

MANUFACTURING OF SAND AND NATURAL FIBRE REINFORCED COMPOSITES

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CP301
DEVELOPMENT
ENGINEERING
PROJECT

ABSTRACT

- To explore the potential of using Sand and Natural fiber (Rice Straw) to manufacture a composite.
- To inspect the physical and mechanical properties of the formed composite material.
- To analyze if the composite can be utilized as a sustainable, eco-friendly and cost effective alternative that can meet performance requirement of various industries.

OBJECTIVE

- To determine optimal proportion of sand and rice straw for making the composite.
- To evaluate the tensile and impact strength of the composite.
- To analyze the potential applications of the composite.
- To estimate the environmental and economic benefits of using this composite.

MATERIALS USED

- Epoxy – ER099 and Hardener
- Sand
- Rice Straw

EQUIPMENTS USED

- Universal Testing Machine
- Izod Impact Testing Machine
- Sieving Machine

METHODOLOGY

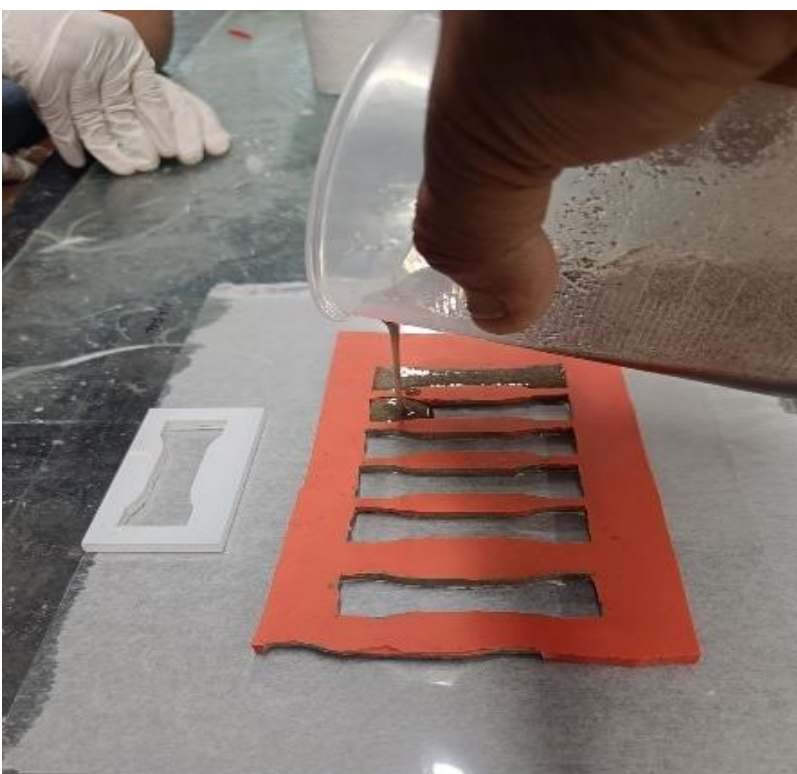
Phase – 1 : Sand Reinforced Composite



Separation of Sand using Sieving Machine



300 μ m Sand Particles



Epoxy and Sand Mixture into tensile sample mold



Get samples of varied compositions

Phase – 2: Sand + Rice Straw Reinforced Composite



Rice Straw



Cutting of Rice Straw



Epoxy+ Sand+ Rice Straw Samples



Impact Test Samples

TESTING METHODS



Universal Testing Machine For Tensile Test



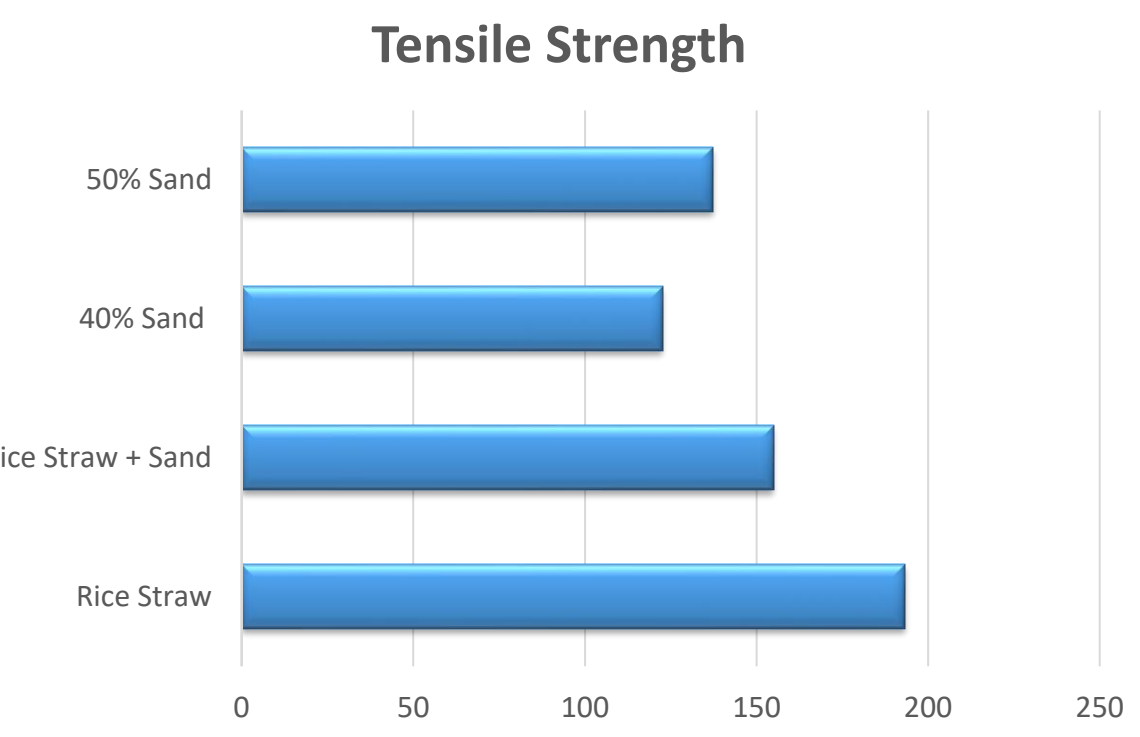
Izod Impact Test for samples

CONCLUSION

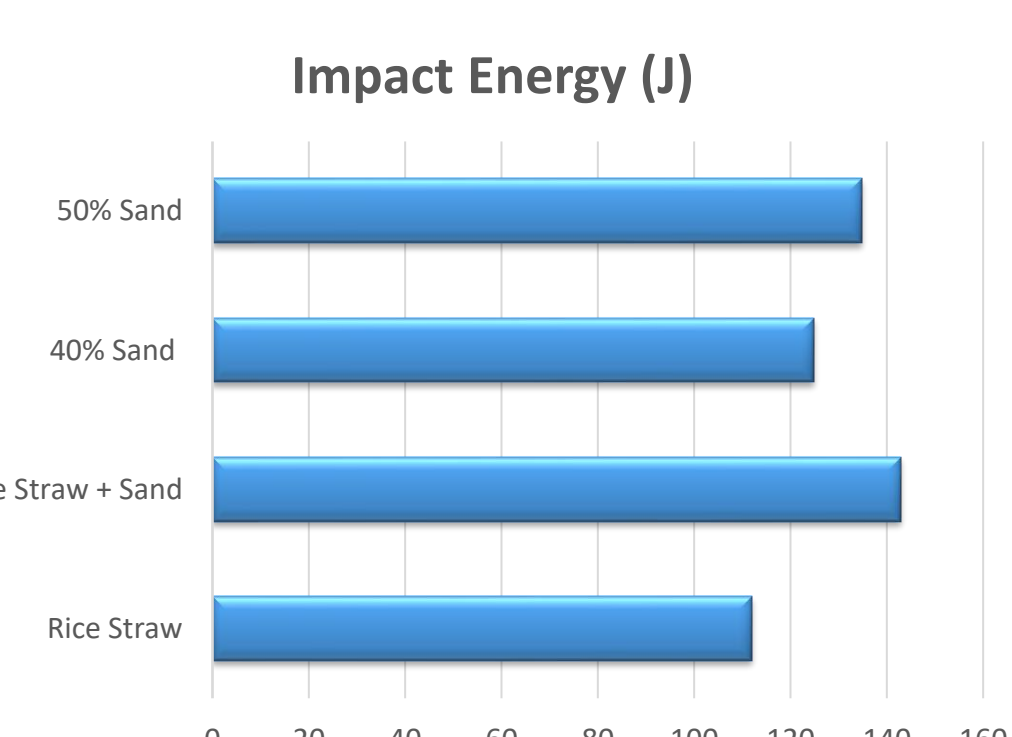
- The incorporation of Rice Straw into the Sand reinforced composite has shown better results for impact resistance which validates that utilizing this mixture is beneficial.
- One potential reason for less tensile strength of the sand reinforced composite can be bonding issues between epoxy and sand particles.
- The inclusion of rice straw fibers enhances mechanical properties, while the high silica content of rice straw ash provides excellent thermal insulation properties.
- The increased water absorption observed with the addition of these materials can provide benefits such as improved moisture regulation and dampening effects, which may be advantageous in specific climates or environments.
- In-order to stop the bullet from penetrating, the sample should resist more impact. One potential obstruction for this can be due to melting of epoxy and sand mixture near the area where the bullet hits. Optimized composition and post processing can prevent this issue.

RESULTS

Tensile Test



Impact Test



Observation

- The impact energy is higher for mixtures containing sand and rice straw compared to sample containing only sand or only rice straw.
- Tensile Strength of Mixture is higher than only sand sample however only rice husk has highest tensile strength

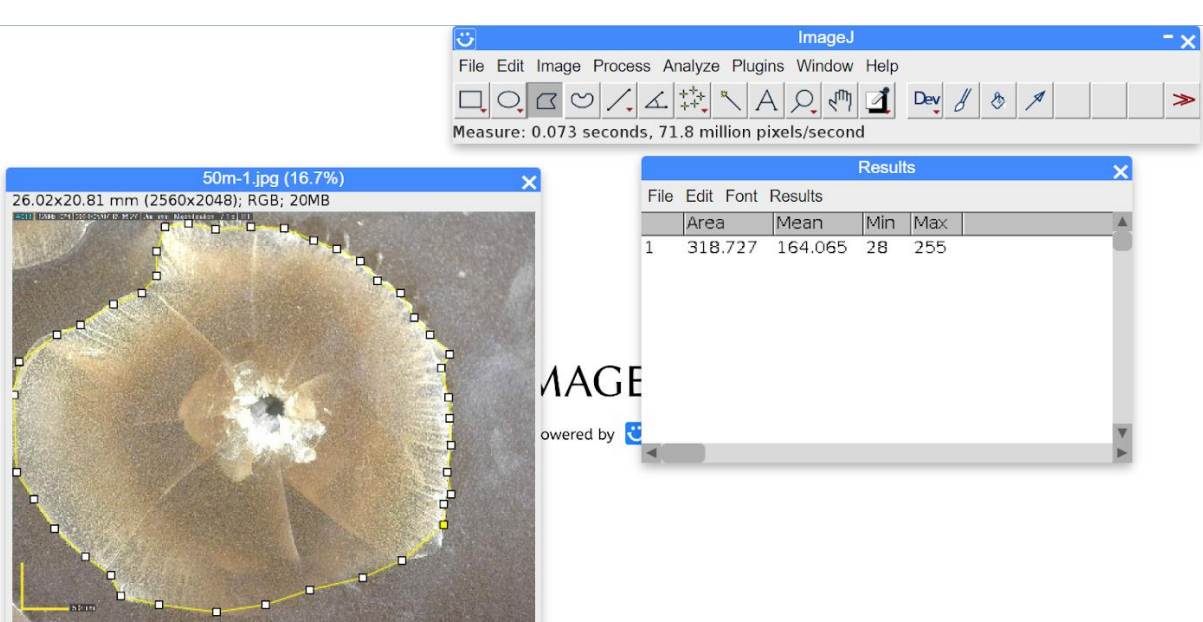
POTENTIAL APPLICATION – BULLET PROOF



Sand- Reinforced Tested Sample



INSAS Bullet



Impacted Area using Image J

Immediately after the Phase-1, the sand reinforced composites were tested with INSAS 5.66mm Diameter bullet. A single plate of 13x13x0.5cm could withstand 5 bullets. It showed good impact energy absorption, however the bullet has penetrated. With further enhancements and incorporation of rice straw it is expected to show better results.

FUTURE WORK

- To perform testing on different types of sand particles and epoxy to find out the best bonding composition to enhance strength and impact resistance.
- To find out if incorporation of any other natural fiber along with rice straw which can provide more impact resistance and strength which will be favorable for bullet proof application.
- To optimize several other parameter like post processing techniques and treatments to provide better results.