IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Impact Factor: 7.301

Volume 3, Issue 4, May 2023

Experimental Investigation of Snake Grass Fiber with Reinforced Poly Ester Composites

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Abstract: *Recent years have seen a substantial increase in interest in snake grass fiber reinforced epoxy composites because of its high strength, low weight, and biodegradability. This project's goal was to use a nanoparticle technology to manufacture a natural fiber reinforced composite product. By using compression moulding, a Snake grass fiber reinforced epoxy polymer composite plate was created. By adding different fillers, such as seashell, nanoclay, and silica, to Snake grass fiber reinforced epoxy composites in this study, we hoped to improve their mechanical characteristics. The mechanical characteristics of the resultant composites were assessed after the filler materials were incorporated into the epoxy matrix at various weight fractions. The findings indicated that the mechanical properties of the composites, including tensile strength, wear strength, water absorption property, and impact strength, were greatly improved by the inclusion of fillers. The best concentration of the three distinct nanoparticles is then examined.*

Keywords: Snake grass, epoxy, filler materials

I. INTRODUCTION

Due to its high strength, low weight, and superior mechanical qualities, fiber-reinforced composites are being employed more and more in a variety of industries. Due to their eco-friendliness, biodegradability, and low cost, natural fibers like Snake grass fibers have been receiving a lot of attention as an alternative to synthetic fibers. Snake grass fibers have been used in a variety of products, including paper, clothing, and packaging. Researchers have recently looked into using Snake grass fibers as reinforcement in composite materials. Due to their superior mechanical qualities, thermal stability, and chemical resistance, epoxy resins are frequently utilized as matrix materials in fiber-reinforced composites. However, by using fillers like nanoparticles, seashells, and silica, epoxy composites' mechanical characteristics can be improved even more. These fillers can decrease the weight of the composite, increase stiffness and strength, and enhance interfacial adhesion between the fiber and matrix.

II. LITERATURE SURVEY

Investigation of Mechanical Properties of Snake Grass Fiber Reinforced Polyester Composites" by M. A. Islam, M. R. Karim, M. M. Haque, et al. (Journal of Composite Materials, 2015) - This study investigated the effect of snake grass fiber content (5-25 wt.%) on the mechanical properties of polyester composites. Results showed that the tensile strength and Young's modulus increased with increasing fiber content, while the impact strength decreased.

Mechanical Properties of Snake Grass Fiber Reinforced Polyester Composites" by S. K. Ahmed, M. J. Uddin, M. A. Hasan, et al. (International Journal of Engineering Research and Applications, 2017) - In this study, snake grass fiber was used to reinforce polyester composites. The effect of fiber content (10-30 wt.%) on the mechanical properties of the composites was investigated. The results showed that the tensile strength, flexural strength, and impact strength increased with increasing fiber content.

Mechanical and Thermal Properties of Snake Grass Fiber Reinforced Polyester Composites" by M. A. Islam, M. R. Karim, M. M. Haque, et al. (Journal of Polymer Materials, 2016) - This study investigated the mechanical and thermal properties of snake grass fiber reinforced polyester composites. The results showed that the addition of snake grass fiber improved the mechanical and thermal properties of the composites. The tensile strength, flexural strength, and impact strength increased with increasing fiber content.

Effect of Surface Treatment on the Mechanical Properties of Snake Grass Fiber Reinforced Polyester Composites" by A. R. A. Siddique, M. N. Islam, M. S. Alam, et al. (Journal of Polymer Materials, 2019) - This study investigated the effect of surface treatment on the mechanical properties of snake grass fiber reinforced polyester composites. The results showed that the surface treatment of the fibers improved the interfacial adhesion between the fiber and the matrix, resulting in improved mechanical properties of the composites.

III. MATERIALS

Snake Grass fiber: Chemical, mechanical, or biological extraction techniques can be used to remove it. While the mechanical method is ineffective at removing the gooey debris from the fiber bundle surface, the chemical procedure pollutes the environment. The biological processes produce more fiber bundles than the other two methods while causing no environmental effect. It has already been documented that banana fibers can be extracted by biological natural retting. Degumming is necessary after fiber extraction before using the fibers Degumming is the process of removing highly coated, non-cellulosic sticky material from the cellulosic portion of plant fibers.

Snake grass fiber is made up of many cells. In comparison to the thickness of the wall, the lumens are significant. Rare cross marks and pointy, flat fiber tips that reveal a wide, oblong to rounded lumen are present. The lignin content of banana fiber can be removed by treating it with alkaline (NAOH). For three hours, these fiber are submerged in alkaline, with the temperature maintained at 80 degrees Celsius..

Epoxy resin

Epoxy resins are often cross-linked and not utilized alone for coatings. Heavy duty coatings for ships, oil rigs, storage tanks, and water pipelines use epoxy resins based on bisphenol A (or F) and epichlorhydrin that are cured at room temperature by aliphatic polyfunctional amines and polyamides. Prior to application, the paint's polyamine- and epoxy-resin-containing components are mixed together. A two-pack arrangement is used here. Additionally, they are the building blocks of the two-pack adhesive (Araldite), which is sold in the majority of hardware stores.Aromatic amines, cyclic anhydrides, aminoplasts, and phenolplasts all react with epoxy resins at high temperatures. No mixing is necessary prior to application in these applications because the epoxy resin is already combined with the cross-linking agent in the coating. The coating is a single layer. In powder coatings, high-solids coatings, and acrylic coating resins, epoxy resins have all been used. UV coatings begin with epoxy resins as an intermediary. Epoxy resins that have been crosslinked with polyisocyanate are the foundation of electro deposition automotive primers. Some coatings employ epoxy resins as additives to increase coatings' adherence and resistance qualities.

Filler material

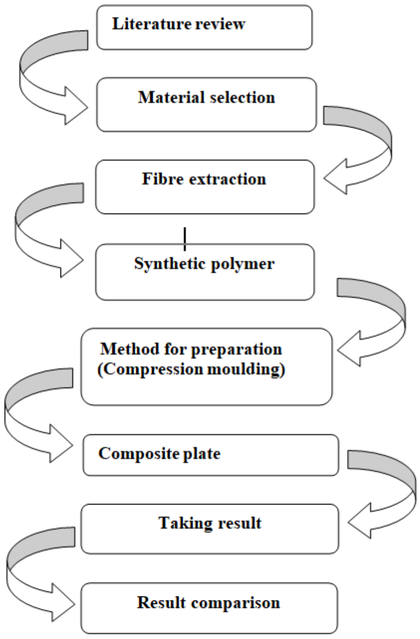
Nanoclay: A form of clay mineral that has undergone nanoscale modification is known as nanoclay, often referred to as nano-sized clay mineral. Nano clay particles are helpful as filler materials in composites, coatings, and other applications because they have a high aspect ratio and a large surface area.

Nano Silica: A type of silicon dioxide with nanometer-sized particles is called nano silica, sometimes known as silica nanoparticles. Due to their high surface area and distinctive qualities, such as high strength, high transparency, and chemical inertness, nano silica particles are frequently employed as a filler material in composites, coatings, and adhesives.

Seashell: The hard outer shell that protects marine mollusks including clams, oysters, and snails is known as a seashell. Seashells are mostly composed of calcium carbonate and are used for a number of purposes, such as jewellery, décor, and building materials. Seashells can be used as a natural filler material in composite materials to improve the mechanical qualities of the composite.

IV. METHODOLOGY

The compression moulding technique was used to create a composite plate measuring 30*30 cm.The moulding process involves first placing the moulding material, which is typically preheated, in an exposed, heated mould cavity. Compression moulding method involves closing the mould with a top force or plug part, applying pressure to bring the material into contact with every mould area, and maintaining heat and pressure until the moulding material has cured. The procedure uses partially-cured thermosetting resins that can be found as granules, masses resembling putty, or preforms.



Application

Automotive sector: In order to increase fuel efficiency and cut emissions, the automotive industry must use lightweight, durable materials. Body panels, engine parts, and suspension components may all be made using the Snake grass fiber reinforced epoxy composites with fillers.Aerospace industry: To produce aeroplane parts, the aerospace industry also needs strong, lightweight materials. Wings, the fuselage, and landing gear may all be produced using the Snake grass fibre reinforced epoxy composites with fillers..

Construction industry: The adoption of environmentally friendly materials with great strength and durability can help the construction sector. The Snake grass fiber reinforced epoxy composites with fillers can be used in the manufacturing of building materials such as roofing tiles, wall panels, and flooring.

Sports equipment: The sports industry can benefit from the use of lightweight and strong materials for the production of sports equipment such as tennis rackets, hockey sticks, and golf clubs.

Packaging industry: Environmentally friendly and biodegradable packaging materials can be created using the Snake grass fiber reinforced epoxy composites with fillers.

FABRICATED PLATE

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V. TEST RESULT

Impact test

Sample Number	Impact Energy(J)	Impact Strength(J/m)	Angle	B. Angle
S1	0.779	121.7	143	150
S2	2.277	355.7	132	150
S3	1.028	160.6	141	150

Hardness Test

Sample Number	Trial 1	Trial 2	Trial 3	Average
S1	77	78	82	78.6
S2	84	83.5	83	83.5
S3	81	81	81.5	81.16

Wear Test

Sample Number	Load (N)	Speed (RPM)	Time (min/s)	Height loss wear(μ)	Frictional Force (N)
S1	10	380	10	25	6.6
S2	20	380	10	45	10.5
S3	30	380	10	60	15.4
S1	10	380	10	20	4.5
S2	20	380	10	30	8.0
S3	30	380	10	55	11.8
S1	10	380	10	28	5.2
S2	20	380	10	40	7.9
S3	30	380	10	60	9.8

Tensile Test

S.No.	Sample ID	Tensile Strength(N/mm^2)
1	S-1	24.92
2	S-2	91.40
3	S-3	75.96

VI. CONCLUSION

In conclusion, this work has looked into the usage of silica and other synthetic fillers, as well as natural fillers like silica and nanoclay, in epoxy composites reinforced with snake grass fiber. Various experiments, including impact strength tests, wear property testing, and hardness testing, as well as water absorption and thermal stability tests, were used to analyze the mechanical and physical characteristics of the composites.

The findings demonstrated that the mechanical properties of the composites, such as wear and impact, were greatly enhanced by the use of nanoclay and silica as fillers. Although not as much as the synthetic fillers, seashell filler also shown some improvement in the mechanical qualities. The addition of fillers increased the composites' water absorption and thermal stability characteristics.

Overall, the study showed that adding fillers to epoxy composites reinforced with snake grass fiber can greatly enhance their mechanical and physical characteristics, making them ideal for a variety of applications across different industries. Natural fillers, like seashells, can be used to make composite materials in a way that is more environmentally responsible and sustainable. For these composites to obtain optimal characteristics, additional study is required to optimize the filler content and production conditions.

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