



National Science Fair Synopsis

Project ID	NSF-SCH-2025-60
Project Title	Bright Waste: Making Translucent Eco-Tiles from Rice Husk Ash and Clear Resin
Level	Primary level (V-A)
Category	Physical Science
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ABSTRACT

Agricultural waste such as rice husks is often burned or discarded, causing pollution and waste of valuable silica-rich material. This project aims to transform rice husk ash (RHA) — a by-product obtained from controlled burning of rice husks — into a useful and visually appealing material. By combining RHA with clear resin, translucent eco-tiles were developed and tested for their strength, translucency, and water absorption. Tiles were made using different proportions of RHA (10%, 20%, 30%, and 40%) mixed with transparent resin and cured in molds. Results showed that increasing RHA content reduced translucency but moderately improved strength up to 20–30% loading. Higher RHA levels made tiles more opaque and slightly brittle. The optimum composition balanced light transmission and durability at 20–30% RHA. These eco-tiles demonstrated potential for use in decorative and sustainable building applications such as wall panels or skylights. The study highlights a novel and practical way to upcycle rice husk waste into a lightweight, semi-transparent, and eco-friendly construction material.

INTRODUCTION

Every year, large amounts of rice husk — the outer covering of rice grains — are discarded as agricultural waste. When these husks are burned in open fields, they produce smoke and ash that cause air pollution. However, this ash, known as rice husk ash (RHA), is rich in silica, a mineral that can strengthen and reinforce building materials. At the same time, modern architecture increasingly demands materials that are not only strong and eco-friendly but also visually attractive, such as translucent tiles that allow natural light to pass through.

This project explores a new way to reuse rice husk ash by mixing it with clear resin to form translucent eco-tiles. The idea is to combine waste reduction with creative design — turning discarded rice husk ash into lightweight, semi-transparent tiles that could reduce dependence on energy-intensive glass or ceramic tiles. These eco-tiles are expected to be durable, sustainable, and decorative, making them suitable for green buildings, skylights, and interior panels.

By developing and testing these tiles with different proportions of RHA and resin, this research aims to identify an eco-friendly material that balances translucency, strength, and environmental benefits, promoting a brighter and more sustainable future.

PROBLEM STATEMENT:

Rice husk — a plentiful agricultural by-product — is often burned or dumped, creating air pollution and wasted material. Conventional tiles (ceramic, glass) consume energy and raw materials. There is a need to develop sustainable building/decorative materials that

- (a) use agricultural waste,
- (b) reduce pollution and resource use, and
- (c) provide useful properties such as translucency and reasonable mechanical strength for indoor architectural applications.

This project addresses the problem by studying whether rice husk ash can be combined with clear resin to create translucent eco-tiles that are strong, durable, and capable of allowing light to pass through — providing both environmental and aesthetic benefits.

HYPOTHESIS

Tiles made with moderate RHA content (10–30 wt. %) in clear resin will retain useful

translucency (>50% light transmission for 10–20% RHA), maintain adequate mechanical strength for decorative/low-traffic applications, and show acceptable water uptake when surface cured or sealed.

DESIGN OF STUDY:

VARIABLES

* **Independent variable:** RHA content (wt% of total composite) — suggested levels: 0% (control), 10%, 20%, 30%, 40%.

* **Dependent variables:** Light transmittance (%), maximum load to failure (kg or N), water absorption (%), surface hardness (pencil scale or scratch test), optical haze/clarity (qualitative).

* **Controlled variables:** Resin type & brand, hardener ratio, curing time & temp, tile thickness (e.g., 10 mm), mold geometry, RHA particle size (<75 μm), mixing procedure.

PROCEDURE:

Step 1: Preparation of RHA

- * Collect rice husks.
- * Burn in a controlled environment (not open fire) at ~600–700°C to obtain fine, grayish- white RHA.
- * Grind and sieve to obtain uniform powder (<75 µm).

Step 2: Tile Fabrication

Prepare resin–RHA mixtures with different ratios (by weight):

- * Sample A: 90% resin + 10% RHA
- * Sample B: 80% resin + 20% RHA
- * Sample C: 70% resin + 30% RHA
- * Sample D: 60% resin + 40% RHA

Pour mixtures into molds and allow curing (24–48 hrs depending on resin type).

Step 3: Testing

1. Strength Test:

- * Perform weight-bearing test (place gradually increasing loads until fracture).
- * Record maximum load sustained.

2. Water Absorption Test:

- * Soak tiles in water for 24 hrs.
- * Measure % weight increase.

3. Translucency Test:

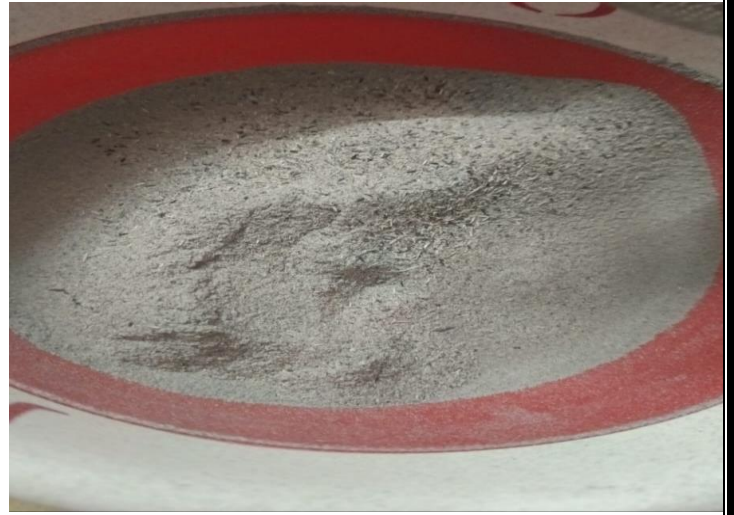
- Place tile in front of a light source.
- Measure light intensity before and after passing through tile using lux meter.
- Calculate % light transmission.

4. Durability Observation:

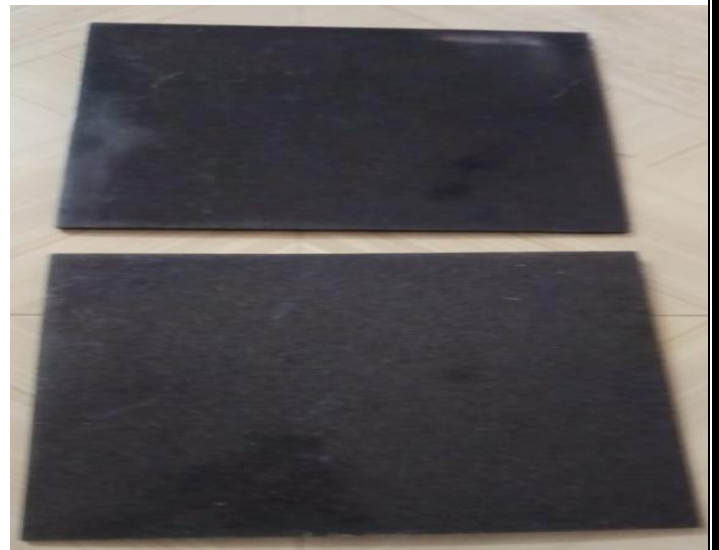
- * Check surface hardness (scratch resistance).
- * Observe colour stability and cracks after repeated heating/cooling cycles.

COLLECTION OF DATA PHOTOGRAPHS:

Preparation of RHA



Tiles fabrication (90% Resin + 10% RHA, 80% Resin +20% RHA, 70% Resin 30% RHA, 60% Resin 40% RHA)

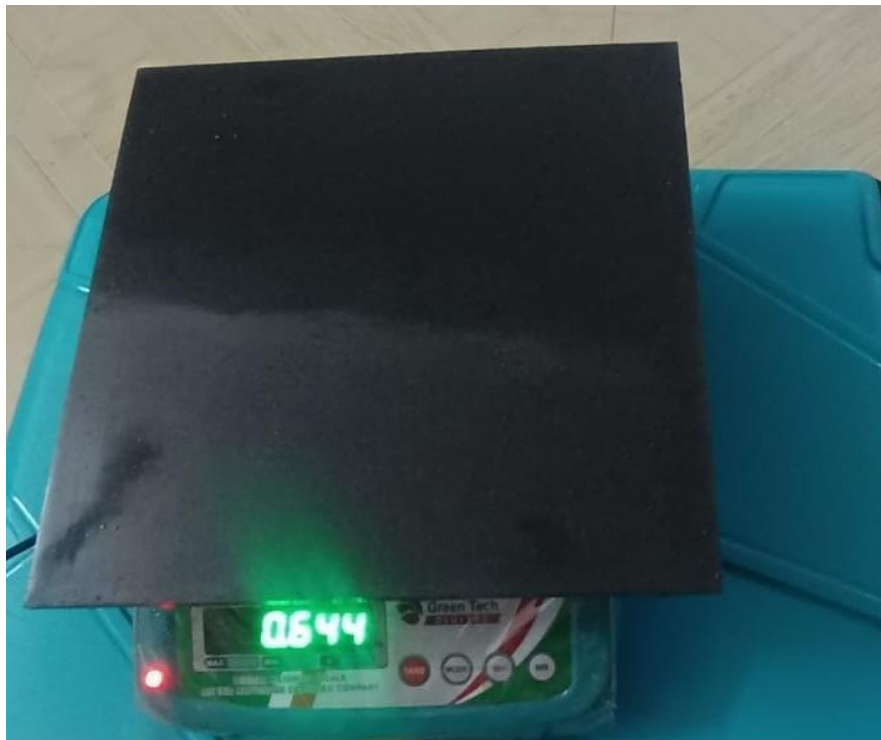


WATER ABSORPTION TEST

Before 644g



After 644g (no significant changes)



STRENGTH TEST:

Different masses of weight were tested on fabricated tiles to notice any cracks had been formed



100Kg



25L



30Kg

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FLEXURAL STRENGTH TEST:

Flexural strength test was performed to measure materials ability to withstand bending forces. The following test was performed in Das material testing Pvt, Ltd. The material showed no significant changes/cracks even after maximum force being applied. As the load is being applied the specimen experienced both tensile and compressive stresses with maximum stress yet showed no changes in materials loaded with 10%, 20%, 30% and 40% RHA.



SCRATCH TEST:

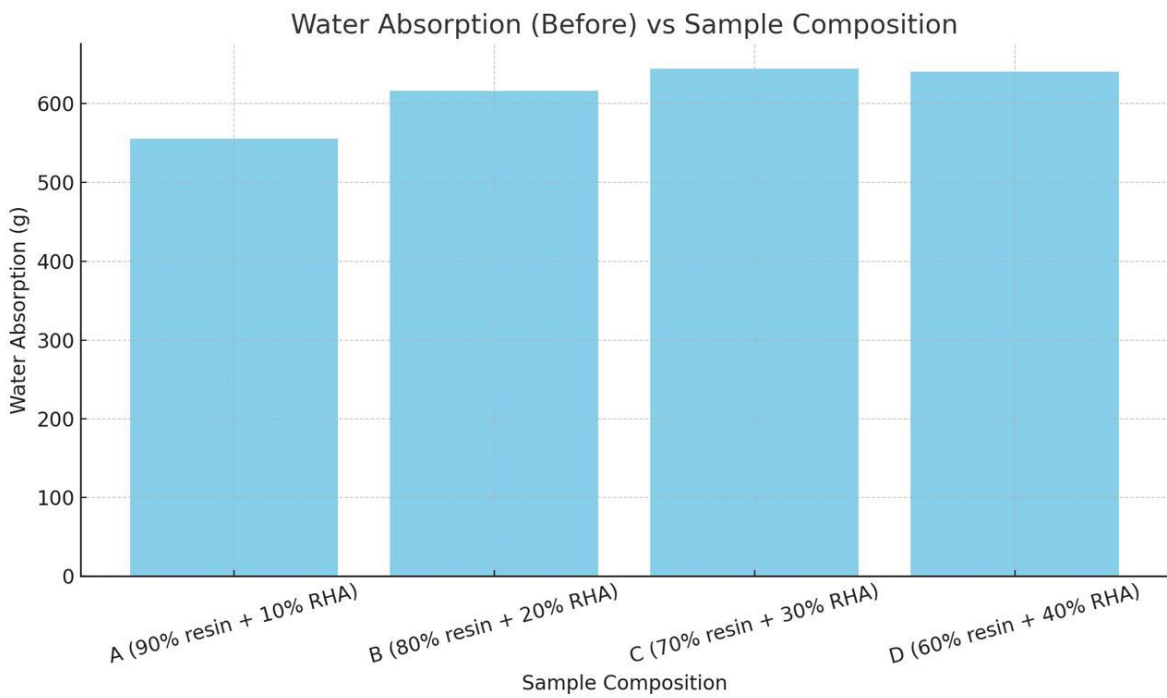
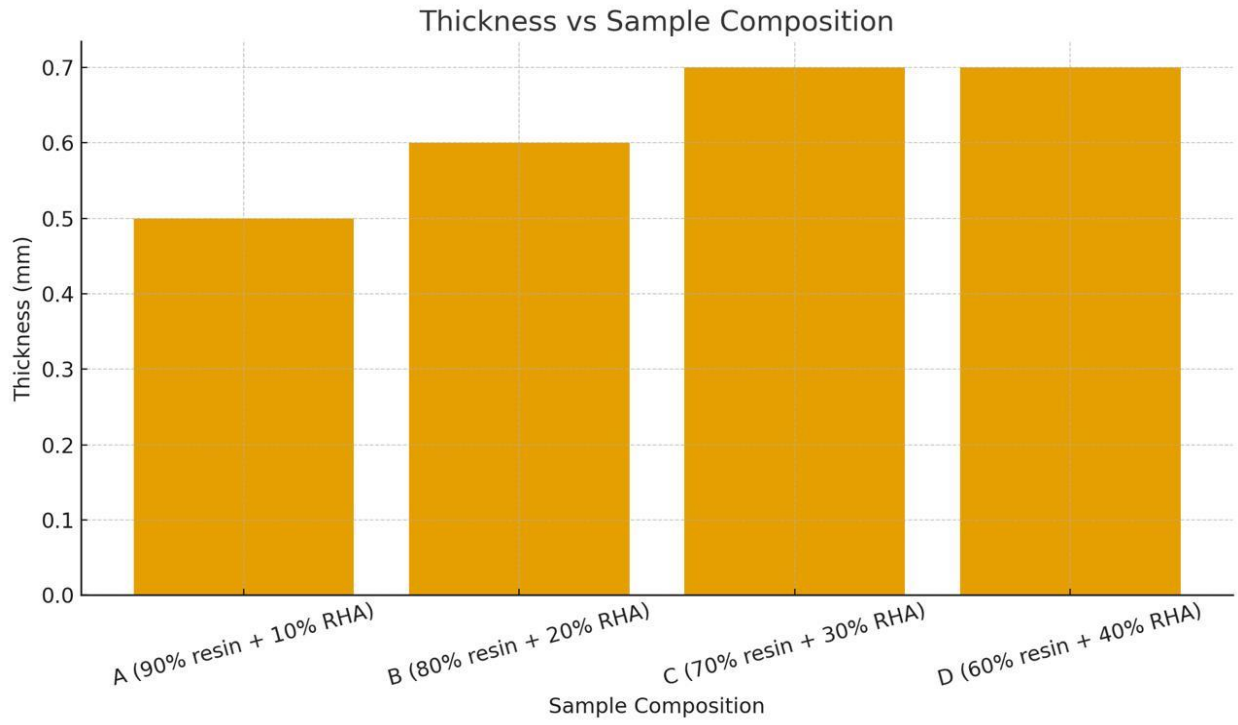
Mild visible scratches were observed



TABULATION:

Sample	RESIN + RHA %	Thickness (mm)	Light Transmittance %	Max load (g before crack)	Cracks	Water absorption (Before)	Water absorption After %
Sample A	90% resin + 10% RHA	0.5mm	78	25kg 30kg 100kg	No cracks	555g	0%
Sample B	80% resin + 20% RHA	0.6mm	68	25kg 30kg 100kg	No cracks	616g	0%
Sample C	70% resin + 30% RHA	0.7mm	59	25kg 30kg 100kg	No cracks	644g	0%
Sample D	60% resin + 40% RHA	0.7mm	46	25kg 30kg 100kg	No cracks	640g	0%

GRAPHICAL REPRESENTATION



RESULT AND DISCUSSION:

Result:

Tiles made with moderate RHA content (10-30%) in clear resin is maintaining adequate mechanical strength for decorative / low traffic applications and showed no water uptake when surface cured or sealed matching the given hypothesis.

Tiles with 40% RHA appeared opaque. The ash particles scattered and absorbed light, reducing clarity. However, tiles with 10–20% RHA still allowed enough light to pass through to be used as decorative or semi-transparent materials.

Water absorption increased gradually with more RHA because ash particles are porous and allow moisture to enter. Despite this, absorption levels stayed low (below 3% or 0%), showing that the resin still acted as a good waterproof binder.

Overall performance:

The results show that 20–30% RHA gave the best balance between translucency, strength, and durability. These samples remained semi-transparent while strong enough for decorative wall or interior applications.

Discussion:

Using rice husk ash in resin not only reduces agricultural waste but also saves energy compared to producing ceramic or glass tiles. The eco-tiles produced demonstrate how waste can be up cycled into useful and attractive materials, supporting cleaner and more sustainable building practices.

(Remaining results and data yet to come)

REFERENCES: BIBLIOGRAPHY

Rice Husk Ash: Effective Reinforcement for Epoxy-Based Composites (2023)

Demonstrates that adding RHA improves the thermal stability, glass transition temperature (T_g), storage modulus (up to +55%), and microhardness (up to +45%) of epoxy composites.

Rice Husk Ash-Based Concrete Composites: A Critical Review of Their Properties and Applications

Offers foundational insight into the composition, production, and eco-applications of RHA in construction materials, helping justify environmental significance.

Exploring the Impact of Rice Husk Ash Masonry Blocks on Building Energy Performance (2024) Covers how RHA blocks can reduce building energy consumption and improve sustainability—aligns with your project’s goal of light-transmitting, eco-tiles.

Rice Husk Ash: An Agro-Waste Recycled Value Added Product

Describes the density and processing considerations of RHA in polymer composites, aiding your materials and preparation rationale.

Bisht, N., & Rani, N. (2024). Effect of Rice Husk Ash on the Tensile Strength of Epoxy Based Bio-Composite. *Advances in Research*, 25(4), 258–270.