

# Development of Sustainable Bricks Incorporating Rice Husk Ash: A Study on Environmental Impact

Author Details:

**Muthu Selva Kumar.N<sup>1</sup>, Gowtham.M<sup>2</sup>, Pranav.C.V<sup>3</sup>, Saran.M<sup>4</sup>**

<sup>1</sup> Civill / Kongunadu College of Engineering And Technology Tholurpatti, Tamil Nadu 621215; Email: muthuselvakumar22@gmail.com

<sup>2</sup> Civil / Kongunadu College of Engineering And Technology Tholurpatti, Tamil Nadu 621215; Email: gowtham0111111@gmail.com

<sup>3</sup> Civil Kongunadu College of Engineering And Technology Tholurpatti, Tamil Nadu 621215; Email:

veeramuthupranav284@gmail.com <sup>4</sup> Civil / Kongunadu College of Engineering And Technology Tholurpatti, Tamil Nadu 621215; Email: saranpolice1104@gmail.com Corresponding Author


Email:muthuselvakumar22@gmail.com | ORCID: <https://orcid.org/xxxx-xxxx-xxxx-xxxx>



<https://doi.org/10.55041/ijst.v2i3.403>

**Cite this Article:** Kumar.N, M. S., Gowtham.M., Pranav.C.V, & Saran.M, (2026). Development of Sustainable Bricks Incorporating Rice Husk Ash: A Study on Environmental Impact. International Journal of Science, Strategic Management and Technology, 02(03).

<https://doi.org/10.55041/ijst.v2i3.403>

**License:**  This article is published under the Creative Commons Attribution 4.0 International License (CC BY 4.0), permitting use, distribution, and reproduction in any medium, provided the original author(s) and source are properly credited.

## Abstract—

The construction industry is one of the major causes of degradation of the environment, as this industry utilizes a large quantity of natural resources and also emits a large quantity of CO<sub>2</sub>. In addition to this, burnt clay bricks also play a major role in the degradation of the environment. Rice Husk Ash, which is abundantly available in nature, also contains a large quantity of silica. In a similar way, fly ash, which is available in industrial form, can also be used to develop bricks that are more friendly to the environment. In this project, bricks that are more friendly to the environment and possess higher strength will be developed by using a combination of optimized amounts of Rice Husk Ash and fly ash instead of burnt clay bricks. In this context, a combination of Rice Husk Ash and fly ash will be developed to identify the maximum combination that can provide higher strength and sustainability to bricks with minimum water absorption. In addition to this, durability tests will also be carried out to identify the water absorption capacity of bricks. In addition, a comparative study on the emission of CO<sub>2</sub> will be made to assess the sustainability of the eco-friendly bricks over the burnt clay bricks. The findings revealed that the RHA-fly ash bricks made from the optimized mixture have higher strength, good durability, and a very low carbon footprint. Keywords: Eco-friendly bricks, Rice Husk Ash (RHA), Carbon dioxide (CO<sub>2</sub>) emissions, Carbon footprint reduction, Environmental Impact Assessment (EIA)

## I. INTRODUCTION

Brick is one of the most frequently used construction materials, and this material has always been a favorite among human beings for thousands of years. Brick is a construction material that comprises square or rectangular pieces, which can be made from clay or other substances. These pieces are then exposed to high temperatures to make them more durable. The shape and size of bricks have remained the same over the years, and their uses have remained the same as well. Bricks can be used for the construction of buildings, walls, arches, etc. Bricks can also be used for paving paths and roads, as well as for decorative purposes. The most frequently used bricks are those made from clay, which is exposed to high temperatures to make the bricks more durable. The other materials that can be used

for making bricks include rice husk ash, rice husk, gypsum, lime, and cement.

## 4.2 MATERIAL USED

### 4.2.1 Fly Ash

The byproduct of burning coal in thermal power plants is fly ash. Fly ash contains a lot of silica and other mineral compounds and hence acts as a pozzolana. Fly ash bricks absorb less heat compared to clay bricks. This is a better option considering the Indian environment



Figure 4.1 Fly Ash

#### 4.2.1.1 Determination of specific gravity of fly ash

**4.2.1.2 Specific gravity of fly ash is defined as the ratio of the weight of a given volume of fly ash to the weight of an equal volume of water at a specified temperature.**

S.No	Parameter	Obtained value (%)	Permissible limit (%) (IS 3812-2003)
1	Loss On Ignition (LOI)	0.69 %	5 %
2	Silica (Si)	68.22 %	70 %
3	Calcium Oxide (CaO)	1.78 %	2.0 %
4	Magnesium Oxide (MgO)	1.06 %	4.56 %
5	Iron Oxide (Fe <sub>2</sub> O <sub>3</sub> )	5.41 %	7.09 %
6	Aluminium Oxide (Al <sub>2</sub> O <sub>3</sub> )	20.32 %	70 %
7	Sodium Oxide (Na <sub>2</sub> O)	0.68 %	1.5 %
8	Potassium Oxide (K <sub>2</sub> O)	1.12 %	3.14 %

Table 4.2 Chemical composition of fly ash

Formula used for specific gravity

$$\text{Specific gravity} = \frac{W2 - W1}{W3 - W4} = \frac{(910 - 638)}{(910 - 638)} = \frac{(1550 - 1400)}{(910 - 638)} = 2.2$$

### 4.2.3 Lime

The lime powder contains silica. Then it will be dried under the sunlight, and it binds the particles of the brick together, thus making strong bricks. It was used as a binder as well as a filler.



Figure 4.3 Lime

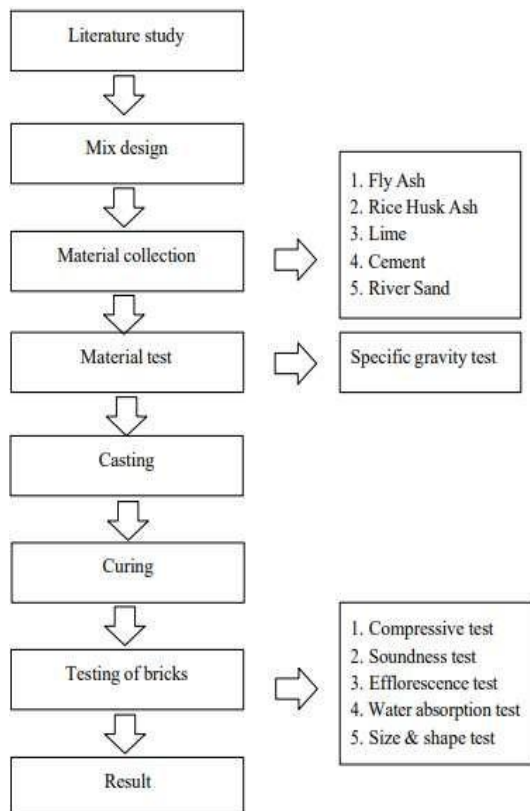
#### 4.2.4 Cement

In order to make brick and mortar, Portland Pozzolana cement was used. Between two bricks, it is used as a bonding agent. Generally, cement plays a significant role in the development of durable structures



Figure 4.4 Cement

### III. METHODOLOGY



## IV. RESULTS AND DISCUSSION

The study on the development of sustainable bricks incorporating rice husk ash (RHA) demonstrated significant improvements in both environmental performance and material efficiency compared to conventional clay bricks. The experimental results revealed that partial replacement of clay with RHA (ranging from 5% to 25%) influenced the physical and mechanical properties of the bricks.

The compressive strength test indicated that bricks with 10–15% RHA content achieved optimum strength, comparable to or slightly higher than traditional burnt clay bricks. This improvement is attributed to the pozzolanic nature of rice husk ash, which enhances bonding within the brick matrix. However, beyond 20% replacement, a reduction in strength was observed due to increased porosity and reduced cohesion among particles.

## V. CONCLUSION

The compressive strength of rice husk ash bricks varies from 7.07 to 10.19 N/mm<sup>2</sup> for mix combinations. Compared to mix 3, conventional bricks are low in value; however, mix 3 bricks are better compared to conventional bricks. Hence, mix 3 bricks are higher in compressive value. The water absorption percentage varies from 2.94 to 12.47 for a mix combination. This indicates that water absorption by rice husk ash bricks is less than 20%, and this complies with the code. The development of eco-friendly bricks using industrial and agricultural waste materials is a step in the right direction to develop sustainable and environmentally friendly bricks. These bricks not only help to reduce the amount of waste generated but also reduce the environmental impact of traditional brick production methods, which typically involve the use of non-renewable resources and generate significant greenhouse gas emissions. Eco-friendly bricks can be developed by using waste materials like fly ash, rice husk, and river sand with low energy consumption and less greenhouse emissions.

### 6.1 COMPRESSIVE STRENGTH TEST

To test the compressive strength of rice husk ash brick specimens of different mix ratios, the test was conducted by using a compression test machine (CTM). The compressive strength test was conducted based on the IS 3495:1992 (part 1) code.

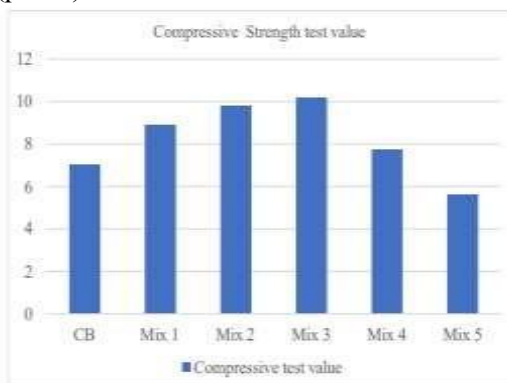


Figure 6.1 Bar chart of Compressive Strength test value

## 6.2 WATER ABSORPTION TEST

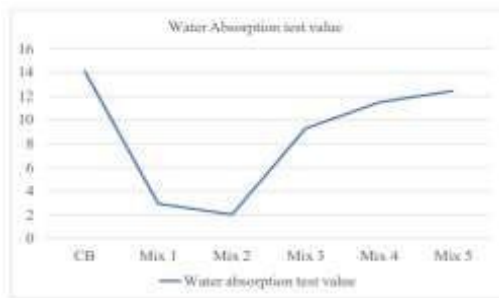


Figure 6.4 Line graph of Water Absorption test value

## ACKNOWLEDGMENT

I would like to express my sincere gratitude to all those who supported me in the successful completion of this study on the development of sustainable bricks incorporating rice husk ash. First and foremost, I thank my project guide for their valuable guidance, constant encouragement, and constructive suggestions throughout the course of this work.

I am also thankful to the faculty members of the department for providing the necessary academic support and technical knowledge required for this study. My heartfelt thanks go to the laboratory staff for their assistance in conducting experiments and testing the materials

## REFERENCES

1. Ahmed, M. M., et al. "Development of bio- based lightweight and thermally insulated bricks: Efficient energy performance, thermal comfort, and CO2 emission of residential buildings in hot arid climates." *Journal of Building Engineering* 91 (2024): 109667.
2. Ahmed, Mushtaq, et al. "Scholars Journal of Engineering and Technology." (2020).
3. Anitha, K., and S. Senthilselvan. "Agricultural Waste Materials Applications in Building Industry—An Overview." *Ecs Transactions* 107, no. 1 (2022): 2371.
4. Chin, Wei Quan, Yeong Huei Lee, Mugahed Amran, Roman Fediuk, Nikolai Vatin, Ahmad Beng Hong Kueh, and Yee Yong Lee. "A sustainable reuse of agro- industrial wastes into green cement bricks." *Materials* 15, no. 5 (2022): 1713