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Comparative Analysis of Eco Friendly Brick with Red Bricks

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Abstract

This research presents a comparative analysis between conventional red bricks and eco-friendly bricks made from mud, rice husk, and dry plant leaves. The aim is to evaluate the potential of using sustainable, low-cost, and locally available agricultural waste materials in brick production as an environmentally conscious alternative to traditional methods. The eco-bricks were manufactured without kiln firing, significantly reducing energy consumption and carbon emissions. A series of laboratory tests—including compressive strength, water absorption, weight, and thermal insulation—were conducted following standard IS codes to assess their physical and mechanical properties in comparison to red bricks. The results indicate that while the compressive strength of eco-friendly bricks (3–5 N/mm²) is lower than that of red bricks (7–10 N/mm²), it remains sufficient for non-load-bearing applications such as partition walls and rural housing. Eco-bricks were found to be 30–40% lighter, more thermally insulating, and cheaper to produce due to the use of waste materials. Their environmental benefits include the reduction of agricultural waste, conservation of topsoil, and lower emissions. This study concludes that eco-friendly bricks offer a viable and sustainable construction alternative, especially in regions where cost, environmental impact, and material availability are critical factors. Further research is recommended to improve their strength and expand their use in broader structural applications.

Keywords: Eco-friendly bricks, red bricks, sustainable construction, rice husk, mud bricks, agricultural waste, compressive strength, water absorption, thermal insulation, low-cost building materials, green building, environmental impact

INTRODUCTION

The construction industry is one of the largest consumers of natural resources and a significant contributor to environmental pollution. Among the materials used, clay bricks—commonly known as red bricks—are extensively utilized for building purposes across the world, particularly in developing countries like India. The production of red bricks involves the extraction of fertile topsoil and the firing of bricks in kilns at high temperatures, which not only leads to the depletion of agricultural land but also results in high carbon dioxide emissions. Additionally, the use of coal or wood as fuel for kilns contributes to air pollution and deforestation, further exacerbating environmental degradation [1–3].

In recent years, there has been a growing demand for sustainable and eco-friendly building materials that reduce the environmental footprint of construction activities. One promising solution is the development of alternative bricks using natural and waste materials that are locally

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available and renewable. Agricultural residues such as rice husk and dry plant leaves, which are typically discarded or burned, can be repurposed as raw materials for making eco-bricks. Combined with mud, these materials can be used to produce bricks without the need for kiln firing, resulting in a low-cost and energy-efficient solution. This research focuses on manufacturing eco-friendly bricks using mud, rice husk, and dry plant leaves, and comparing their performance with conventional red bricks. The aim is to assess their viability in terms of mechanical strength, water absorption, weight, cost, and environmental impact, thereby contributing to the advancement of green and sustainable construction practices [4-7].

LITERATURE REVIEW

The environmental impact of conventional brick manufacturing has drawn significant attention in recent years, particularly due to its reliance on topsoil and high-temperature kiln firing, both of which contribute to ecological degradation and carbon emissions. According to the United Nations Environment Programme (UNEP, 2020), traditional red brick production is a major contributor to global greenhouse gas emissions, especially in developing nations where brick kilns operate with limited emission controls.

In response to these challenges, numerous researchers have explored the development of alternative, eco-friendly brick materials. Goyal et al. (2022) investigated the use of rice husk as a partial replacement for clay in bricks and found that it significantly enhances thermal insulation while reducing brick weight. The silica content in rice husk also contributes to improved fire resistance and energy efficiency. Similarly, studies by Sharma and Singh (2021) highlight the feasibility of incorporating dry plant leaves and other organic waste into bricks to lower production costs and promote biodegradable construction solutions [8].

Mud-based bricks have also been the focus of sustainable construction research. Lal and Thomas (2019) demonstrated that mud, when combined with fibrous materials like straw and husk, can yield bricks with sufficient compressive strength for non-load-bearing walls, especially in rural housing. These bricks offer additional benefits such as better temperature regulation and moisture control. Patel and Mehta (2021) further confirmed that bricks made from mud and agricultural waste materials can reach compressive strength values between 3–5 N/mm², which, while lower than red bricks, are acceptable for internal partitioning and temporary shelters [9].

Despite promising outcomes, existing studies tend to focus on individual materials rather than a holistic mixture. There is a research gap in understanding the combined use of mud, rice husk, and dry plant leaves—a blend that could offer a more balanced solution between strength, thermal performance, cost, and sustainability. This paper builds upon prior research by analyzing the performance of this composite mixture and evaluating its potential as a practical alternative to conventional red bricks in eco-friendly construction [10-12].

PROPOSED METHODOLOGY

The objective of this study is to develop eco-friendly bricks using sustainable, biodegradable materials such as mud, rice husk, and dry plant leaves, and to compare their performance with that of conventional red bricks. The methodology involves the design, preparation, testing, and analysis of the properties of these bricks through a systematic and comparative approach.

Materials Collection

Mud: Collected from local soil with good plasticity and bonding properties.

Rice Husk: Obtained as agricultural waste from rice mills; cleaned and dried.

Dry Plant Leaves: Gathered from dried vegetation, shredded to fine particles.

Water: Clean water used for mixing and curing.

Brick Manufacturing Process

The materials were mixed in the proportion: Mud (60%), Rice Husk (25%), and Dry Leaves (15%).

The mixture was homogenized using water until a consistent, moldable paste was formed.

Standard-sized brick molds (190 mm × 90 mm × 90 mm) were used.

The bricks were sun-dried for 7–10 days, followed by air curing for 14 days to improve strength and reduce moisture Figure 1.

Figure 1. Brick Manufacturing Process

Testing Procedures

Both eco-friendly and red bricks were tested using standard laboratory procedures as per IS: 3495. The following tests were conducted:

Compressive Strength Test (IS: 3495 Part 1): Determines load-bearing capacity.

Water Absorption Test (IS: 3495 Part 2): Measures porosity and durability.

Weight and Density Measurement: To compare the bulk density and weight.

Thermal Insulation Observation: Basic qualitative comparison for heat retention.

Cost Estimation: Comparative analysis of raw material and production costs.

RESULT

Compressive Strength

The compressive strength of eco-friendly bricks ranged between 3 to 5 N/mm², which is lower than that of conventional red bricks, which showed values between 7 to 10 N/mm². While red bricks are suitable for structural and load-bearing applications, eco-friendly bricks are adequate for non-load-bearing uses such as partition walls and low-rise rural structures.

Water Absorption

Eco-friendly bricks had a water absorption rate of approximately 18–25%, slightly higher than that of red bricks, which ranged from 15–20%. Though within acceptable limits, higher porosity in eco-bricks may affect durability in high-moisture environments unless treated or coated.

Weight

Eco-friendly bricks were significantly lighter, weighing around 2.0–2.5 kg per brick, compared to red bricks, which typically weigh 2.8–3.2 kg. The reduced weight can lower transportation costs and make handling easier, particularly for low-rise or temporary structures.

Thermal Performance

Qualitative observations suggested that eco-friendly bricks provided better thermal insulation, likely due to the presence of rice husk and plant fibers which trap air and slow heat transfer. This makes them well-suited for hot climates where indoor cooling is essential.

Cost Comparison

Eco-friendly bricks proved to be 20–30% cheaper to produce due to the use of locally available waste materials and the elimination of kiln firing. This makes them a cost-effective option, especially in rural and low-income housing projects.

Table 1. Properties of red and ecofriendly bricks

Property	Red Bricks	Eco-Friendly Bricks
Compressive Strength	7–10 N/mm²	3–5 N/mm²
Water Absorption	15–20%	18–25%
Weight	2.8–3.2 kg	2.0–2.5 kg
Thermal Insulation	Average	Good
Cost per Brick	Higher	Lower

CONCLUSION

The experimental analysis conducted in this study demonstrates that eco-friendly bricks made from mud, rice husk, and dry plant leaves offer a promising alternative to conventional red bricks in certain construction applications. While their compressive strength is lower than that of red bricks, the eco-bricks are significantly lighter, more thermally efficient, and cost-effective. These advantages make them especially suitable for non-load-bearing structures such as partition walls, rural housing, and temporary buildings.

In addition to performance metrics, the environmental benefits of eco-bricks are noteworthy. Their production eliminates the need for kiln firing, thereby reducing carbon emissions and preserving topsoil. The use of agricultural waste materials such as rice husk and dry leaves not only reduces raw material costs but also promotes sustainable waste management. Overall, this research supports the viability of eco-friendly bricks as a sustainable, low-cost building material that aligns with the goals of green construction and rural development.

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Future Scope

The development of eco-friendly bricks using mud, rice husk, and dry plant leaves presents numerous opportunities for future research and application. While the current study focuses on basic physical and mechanical properties, further investigation can be carried out to enhance the performance and durability of these bricks through chemical stabilization, waterproof coatings, or the inclusion of natural binders like lime or fly ash.

Additionally, large-scale field trials and long-term performance monitoring under different climatic conditions would provide more comprehensive insights into their suitability for real-world construction. Future studies could also explore the use of other locally available agricultural or industrial waste materials to improve the versatility and regional adaptability of eco-brick formulations. With increasing focus on sustainable and affordable housing, these bricks have great potential in rural development schemes, disaster-relief shelters, and environmentally conscious building practices.

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