Enhance the Mechanical Properties of Prosopis Juliflora and Maize Fiber Reinforced in Polyester Resin Composites

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ABSTRACT

In recent year's Natural fiber reinforced composite (NFRC) are considered as a suitable alternative to engineering material. They have excellent properties and are being extensively used in verity of engineering application like Automobile and aerospace etc. This project work examines the mechanical properties of maize fiber and Prosopis Juliflora particles reinforced polyester composites with various ratio 70.30 %, 65.35% and 60.40%. This project work examines the mechanical properties of maize fiber and Prosopis Juliflora particles reinforced polyester composites with the aim of producing a composite material. Composite samples are produced from these mixtures and the Effects of the Tensile, Compressive, Flexural, Impact strength were studied.

Key words: NFRC, Prosopis Juliflora, maize fiber, powder hand-lay-up method, tensile & compressive Properties, UTM.

INTRODUCTION

By definition "A composite material is considered to be one that contains two or more distinct constituents with significantly different macroscopic behaviour and distinct interface between each constituent. It has characteristics that are not depicted by any of the components in isolation."

Due to their many advantages they are widely used in the aerospace industry, in a large number of commercial mechanical engineering applications such as machine components, internal combustion engines; automobiles, thermal control and electronic packaging, railway coaches and aircraft structures, mechanical components such as drive shafts, tanks, brakes, pressure vessels and flywheels, process industries.

METHODS OF MOULD FABRICATION:

The most popular type of Open Moulding is Hand Lay-up process. The Hand Lay-up is a manual, slow, labor consuming method, which involves the following operations. The mould is coated by a release anti-adhesive agent, preventing sticking the moulded part to the mould surface. The prime surface layer of the part is formed by applying gel coating. A layer of fine fiber reinforcing tissue is applied.

Layers of the liquid matrix resin and reinforcing fibers in form of woven fabric, rovings or chopped strands are applied. The resin mixture may be applied by either brush or roll. The part is cured (usually at room temperature). The part is removed from the mould surface. The disadvantages of the Hand Lay-up method are: low concentration of reinforcing phase (up to

30%) and low densification of the composites (entrapped air bubbles.

Applications of Natural Fiber Composites:

The natural fiber composites can be very cost effective material for following applications are Building and construction industry: Panels for partition and false ceiling, partition boards, wall, floor, window and door frames, roof tiles, mobile or pre-fabricated buildings which can be used in times of natural calamities such as floods, cyclones, earthquakes, etc.

1. Storage devices: post-boxes, grain storage silos, bio-gas containers, etc.

2. Furniture: chair, table, shower, bath units, etc. Electric devices: electrical appliances, pipes, etc.

3. Everyday applications: lampshades, suitcases, helmets, etc.

4. Transportation: automobile and railway coach interior, boat, etc.

Advantages of Natural Fiber Composites:

- Low specific weight, resulting in a higher specific strength and stiffness than glass fiber.
- It is a renewable source, the production requires little energy, and CO2 is used while oxygen is given back to the environment.
- Producible with low investment at low cost, which makes the material an interesting product for low wage countries.
- Reduced wear of tooling, healthier working condition, and no skin irritation.

LITERATURE SURVEY

1. Sripathy Malaiah, Krishna Vinayak Sharma, M Krishna —Investigation on Effect of Fiber and Orientation on the Properties of Bio- Fibre Reinforced Laminatese (January 2023)

"The results shows the tensile strength and flexural strengths of the jute and bamboo laminates higher at 0/90 orientation and jute shows the highest in both tensile and bending strength"

2. Dr. Shivappa, Ananda. G. K, Shivakumar.N Mechanical Characterisation Polymer Composite 2023, November.

"In this study, composites were prepared with unmodified Rice Husk Flour (RHF) as a filler and Unsaturated Vinlyester Resin (UVR) as the matrix. 0%, 2.5%, 7.5% and 10% by weight of filler percentages were used in order to gain insights into the effect of filler content on the mechanical properties (Tensile and Flexural) of the composite produced using Hand Layup method"

3.Vasanta V, Cholachagudda, Udayakumar A,Ramalingaia MechanicalCharacterisation Of Coir And Rice Husk Reinforced Hybrid Polymer Composite 8, August 2022.

They have chosen coir fiber as the major reinforcement and rice husk as an additional fiber to improve the mechanical property of polymer composite with vinyl ester as the base material prepared by hand layup process according to ASTM standards. Test Samples are prepared with different weight fractions of coir fiber at the optimization point of tensile test a small percentage of rice husks are added and tests were conducted and the improvement in mechanical properties (tensile strength and flexural strength) of the hybrid composite material is observed.

4. PPSimone Maria Leal Rosaa, Evelise Fonseca Santosb, Carlos Arthur Ferreiraa,

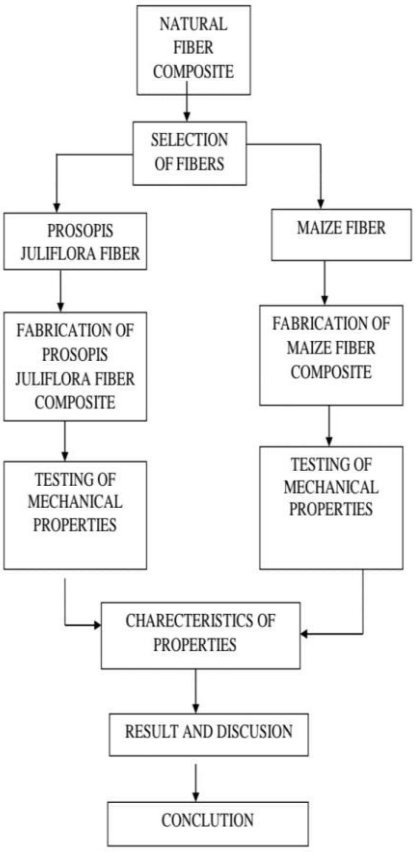
Sônia Marlí Bohrz Nachtigallb Studies on the Properties of Rice-Husk-Filled-PP Composites, 2022

In this work composites of polypropylene (PP) and rice husk flour (RHF) were prepared by melt extrusion. Maleic anhydride- modified PP (MAPP) was added as a coupling.

OBJECTIVE OF THE PROJECT

- Reduced cost
- Developing cultivation
- Increase in reliability
- Developing the country
- Pollution control
- Environmental friendly
- Developing agriculture field
- Reduce for earthquake & explosive loss

METHODOLOGY



SELECTION OF MATERIALS

1. Prosopis Juliflora

2. Maize Husk

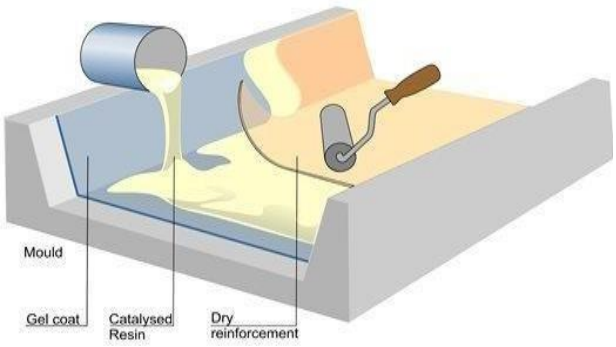
3. Polyester resin
4. Catalyst (cobalt octate).
5. Accelerator(methyl ethyl ketone)

PROCESSING OF FIBERS

Prosopis Juliflora Fiber and Maize fibers are cleaned thoroughly and later chopped them in tiny sizes. These fibers are chemically treated by alkali method with 5% sodium hydroxide (NaOH) and thoroughly rised with distilled water for 2-3 times and placed them in oven for 70 minutes at 60° C. The polymer matrix is mixed with catalyst and promoter.

FABRICATION WORK
HAND LAY UP METHOD

- The Natural Fiber Reinforced polymer matrix composites were fabricated using hand lay-up method.
- Prosopis Juliflora Fiber and Maize fibers was cleaned
- We prepared the mould of size. 300mm×270mmx5mm moulding plate



Hand Lay Up Method

- Another moulding plate made of mild steel was used with dimensions of 300×270×10mm
- A 100 ml quantity of polyester resin was mixed with 10 gm of fiber
- Stirring was carried out to achieve homogeneous condition.
- Catalyst of 10 ml was added to mixture to increase recrystallization temperature.
- Poly vinyl was applied inside the mould to prevent rubbing.
- The mixture was poured into the mould.

Parameter Details And Particle Size Range

Ratio	Maize-Husk gm	Prosopis Juliflora gm	Polyester Resin ml
Plate 1	15	15	70
Plate 2	17.5	17.5	65
Plate 3	20	20	60

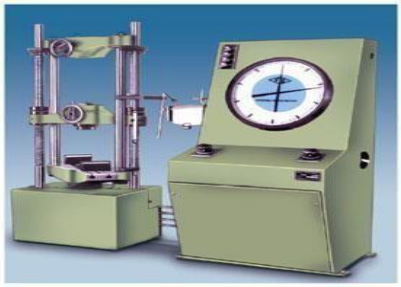
Reinforcement	Particle size range (µm)
MAIZE-HUSK	150
PROSOPIS JULIFLORA	150

TESTING METHODS

1. TENSION TEST

UTM Machine

2. COMPRESSION TEST



Test Sample

3. FLEXURAL TEST

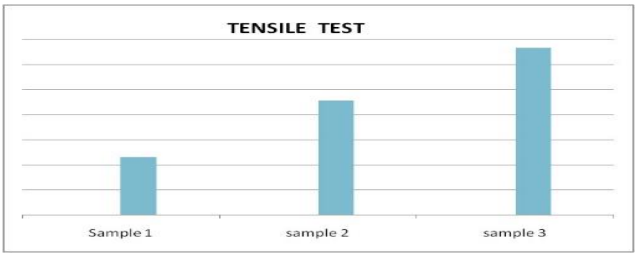
4. IMPACT TEST

FABRICATED IMAGE

RESULTS AND DISCUSSION

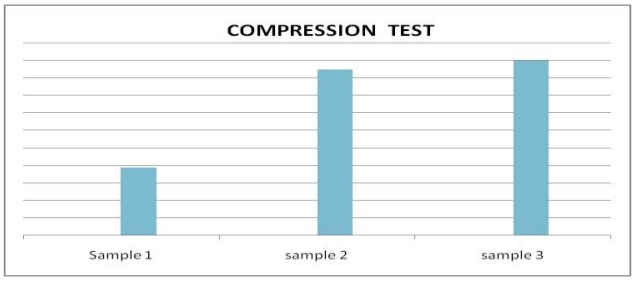
1. Tensile Test Result

Sample No.	%Elongation	UTS [N/mm²]
Plate 1	2.560	36.244
Plate 2	2.769	34.677
Plate 3	2.967	41.720



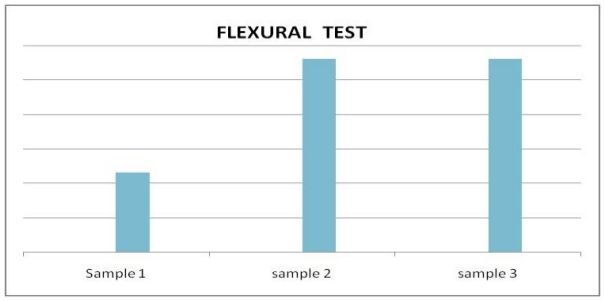
2. Compression Test Result

Sample Number	Compressive Strength [N/mm²]
Plate 1	32.237
Plate 2	34.799
Plate 3	38.801



3. Flexural Test Result

Fiber ratio	Flexural Strength (MPa)
Sample 1	78.437
Sample 2	79.524
Sample 3	88.957

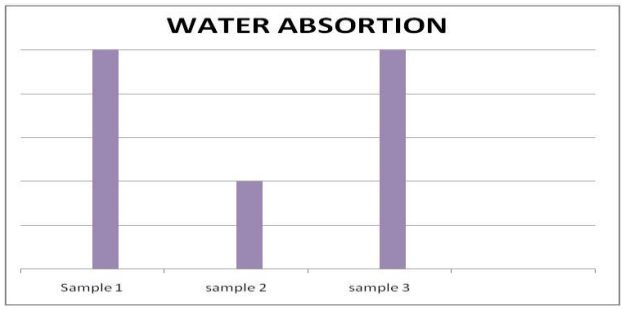


4. Impact Test Result

S No	Sample Number	Impact value in (J)
01	Sample 1	11.5
02	Sample 2	18.4
03	Sample 3	18.9

5. Water Absorption Test Result

Sample Number	% of water absorption
Sample 1	0.01
Sample 2	0.01
Sample 3	0.00



CONCLUSION

- The Prosopis Juliflora Fiber and Maize fibers 60.40 ratio Sample best yields compression strength of about **41.720 N/mm²**.
- The Prosopis Juliflora Fiber and Maize fibers Sample 60.40 ratio yields compression strength of about **38.801N/mm²**

- The Prosopis Juliflora Fiber and Maize fibers 60.40ratioSample best yields impact strength of about **18.9 J**
- The Prosopis Juliflora Fiber and Maize fibers 60.40 ratio Sample best yields flexural strength of about **88.957 MPa**.
- The Prosopis Juliflora Fiber and Maize fibers 60.40 ratio Sample best result is **0.00** %.

REFERENCES

1. Sripathy Malaiah, Krishna Vinayak Sharma, M Krishna Investigation on Effect of Fiber and Orientation on the Properties of Bio-Fibre Reinforced Laminatese (January 2013) PP: 65-70‘”
2. Dr. Shivappa, Ananda. G. K, Shivakumar.N Mechanical Characterisation Rice Husk Flour Reinforced Vinylester Polymer Composite ISSN: 2319-8753, Vol. 2, Issue 11, November 2013.
3. Vasanta V, Cholachagudda, Udayakumar A, Ramalingaia “Mechanical Characterisation Of Coir And Rice Husk Reinforced Hybrid Polymer Composite August 2022”
4. PP Simone Maria Leal Rosaa, Evelise Fonseca Santosb, Carlos Arthur Ferreiraa, Sônia Marlí Bohrz Nachtigallb Studies on the “Properties of Rice- Husk-Filled-PP Composites” May 2022
5. Sobukola, O. P., Kajihausa, O. E., Onwuka, V. I. and Esan, T. A. Physical properties of high quality maize (Swam 1 variety) seeds (Zea mays) as affected by moisture levelsAfrican Journal of Food Science Vol. 7(1) pp. 1-8, January 2013 DOI: 10.5897/AJFS11.167 ISSN 1996 0794
6. William Joseph Stuar Composite Materials Hand Layup Lab Oregon Institute of Technology Klamath Falls, OR 97601
7. Samrat Mukhopadhya, Raul Fangueiro—Banana Fibers Variability and Fracture Behaviour‖ Journal of Engineered Fibers and Volume 3, Issue 2-2018
8. Ningpan, division of Textile and clothing, biological and the agricultural engineering dept., university of California, davis they have published on Journal of Composite 2017
9. B.Babu, S.Meinathan, P.Manikandan, P.Lingeswaran, S.Nanthakumar, A.Yas minebegum and R.Girimurugan, “Investigation on the characterization of hot extruded AA7075 based metal matrix composites developed by powder metallurgy”, 2603 (2023).
10. J. Yasin, S. Selvakumar, P.M. Kumar, R. Sundaresan, and K.M. Arunraja, Experimental Study of TiN, TiAlN and TiSiN Coated High Speed Steel Tool, Mater. Today Proc., 2022, 64, p 1707–1710. https://doi.org/10.1016/j.matpr.2022.05.468
11. P.Thangavel, K.M.Arunraja, S.Prakasam, P.Lingeswaran, “Investigation of AA7075 MMC Reinforced by Al0.5cocragnic Heap Through Stir casting and Cryorolling.
12. Lingeswaran P, Nagaraj J, “Design & Fabrication of Electro Magnetic Clutch System for Four-Wheeler”, ISSN No: 2583 0368, Special Issue, March-April 2023, Vol 3 (02), 81-82.
13. P.Lingeswaran, “A study on Electro chemical discharging drilling of soda-lime-silicon-glass with aid of modified setup”, ISSN: 2582-3930,

Volume 05, Issue 05, May 2021.

14. R. Girimurugan, K.M. Arunraja, A. Shanmugam, S. Saranya, M. Vigneshwaran, The effects of nano-alumina particles on the enrichment of tensile, flexural and impact properties of carbon fiber-reinforced epoxy composites, Materials Today: Proceedings, 2023, ISSN 2214-7853, https://doi.org/10.1016/j.matpr.2023.04.053.

15. Mathew Joseph P. Lingeswaran, "New Product Development of Advanced Tube Conveyor Shrink Tunnel for Packaging Industry", Vol. 4, Issue 05, 2016 | ISSN (online): 2321-0613.