



National Science Fair

Research Paper

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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State	Tamil Nadu

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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 triplicates of resin–RHA mixtures with different ratios for each experimental setup (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 flexural strength 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 for L_0 (without tile) and LT (with tile)

4. Durability Observation:

- * Check surface hardness (scratch resistance).

COLLECTION OF DATA PHOTOGRAPHS:

Preparation of RHA and making of tiles using RHA+resin



Clear Resin



Rick Husk Ash (RHA)



Mixing of RHA with clear Resin



Tiles fabrication for triplicates

90% Resin + 10% RHA



80% Resin +20% RHA



70% Resin 30% RHA



60% Resin 40% RHA



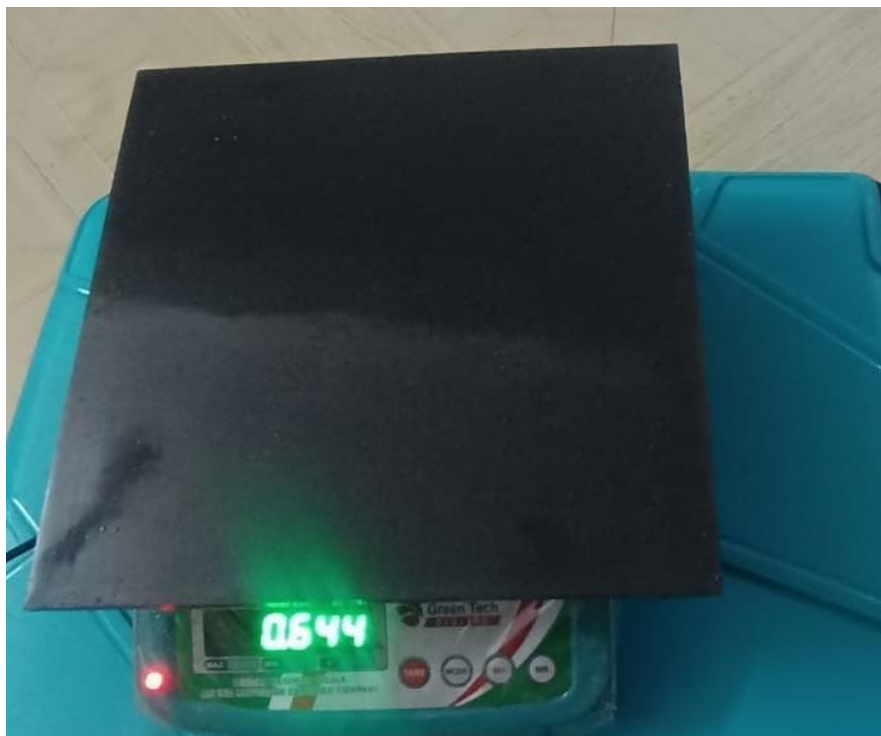
WATER ABSORPTION TEST:

Water absorption test was performed for the triplicates for each experimental setup for over 24hours soaking and the weight was measured before and after soaking the tiles.

Before 644g



After 644g (no significant changes)



FLEXURAL STRENGTH TEST:

Flexural strength test was performed for triplicates of each proportion 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



Luxmeter reading for light transmission under visible sunlight using Luxmeter app



TABULATION:

COMAPRISON OF WEIGHT, DIMENSIONS AND BREAKING STRENGTH (N)

Sample	Weight (g)	dimensions (mm)	Load applied F (N)	Breaking strength (N)
Sample A1 (90% resin + 10% RHA)	600g	300 x300x 7	3693.58	2462.39
Sample A2	604g	298x298x7	3693.58	2478.91
Sample A3	598g	297x297x6	3693.58	2487.26
Sample B1 (80% resin + 20% RHA)	616g	298x298x6	3693.58	2478.9
Sample B2	619g	297x297x7	3693.58	2487.26
Sample B3	625g	297x297x7	3693.58	2487.26
Sample C1 (70% resin + 30% RHA)	634g	298x298x6	3693.58	2478.9
Sample C2	632g	297x297x7	3693.58	2487.26
Sample C3	638g	297x297x7	3693.58	2487.26
Sample D1 (60% resin + 40% RHA)	637g	300x300x8	3693.58	2462.39
Sample D2	640g	297x297x7	3693.58	2487.26
Sample D3	644g	297x297x7	3693.58	2487.26

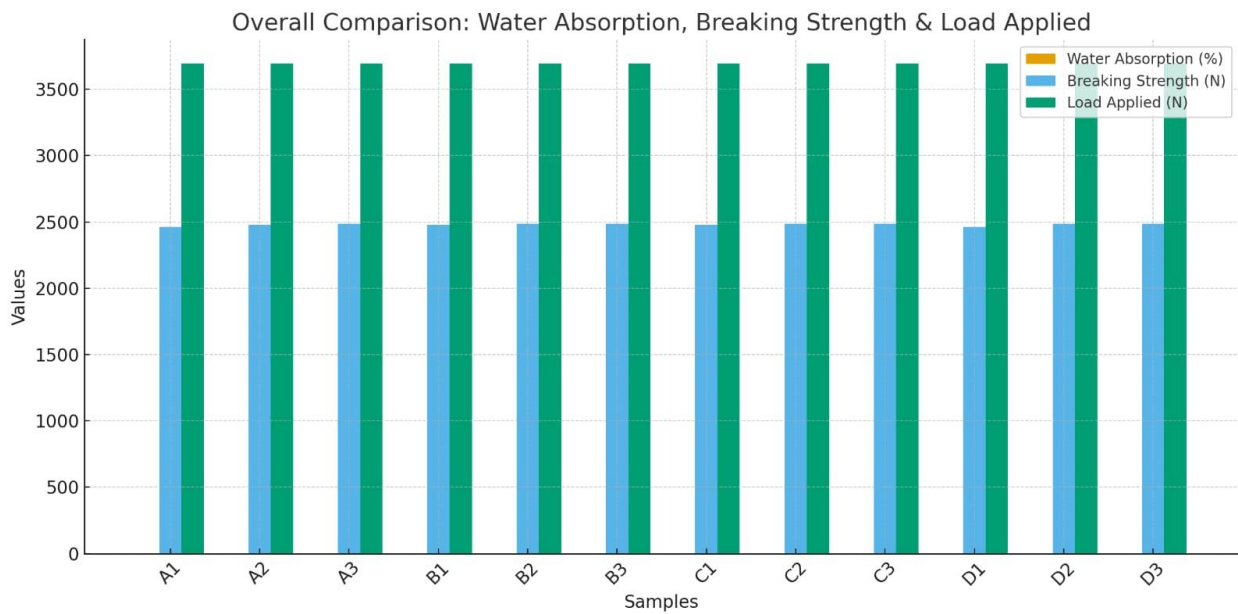
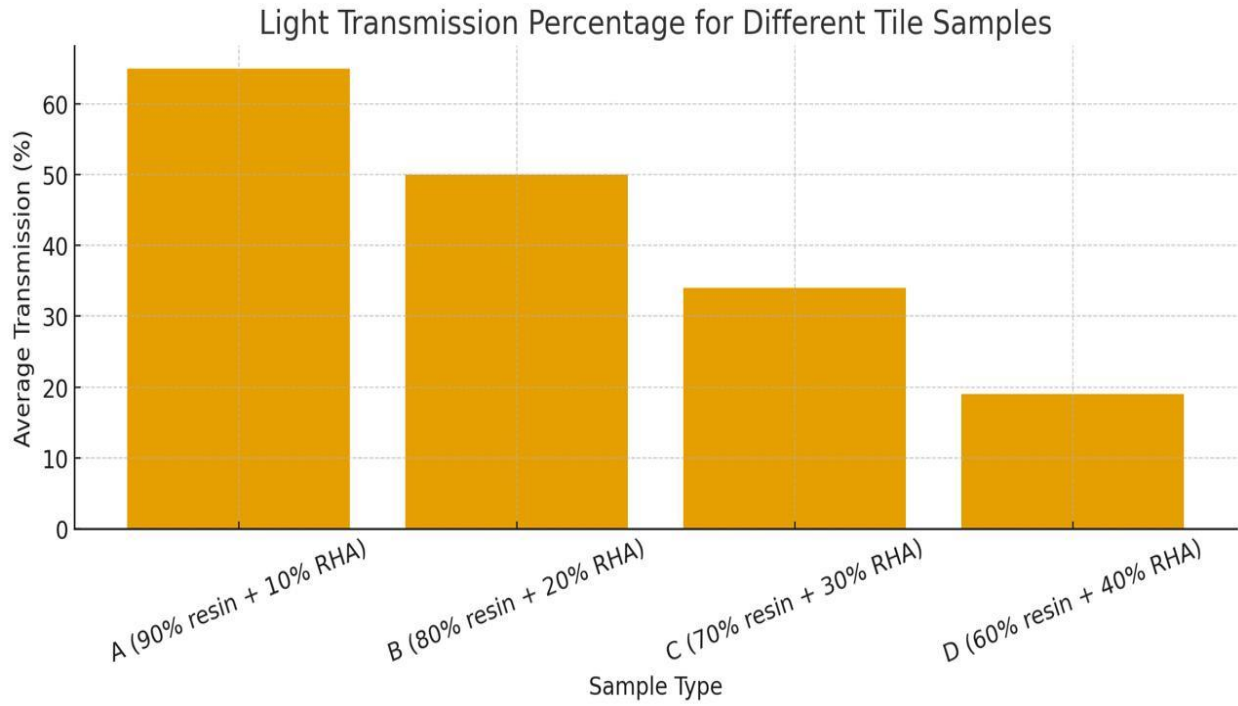
WATER ABSORPTION BEFORE AND AFTER PERCENTAGE %

Sample	Sample A (90% resin + 10% RHA)			Sample B (80% resin + 20% RHA)			Sample C (70% resin + 30% RHA)			Sample D (60% resin + 40% RHA)		
	A1	A2	A3	B1	B2	B3	C1	C2	C3	D1	D2	D3
Water absorption (Before)	600g	604g	598g	616g	619g	625g	634g	632g	638g	637g	640g	644g
Water absorption After %	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

LIGHT TRANSMISSION % USING LUX-METER IN DIFFERENT TILES FABRICATION

Sample	Sample A (90% resin + 10% RHA)			Sample B (80% resin + 20% RHA)			Sample C (70% resin + 30% RHA)			Sample D (60% resin + 40% RHA)		
	A1	A2	A3	B1	B2	B3	C1	C2	C3	D1	D2	D3
L_o (lux)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
LT (lux)	680	650	620	540	500	460	380	340	310	340	180	150
Transmission % = (LT / L_o)×100	68%	65%	62%	54%	50%	46%	38%	34%	31%	24%	18%	15%
Average (%)	65%			50%			34%			19%		

GRAPHICAL REPRESENTATION



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 as the tiles become less translucent when the percentage of RHA increases and 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 should gradually increase 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 the tiles retain sufficient breaking strength despite increasing RHA (40%), there is no reduction in mechanical strength. Resin acts as a strong binder even at higher RHA percentages the tiles remain rigid but there's a slight decrease in sample D due to higher RHA content and lower resin binding proportion.

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. This supports my hypothesis is true.



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28, Velachery Road, Little Mount, Saidapet, Chennai - 600 015
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Email: dasmaterial@yahoo.com Web: www.dasmaterial.in

TEST REPORT

Page : 1/1

Report No : 5111701
Date : 18.11.2025

Customer:
Mrs. Salma Mohammed,
No: 9/17, Owliya Salub Street,
Ellis Road, Triplicane,
Chennai - 600 002.

Customer's Reference : Letter Dated: 17.11.2025
Sample Received : 17.11.2025
*Project /Name of work : -
*Sample Description : Epoxy Tiles
Sample 1: RHA: 10% - 1no
RHA: 40% - 1no

TILES - MODULUS OF RUPTURE

S. No	*Sample ID	Sample Details		Applied Load, F (N)	Breaking Strength (N)	Modulus of Rupture (N/mm ²)	Remarks
		Weight (g)	Size (mm)				
1.	10%	556.5	300 x 300 x 7	> 3693.58	> 2462.39	> 75.38	No visible cracks or rupture observed
2.	40%	637.5	300 x 300 x 8	> 3693.58	> 2462.39	> 57.71	

Test Conducted as per IS 13630 (Part 6): 2019

Note: The Results of the above test parameters exceed the Machine's load Capacity.

Remarks:
*As furnished by the customer
Sample submitted by the customer

-End of Report



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TEST REPORT

Page : 1/1

Report No : 5111701
Date : 18.11.2025

Customer:
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No: 9/17, Owliya Salub Street,
Ellis Road, Triplicane,
Chennai - 600 002.

Customer's Reference : Letter Dated: 17.11.2025
Sample Received : 17.11.2025
*Project /Name of work :-
*Sample Description : Epoxy Tiles
Sample 2: RHA: 10% - 1no
RHA: 20% - 1no
RHA: 30% - 1no
RHA: 40% - 1no

TILES - MODULUS OF RUPTURE

S. No	*Sample ID	Sample Details		Applied Load, F (N)	Breaking Strength (N)	Modulus of Rupture (N/mm ²)	Remarks
		Weight (g)	Size (mm)				
1.	10%	604.0	298 x 298 x 7	> 3693.58	> 2478.91	> 75.89	No visible cracks or rupture observed
2.	20%	619.0	297 x 297 x 7	> 3693.58	> 2487.26	> 76.14	
3.	30%	632.0	297 x 297 x 7	> 3693.58	> 2487.26	> 76.14	
4.	40%	654.0	297 x 297 x 7	> 3693.58	> 2487.26	> 76.14	

Test Conducted as per IS 13630 (Part 6): 2019

Note: The Results of the above test parameters exceed the Machine's load Capacity.

Remarks:
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Sample submitted by the customer

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TEST REPORT

Page : 1/1

Report No : 5111701
Date : 18.11.2025

Customer:
Mrs. Salma Mohammed,
No: 9/17, Owliya Salub Street,
Ellis Road, Triplicane,
Chennai - 600 002.

Customer's Reference : Letter Dated: 17.11.2025
Sample Received : 17.11.2025
*Project /Name of work : -
*Sample Description : Epoxy Tiles
Sample 3: RHA: 10% - 1no
RHA: 20% - 1no
RHA: 30% - 1no
RHA: 40% - 1no

TILES - MODULUS OF RUPTURE

S. No	*Sample ID	Sample Details		Applied Load, F (N)	Breaking Strength (N)	Modulus of Rupture (N/mm ²)	Remarks
		Weight (g)	Size (mm)				
1.	10%	598.5	297 x 297 x 6	> 3693.58	> 2487.26	> 103.64	No visible cracks or rupture observed
2.	20%	625.5	297 x 297 x 7	> 3693.58	> 2487.26	> 76.14	
3.	30%	638.5	297 x 297 x 7	> 3693.58	> 2487.26	> 76.14	
4.	40%	685.5	297 x 297 x 7	> 3693.58	> 2487.26	> 76.14	

Test Conducted as per IS 13630 (Part 6): 2019

Note: The Results of the above test parameters exceed the Machine's load Capacity.

Remarks:

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TEST REPORT

Page : 1/1

Report No : 5103002
Date : 01.11.2025

Customer:
Mrs. Salma Mohammed,
No: 9/17, Owliya Salub Street,
Ellis Road, Triplicane,
Chennai - 600 002.

Customer's Reference : Letter Dated: 30.10.2025
Sample Received : 30.10.2025
*Project /Name of work : -
*Sample Description : Epoxy Tiles
Rice Husk Ash: 20% + Resin 80% - 1no
Rice Husk Ash: 30% + Resin 70% - 1no
Size: 10 x10 Inches

TILES - MODULUS OF RUPTURE

S. No	*Sample ID	Sample Details		Breaking Strength (N)	Modulus of Rupture (N/mm ²)
		Weight (g)	Size (mm)		
1.	20%	616.5	298 x 298 x 6	> 2478.91	> 103.29
2.	30%	643.5	298 x 298 x 6	> 2478.91	> 103.29

Test Conducted as per IS 13630 (Part 6): 2019

Note: The Results of the above test parameters exceed the Machine's load Capacity.

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Brenno Damian, B.E., M.S.
Managing Director

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DISCUSSION:

1. Light Transmission

- Transparency decreases with higher RHA content.
- Sample A (90% resin + 10% RHA) is the most translucent.
- Sample D (60% resin + 40% RHA) is the least translucent.

2. Water Absorption

- All tiles showed 0% absorption, proving excellent impermeability and low porosity.
- This makes the tiles suitable for waterproof applications.

3. Mechanical Strength

- All samples showed strong and reliable breaking strength.
- Increasing RHA slightly reduces strength but not significantly.
- Even Sample D maintains good structural quality.

4. Overall Performance

- For translucent tiles → Sample A is best.
- For stronger & less transparent eco-tiles → Samples B or C are ideal.
- For cost-effective, eco-friendly designs with good strength → Sample D is acceptable.

CONCLUSION:

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 showed 0% water absorption proving excellent impermeability, strong and reliable breaking strength demonstrate how waste can be up cycled into useful and attractive materials, supporting cleaner and more sustainable building practices.

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.

ACKNOWLEDGEMENT:

- Praising the Almighty, for giving me good strength throughout my research work and enabling me to complete the fair project successfully.
- I have taken efforts in this project .However, it would not have been possible without the kind support and help of many individuals and organizations.
- I would like to extend my sincere thanks to all of them. I would like to express my deep thanks to my Correspondent Mr. Sadique Batcha.
- I express my deep sense of gratitude to my Principal Mrs. Sogra Jabeen, Vice Principal Mrs. Rabia Basri and Guide teacher Mrs. Farhana Nasuha for their guidance and valuable suggestions & developing my interest in the investigation and in the presentation of this report.
- I would like to thank my parents who helped and motivated me a lot for doing a science fair project