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Improvement of Brick Properties Using Waste Material

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Abstract -
Characterizing the clay bricks made by combining two agricultural waste materials—rice husk and fly ash—is the goal of this study. These waste products are hazardous to the environment and are difficult to dispose of. Fly ash, rice husk, and waste wood powder were gathered. In order to make bricks, these were combined with clay in three different amounts, namely five, ten, and fifteen percent by clay weight. Mechanical tests, such as compressive strength, modulus of rupture, and durability qualities, were carried out. The amount of fly ash, rice husk, and wooden waste powder has greatly grown. But there was no discernible change in the mechanical characteristics. Additionally, by adding garbage, bricks' unit weight has decreased, lowering the structure's total weight and enabling more cost-effective construction. Consequently, it can be said that using waste materials in the production of bricks can reduce the environmental impact and result in more affordable and sustainable building.

1. INTRODUCTION

1.1 General

As the use of low-cost, lightweight, and environmentally friendly construction materials in the building industry grows in popularity, it is necessary to look into ways to accomplish this while still meeting the material requirements specified in the standard and helping the environment. Recycling trash from industrial and agricultural processes for use as building materials seems like a practical way to address the issues of pollution and building economics. Impact of Marble and Aluminium Waste Powder on Brick Performance: Research has demonstrated that when marble and aluminium powder are added to brick composition, qualitative tests such as compressive strength and water absorption yield improved results. Sandeep Kumar Mishra, Vinod Kumar, and Rihan Maaze, 2016.

Since brick is primarily used to make inner and exterior walls for buildings, it is a member of the broad family of building materials. The most obvious technological activity is found in the brick business sector to absorb solid waste because the industry uses a lot of raw materials and produces a lot of finished goods for building.

A number of waste materials, including natural fibres, textile laundry wastewater sludge, foundry sand, granite sawing waste, processed waste tea, sewage sludge, structural glass waste, fly ash, sugar cane bagasse ash, organic residue, and steel dust, have been tried to be used in the brick-making process. Fly ash slag from municipal solid incineration, silica fume, marble, and rice husk ash. It has been demonstrated that bricks made from natural waste materials, such as sugar bagasse ash, can achieve the highest compressive strength. Bricks made of bagasse ash help lessen a building's seismic weight. Mayank Gupta and Rohan Rajput (2016).

The effects of different waste materials on bricks' mechanical, physical, and thermal insulation qualities are highlighted in this review of previous research.

1. To make clay bricks using biomass combustion ash waste (fly ash and wood powder) as secondary raw materials.
2. To ascertain the fly ash and powdered wood waste's chemical and physical characteristics.
3. Using the leftover components, ascertain the bricks' strength.
4. To reduce pollution in the environment.
5. In the process of making bricks, garbage, construction debris, and agricultural waste are diverted from landfills, lowering pollution levels and fostering a circular economy.
6. By using waste materials, less natural resources—such as clay and sand—that are normally used for traditional brick manufacture must be extracted and processed.

7. Compared to conventional brick production techniques, some waste elements, such as fly ash, can help reduce carbon emissions.

1.3 Environmental impact of brick made from waste material

- Waste Utilization: A lot of waste materials, such fly ash, rice husk, or construction debris, would otherwise end up in landfills, which pollutes the environment. We minimize environmental deterioration by using these materials in brick making, which lowers the quantity of trash that ends up in landfills.
- Natural resource conservation: Traditional bricks usually use natural resources like clay, sand, and water, which reduces the demand for virgin materials. Utilizing waste materials (such as mining waste and industrial byproducts) lowers the demand for these natural raw materials, preserving them for later use.
- Energy Savings and a Lower Carbon Footprint: Less energy is used when building bricks from trash, particularly if the waste is already finely ground (such as fly ash), which can eliminate the need for prolonged heating or drying. Because some waste-based bricks might not require the high firing temperatures required for conventional clay bricks, this can reduce energy use.
- Pollution reduction: Traditional brick kilns frequently emit significant amounts of particulate matter and greenhouse gases (GHGs) into the environment, which results in less air pollution. Pollutant emissions may be reduced if different waste materials—particularly those that don't need to be fired at high temperatures—are utilized in the brick-making process.

2. LITERATURE REVIEW

1. G Batham, S. Akhtar, M. Bhaskar, et al. (2014): When alumina is made from bauxite using the Bayer process, red mud is the main waste product. It is made up of silica, titanium, and iron oxides as well as a few other trace elements. In the current work, an experimental investigation was carried out to manufacture brick using red mud. In the laboratory, red mud bricks of various trial mixes were made, and tests were performed to determine their characteristics. The results of the tests were compared to those of regular bricks. The study concludes that red mud bricks perform better than regular bricks. Red mud bricks save the environment since they are affordable and environmentally beneficial.
2. G. Batham, M. Bhaskar, S. Akhtar, and others (2014): Red mud is the primary byproduct of the Bayer process, which turns bauxite into alumina. Silica, titanium, iron oxides, and a few other trace components make up its composition. An experimental inquiry was conducted in the current work to build brick using red mud. Red mud bricks of different experimental mixtures were created in the lab, and tests were conducted to ascertain their properties. The test findings were contrasted with those of ordinary bricks. Red mud bricks outperform ordinary bricks, according to the study's findings. Due of their affordability and environmental advantages, red mud bricks are environmentally friendly.

3. OBJECTIVE

3.1 Objective of this project

1. To make clay bricks using biomass combustion ash waste (fly ash and wood powder) as secondary raw materials.
2. To ascertain the fly ash and powdered wood waste's chemical and physical characteristics.
3. Using the leftover components, ascertain the bricks' strength.
4. To reduce pollution in the environment.
5. In the process of making bricks, garbage, construction debris, and agricultural waste are diverted from landfills, lowering pollution levels and fostering a circular economy.
6. By using waste materials, less natural resources—such as clay and sand—that are normally used for traditional brick manufacture must be extracted and processed.
7. Compared to conventional brick production techniques, some waste elements, such as fly

ash, can help reduce carbon emissions. Project having a smaller environmental impact can be completed more quickly and affordably.

4. METHEDOLOGY

4.1 Material Used for Making Wood Powder Brick:

CLAY: Clay is characterized as a fine-grained, stiff, and sticky earth that can be molded when wet. It is then dried and backed to create ceramics, pottery, and bricks.

WOOD POWDER: An eco-friendly and possibly affordable substitute for conventional materials is wood waste powder, which can be utilized in the production of bricks.

HUSK RICE: Although it typically decreases compressive strength and increases porosity, rice husk can be used in brick production to lower costs, produce environmentally friendly bricks, and solve waste disposal issues.

Fig -1: Wood Powder

Proportions Used:

Table -1: Proportions for making Wood Powder Brick

MATERIAL	Clay	Wood powder	Rice husk
10%	1000gm	200gm	800gm
15%	1000gm	300gm	700gm
20%	800gm	400gm	800gm

4.2 Material Used for Making Fly Ash Brick:

CLAY: Clay is characterized as a fine-grained, stiff, and sticky soil that can be molded when wet. It is then dried and backed to create ceramics, pottery, and bricks.

ASH FROM FLY: For bricklaying, fly ash bricks have many benefits, such as being strong, lightweight, low water absorption, thermally insulated, and environmentally beneficial.

HUSK RICE: Although it often decreases compressive strength and increases porosity, rice husk can be utilized in brick production to lower costs, produce environmentally friendly bricks, and handle waste disposal difficulties**.**

Fig 2-: Fly Ash

Proportions Used:

Table -2: Proportions for making Fly Ash Brick

4.3 Procedure for making bricks:

Clay Preparation: After being excavated and brought to the location, soil is combined with water to create workable clay. For cost-effectiveness and better material quality, rice husk and waste materials are incorporated.

MATERIAL	Clay	Wood powder	Rice husk
10%	1000gm	200gm	800gm
15%	1000gm	300gm	700gm
20%	800gm	400gm	800gm

Moulding: To create raw bricks, clay is poured into molds that are 190 x 90 x 90 mm in size. The molds are then allowed to cure for around half an hour.

Drying: In the Sun For around seven days, raw bricks are set out in the sun on dry sand. As the edges whiten and dry, they are rotated. When the final moisture content drops to 10–15%, they are ready for use.

Burning: To get the necessary strength and hardness, dried bricks are heated to high temperatures in a kiln or clamp.

Fig -3: Preparation of Clay

Fig -4: Moulding

Fig -5: Burning of bricks

Fig -6: Drying of Bricks

Table -3: Results of Visual Test

Sr no.	Test	Yes/No
1	The bricks should be well finished, smooth and are free from cracks.	Yes
2	They should possess sharp and square edges.	Yes
3	They are of uniform color, shape and size as per standard.	Yes
4	When the bricks are struck with each other, they should produce clear ringing sound.	Yes
5	Fracture of good bricks showed uniform and bright compact structure without any voids.	Yes
6	Bricks should not be broken down when dropped from 1m height.	Yes

5. RESULT AND CONCLUSION

5.1 Visual Test:

5.2 Compressive Strength Test:

Compressive Strength of Bricks Made using Wood Powder:

Sr. No	Brick Type	Average Compressive Strength (N/mm2)
1	10%Wood Powder	9.12
2	15%Wood Powder	9.11
3	20%Wood Powder	11.01

Table -3: Average compressive Strength of Wood Powder Brick

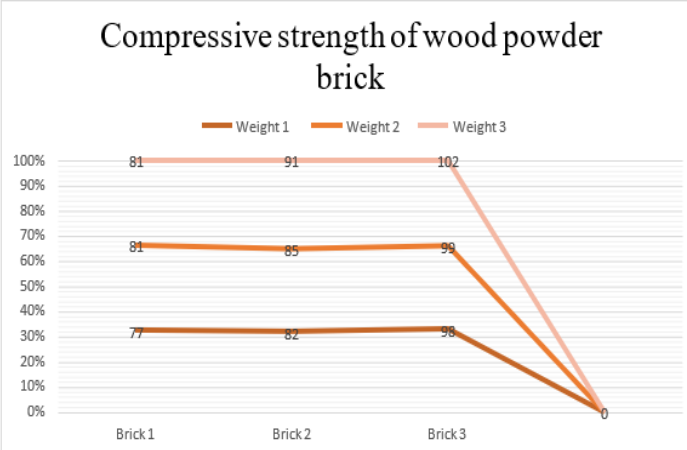

Fig -7: Graph Presentation of Wood Powder Brick

Compressive Strength of Bricks Made using Fly Ash:

Sr. No	Brick Type	Average Compressive Strength (N/mm2)
1	10% Fly Ash	8.45
2	15% Fly Ash	9.18
3	20% Fly Ash	11.28

Table -3: Average compressive Strength of Fly Ash Brick

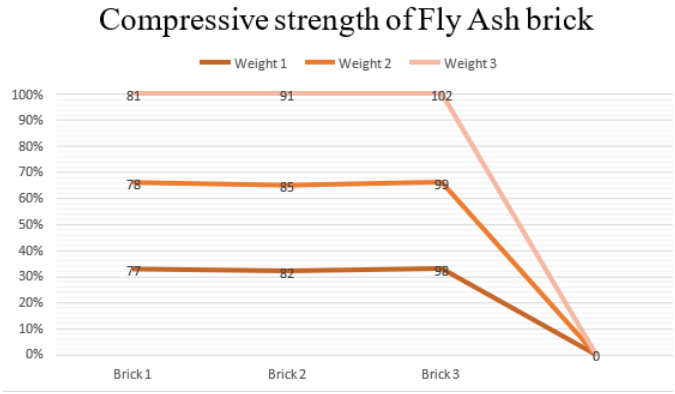

Fig -8: Graph Presentation of Fly Ash Brick

5.3 Conclusion:

- Waste materials such as fly ash, slag, and recycled aggregates have been found to improve the compressive and tensile strength of bricks. This is attributed to the pozzolanic reactions that occur during curing.
- Utilizing industrial waste reduces the reliance on virgin materials, thereby decreasing the environmental footprint of brick production.

This practice contributes to waste management and reduces landfill usage.

- Bricks made with waste materials often exhibit better resistance to weathering, chemical attack, and freeze-thaw cycles, leading to longer service life.
- The use of waste materials can lower production costs, as these materials are often cheaper than traditional raw materials. This economic advantage can make sustainable practices more appealing to manufacturers.
- As resulting, the bricks made by using waste are also useful to our construction process and can give approximately similar strength to the construction as the normal 1st class brick can give.
- • It can be a good initiative of making bricks from waste material because it can help our environment of become healthier and ecofriendly.

6. REFERENCES

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