IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 7.105 ⁜ Vol. 9, Issue 7, July 2022

DOI: 10.17148/IARJSET.2022.9754

Experimental Analysis of Mechanical Properties on Hybrid Composite Materials reinforced with Sawdust and Husk

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Abstract: In this paper the hybrid composite material is fabricated with the combination of two different reinforcement materials namely saw dust and Husk. The test was conducted in this hybrid composite material according to ASTM D309 from which mechanical properties were taken for estimation. The Tensile and Flexural test were conducted according to the above said standards. The test were conducted with varying fiber percentage composition in the ratio of 40:50 , 60:60 for tensile test and 45:45 ,50:40 for Flexural test. The result were analyzed and the result showed 60:60 ratio of hybrid composite material has high Tensile Strength and 45:45 ratio has high flexural strength. This material can be well utilized for designing lightweight materials like automobiles interior parts, electronics boards and sports utilities.

Keywords: Natural Fibre Composites, Tensile Strength, Flexural Strength.

I. INTRODUCTION

Today replacing the conventional material is main focusing in the world because its costlier than natural fibre polymer composite. Natural fibre has many advantages so that its attracting the interest to engineers, researchers and scientist all over the world as an alternative reinforcement, because of its superior properties such as high specific strength, low weight, low cost [1].Natural fibers seem to be good alternative since they are readily available in fibrous form and can be extracted from plant leaves and steam at very low cost. In recent years, there has been sustained interest in utilizing natural fibers in polyester composites and in manufacturing products based on them with a view to have alternative materials which are energy efficient, economical and eco-friendly. The main objective of this paper is to bring out and analyze the mechanical properties of fabricated material of sawdust and husk reinforced polyester composites. There were plenty of earlier investigations done in the development of polymer composites. Sreenivasan et al [4] investigated the mechanical properties of randomly oriented short SCFP (treated S. Cylindrical fibre/polyester) composites..Zahra Dashtizadeh and Mohammad Jawaid[6] investigated Hybrid composites are made up by two or more fibres in one matrix or two polymer blends and with one natural fibre reinforcement. By hybridising one natural fibre with another natural fibre/synthetic fibre in one matrix, the resulting composite is a unique product (hybrid composites) that displays better mechanical and thermal properties in comparison with individual fibre-reinforced polymer composites. The advantages of developing hybrid composites are that they are more reliable for different applications and more environmental friendly. The natural fiber reinforced composites are being used in various fields of applications that are contributing to the replacement of synthetic fibers composites which consists of Boron, glass fiber, carbon fiber etc.. The composite natural fibers are being used due its light weight, higher specific strength and eco-friendly natural, non –abrasive which also have economic value [9]. Mr. BerhanuTolessaand Dr. Balkeshwar Singh[10] Investigated that natural fibers have a great role in the industrial processes that reduce carbon emissions and recyclable materials that minimize waste. An extra degree of flexibility in fiber composites can be obtained by making what are called hybrid composites, wherein one uses more than one type of fiber. Cost-performance effectiveness can be increased by judiciously using different reinforcement types and selectively placing them to get the highest strength in highly stressed locations and directions. In this work, hybrid fibre composites are prepared with combination of polymer and sawdust with husk to study tensile and flexural. This research investigation shows unique trend for two tests when studied with three different weight percentage compositions. The main objective this paper is to fabricate the sawdust and husk reinforced polyester composites and analysing the mechanical properties of the sawdust and husk reinforced polyester composites.

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II. MATERIALS AND METHODS

A. Materials - Sawdust

Sawdust or wood dust is a by-product or waste product of woodworking operations such as sawing, milling, planning, routing, drilling and sanding. It is composed of fine particles of wood. These operations can be performed by woodworking machinery, portable power tools or by use of hand tools. Wood dust is also the by product of certain animals, birds and insects which live in wood, such as the woodpecker and carpenter ant. In some manufacturing industries it can be a significant fire hazard and source of occupational dust exposure.

Figure 1: Sawdust

B. Materials – Husk

Rice hulls are the coatings of seeds, or grains, of rice. The husk protects the seed during the growing season. The hull is mostly indigestible to humans. Winnowing used to separate the rice from hulls, is to put the whole rice into a pan and throw it into the air while the wind blows. The light hulls are blown away while the heavy rice falls back into the pan. Later pestles and a simple machine called a rice pounder were developed to remove hulls.

Figure 2: Husk

C. Material Preparation

The fabrication process consist of fabricating the saw dust and husk reinforced polyester composites by using the compression moulding machine

The following steps are followed during fabrication process

400gms of polyester resin mixed with the 3 ml of cobalt

Stir continuously until it turned in to white colour

Take 40gms of sawdust and 50gms of husk mix thoroughly and mix with above prepared resin

After that add 2ml of methyl ethyl ketone to the mixture

The moulding box is placed on the OHP sheet than pour the above mixture to prepare the composite plates

Finally take in to the hydraulic compression machine maintain the heat of 600c and pressure of 60kg⁄cm2,for 20 minutes

Allow it to dry 3 to 5 hours.

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III. TESTING OF SAWDUST / HUSK FIBERS POLYESTER COMPOSITE

A. Tensile test

Tensile test is done on the composite material with the size of 165mm x19mm x3mmby using the universal testing machine. We can see the attachment of specimen in UTM machine for tensile test. From the figure shows the composite material before testing. In the tensile test, when the load is applied on the two ends of gauge length, the specimen breaks at the highest ultimate load.

Figure 3: (a) Specimen loaded in UTM machine (b) Specimen before tensile test (c) Specimen after tensile test.

B. Flexural test

Flexural test is also known as bending test and is done on the composite material with size 191mm x19mm x 3mm by using bending test attachment in the universal testing machine. Fig shows the composites specimen before testing in the bending test point load is applied at centre of the material. When the point load is applied, the specimen bends and subjected to bending moments.

Figure4: (a) Specimen loaded in UTM (b) Specimen before flexural test (c) Specimen after flexural test.

IV. RESULT AND DISCUSSION

A. Tensile Properties

The tensile strength for various ratio 40:50 and 60:60 is shown in table 1.in MPa. The tensile strength for 40:50 ratio is 4.58 MPa and makes considerable amount increase in 60:60 ratio as 10.8 MPa. This property is much considerable for developing automobile interior and electronic packaging materials.

TABLE I TENSILE PROPERTIES OF SAWDUST /HUSK COMPOSITE MATERIAL

Composition of Saw dust and Husk (Ratio)	Ultimate Break Load in (kN)	Ultimate Tensile Strength (MPa)
40:50	0.352	4.58
60:60	0.828	10.8

B. Flexural Properties

The flexural strength for various ratios 45:45 and 50:40 is shown in table 1.in MPa. The flexural strength for 45:45 ratio is 13.7MPa and make considerable amount decrease in 50:40 ratio as 9.39MPa. As stated by T.P Sathish Kumar et al [12] and many other literatures, flexural strength is one of the most important parameter to be estimated for structural applications.

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TABLE III FLEXURAL PROPERTIES OF SAWDUST /HUSK COMPOSITE MATERIAL

Composition of Saw dust and Husk (Ratio)	Break Load (N)	Ultimate Flexural Strength (MPa)
45:45	0.029	13.7
50:40	0.020	9.39

V. CONCLUSION

In this research we can observed that this composite material will be act as ductile material. The test were conducted with varying fiber percentage composition in the ratio of 40:50 , 60:60 for tensile test and 45:45,50:40 for Flexural test. The result were analyzed and the result showed 60:60 ratio of hybrid composite material has high Tensile Strength and 45:45 ratio has high flexural strength. It is noted that the same ratio of fiber given good tensile and flexural strength. This composite material will use in automobile interior and exterior components, building ventilations like windows and light weight doors, lock handles, and home kitchen appliances, electronic boards and sports utilities.

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