ISSN: 2582-7219

International Journal of Multidisciplinary Research in Science, Engineering and Technology

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Impact Factor: 8.206

Volume 8, Issue 4, April 2025

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ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

An Experimental Study on Mechanical Properties of Natural Fibre (Foxtail Seed Husk & Sunflower Seed Husk)

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ABSTRACT: In recent years, natural fiber reinforced composites have gained much attention over synthetic fiber composites because of their many advantages such as low-cost, light in weight, non-toxic, non-abrasive, and bio-degradable properties. Many researchers have found interest in using epoxy resin for composite fabrication overother thermosetting and thermoplastic polymers due to its dimensional stability andmechanical properties.

This paper presents the results of a current research of the mechanical properties like ultimate strength and wear loss in composites using natural fiber reinforcements. Foxtail seed husk fiber was selected to this study, in order to get good surface morphology and better bonding of fiber surface with matrix. In this research work, the mechanical and wear properties of foxtail seed husk fiber-reinforced epoxy resin hybrid composites were investigated.

In this work, natural hybrid composites were developed by using foxtail seed husk fiber, sunflower seed husk powder as bio fillers using the compression moulding. This experiment showed how combining many NDT techniques yields a thorough assessment of the integrity of composite materials, enabling more informed maintenance choices and an extended component life. Subsequent research endeavors will Centre on augmenting the sensitivity and precision of these methodologies via sophisticated computational techniques and machine learning algorithms for automated flaw identification and categorization.

KEYWORDS: Natural fibre, composite, Sunflower seed husk, Foxtail seed husk, ResinLY556, Hardner HY951.

I. INTRODUCTION

Hybrid composites are manufactured by combining two or more fibers in a single matrix. Hybrid composites can be made from artificial fibers, natural fibers and with a combination of both artificial and natural fibers. Hybrid composites canhelp us to achieve a better combination of properties than fiber reinforced composites.

In the current scenario, the applications of natural fibers are increasing enormously due to their biodegradability, low-density and better mechanical properties. Hybrid composites can help us to achieve a better combination of properties than fiber reinforced composites. The significance of this research lies in its potential to address two critical challenges: the quest for sustainable materialsand the demand for enhanced mechanical performance. By exploring the mechanical properties of natural fiber hybrid composites, this study seeks to contribute valuable insights to the fields of material science and engineering.

Through meticulous experimentation and analysis, we aim to identify the optimal combinations of natural fibers that lead to improved strength, stiffness, andtoughness, while also considering factors such as cost-effectiveness andenvironmental impact. The findings of this study hold the promise of not only advancing the development of eco-friendly materials but also inspiring the design of innovative solutions in industries ranging from automotive and aerospace to construction and consumer goods.

© 2025 IJMRSET | Volume 8, Issue 4, April 2025| DOI:10.15680/IJMRSET.2025.0804357

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Natural hybrid composite materials are innovative materials that combine two or more components from different natural sources to achieve enhanced properties and performance. These composites are increasingly gaining attention in various industries due to their eco-friendly nature, renewable resources, and superior mechanical characteristics.

The use of natural fibers, such as jute, flax, hemp, sisal, and kenaf, combinedwith a biopolymer matrix (e.g., starch, soy protein, cellulose, or chitosan), forms the basis of most natural hybrid composites. These materials offer several advantages over traditional synthetic composites, including lower production costs, reduced carbon footprint, and biodegradability, making them more sustainable alternatives

II. MATERIALS AND METHODS

The Foxtail seed husk were used to extract the Foxtail plant seeds & sunflower seed husk were extracted from sun flower plant seed. To eliminate the moisture content from the fibre, mechanical dryers were employed. Epoxy (LY556), having a density of 1.13–1.16 g/cm³ and a viscosity range of 1800–12000 MPa·s, makes up the matrix material. The curing agent (HY951) has a density of 0.945 g/cm³ and a viscosity of 600–700 MPa . The method of fabricating the specimen will make use of these materials

III. PROCESS OF MAKING

IV. MECHANICAL TESTING

The purpose of this test is to measure the tensile strength of the composite. The 180 x 20 x 6 mm3 specimendimensions used in the tensile test met ASTM D638 specifications. The specimen is continuously loaded in one direction at both ends of the test until it breaks into two pieces. The test was carried out using an INSTRON 4297 DUAL COLUMN FLOOR MODEL Universal Testing Machine, as can be seen in the figurebelow. The samples were strained at a rate of 50 mm per minute.

The purpose of this test is to evaluate the hardness of the composite material, or how well it can tolerate having its surface penetrated or indented. The harder the subject, the longer the reading will be. The tests wereconducted using the Shore D° Hardness Testing Machine, as shown in the Fig. below. The machine can support up to 150 kg of weight. The specimen dimensions (50 x 50 x 6 mm3) were determined in accordancewith ASTM D2240 requirements.

The purpose of this test is to evaluate the specimen's toughness or impact strength of the composite. For this test, a specimen with a notch is facing the swinging hammer while it is fixed in the anvil. After beingraised to a preset height, the hammer strikes the specimen with the notch immediately. The specimen's impactstrength is the maximum amount of energy it can withstand before breaking under impact. Additionally, the specimen's notch sensitivity is assessed using this technique.As shown in the following Fig., the test was run using TINIUS OLSEN IT504. The impact test specimen's measurements (55 x 10 x 6 mm3) were in accordance with ASTM E23 specification

At Omega Inspection & Analytical Testing lab, wear tests are carried out using pin-on-disc equipment. Specimen testing is conducted using the ASTM G99 standard.The wear testing machine's closed view. The sample can be put through the pin-on-disc procedure to determine its wear rate. A snapshot of a worn device of the Pin-on-Disc type is shown in Fig. In order to establish contact between the test sample specimen and the disc surface, the specimens were roughened by utilising abrasive paper and a rotary cutter to reduce theirsize to 50 x 50 x 20 mm.

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Fig.a. Tensile Testing

Fig.b. Impact Testing

Determined the highest stress the composite can withstand when it is stretched, emphasising its ductility and tensile strength. evaluated the ability of the material to absorb energy during fracture, indicating its resilience and toughness. measured resistance to surface deformation, which shows how well a material can tolerate abrasion and wear. examined wear resistance under particular circumstances, offering information on durability and lifetime for real-world uses. investigated fracture properties and surface morphology at the microscopic level, exposing structural alterations brought on by cryogenic treatment. All of these assessments show how cryogenic treatment enhances composite materials' mechanical characteristics, improving their performance in a variety of applications. Below is a thorough examination of these findings.

V. TABLE OF RESULTS

S.NO	NAME OF THE TEST	TSTING REPORT		
		SAMPLE 1	SAMPLE 2	SAMPLE 3
1	Tensile Strength(KN)	0.620	1.115	1.002
2	Impact Strength (J)	2	4	4

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TESTING REPORT:

TEST PARAMETERS	METHODS	SAMPLE P-1	SAMPLE P-2	SAMPLE P-3
LOAD IN KN (Tensile Strength)	ASTM D 638	0.620	1.115	1.002
IMPACT VALUES IN JOULES	ASTM D 256	2	4	4

VI. CONCLUSION

Renewable natural fibers are potentially a possible substitution for harmful synthetic fibers, which are supported by recent research. Developing alternate reinforcing material is needed to sustain the speedy growth of polymer composite industry in a healthy way.

In this investigation, the Fishtail Palm fiber with coir fiber filler is taken reinforced hybrid composites were fabricated using compression moulding technique. These fabricated composites were tested for the mechanical properties according to ASTM standards under four different combinations. Themechanical properties of the fabricated composites were studied the following results were obtained,

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