between fiber and matrix due proper surface treatment of fibre.
5) Wild almond fibre gives better mechanical properties.

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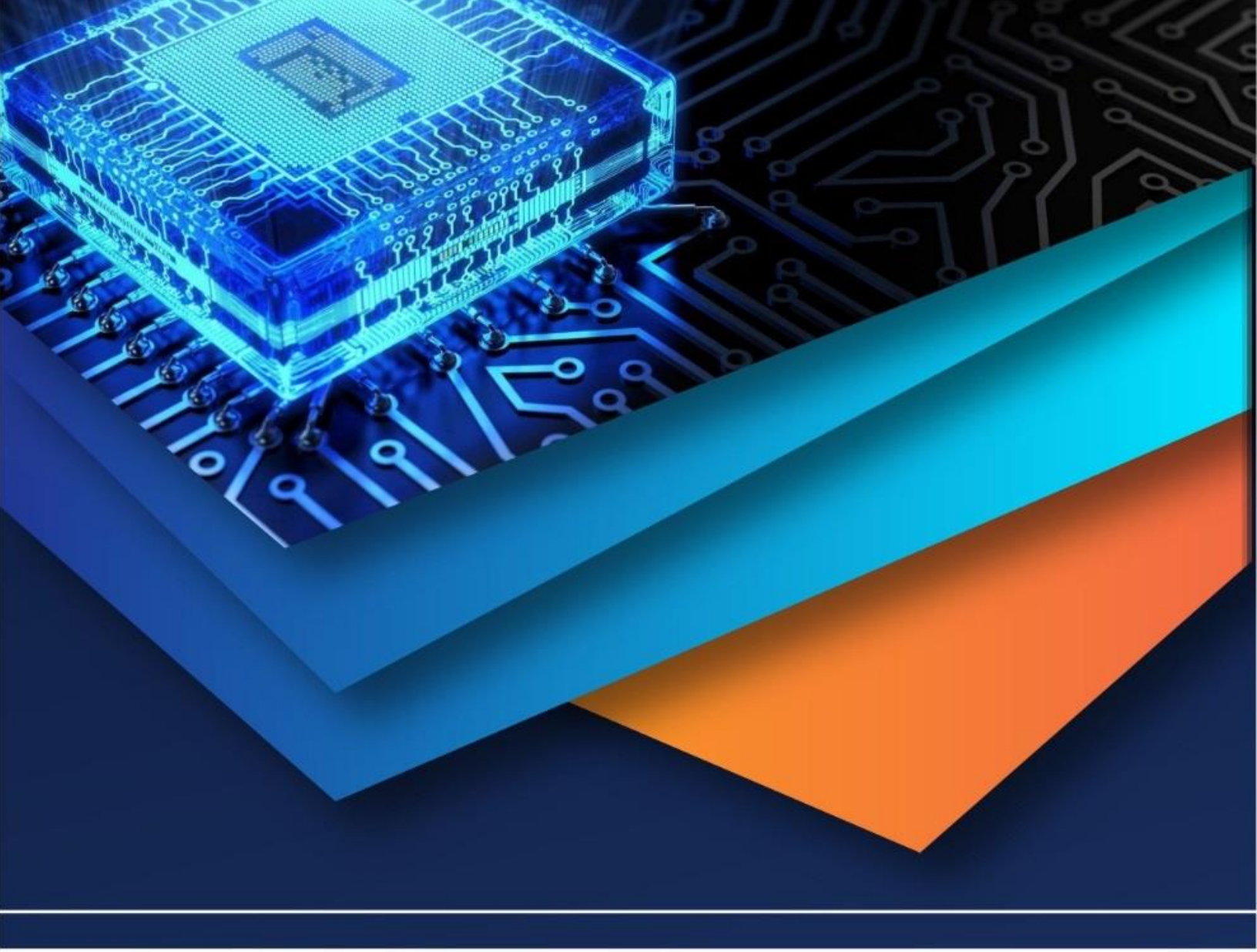

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