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Fabrication of Flyash E-Blocks

J.Ramsai[1], S.Sai Krishna[2], Sk.Basheer[3]

[123]*Aditya Engineering College, Surampalem, 533437*

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A B S T R A C T

This experimental work intends to conserve exploitable natural elements such as sand and locally accessible rock resources by fabricating bricks using recycled building and industrial waste materials.In this experimental investigation, flyash, lime, gypsum, ceramic & steel slag, and recycled aggregate were used to make E-blocks. In addition, because sand is a natural resource, it is being substituted to examine the performance of strength and durability characteristics of FaL-G bricks by substituting quarry dust and sand with ceramic waste powder, steel slag, and recycled aggregate. If used consistently for building, it may deplete. Quarry dust, rather than sand, can be utilized as a basement filling material. Ceramic waste powder, steel slag, and recycled aggregate, on the other hand, cannot be utilized in places where sand and quarry dust are used.As a consequence of this issue, we propose to create FaL-G bricks from these waste materials. We chose these waste materials since a huge number of them are generated in our nation each year. According to the Indian Power stations Association, "Indian power plants generate approximately 600,000 tones of fly ash per day." Due to the increased number of industries in India, the creation of ceramic waste powder and steel slag waste has increased. According to the Building Material Promotion Council, the country generates an estimated 150 million tonnes of Construction and Demolition (C&D) waste each year, while the declared recycling capability is just 6,500 tonnes per day, or around 1. Following the casting of the bricks, their strength characteristics will be evaluated in accordance with IS: 3495 (Part I to IV) 1992.Part 1 describes how to calculate compressive strength. Part 2 discusses the method of determining water absorption, and Part 3 discusses the way of determining efflorescence.

Keywords: Fly Ash , Lime, Gypsum, Ceramic Waste, Steel Slag, Recycled Aggregate.

1. Main text

FaLG bricks have a low water absorption rate, a high compressive strength, and good insulating qualities. They are also environmentally friendly because they are made from fly ash, a byproduct of coal combustion that would otherwise be discarded as waste.FaLG bricks come in many sizes and forms, including solid and hollow blocks, and may be used in both load-bearing and non-load-bearing walls. They are frequently utilised in residential and commercial building projects, as well as in infrastructure projects including as bridges, tunnels, and dams.This project involving the use of fly ash, recycled concrete aggregate, ceramic waste, and steel slag can also be applied to the production of bricks. By using these materials, a more sustainable and eco-friendly alternative to traditional clay bricks can be created. Fly ash can be used as a partial replacement for the clay component in traditional brick-making, reducing the amount of clay needed and the energy required for firing the bricks.Recycled concrete aggregate can be used as a substitute for traditional aggregates in the production of brick-making concrete mixtures. This reduces the amount of waste sent to landfills and conserves natural resources.

Ceramic waste can also be used as a substitute for traditional clay in brick production. This further reduces the amount of waste generated and minimizes the environmental impact of the manufacturing process.Steel slag can be used as a substitute for natural aggregates in the production of brick-making concrete mixtures. This provides additional strength and durability to the bricks, while also reducing waste and conserving natural resources.Overall, using these materials in the production of bricks can result in a more sustainable and eco-friendly building material that has enhanced mechanical properties. This type of project aligns with sustainable development goals and contributes to a more circular economy.

These bricks are made from ceramic waste, which is obtained from industries that .We can make E blocks out of industrial trash. It is environmentally sustainable; by employing industrial waste, we can minimise the cost of the brick while also controlling pollution in the environment. We may avoid utilising naturally available resources like sand by employing waste materials in the manufacture of E blocks. Because these blocks are larger in size, we may lower the cement mortor and the number of joints. On-site wall construction is quick. These E blocks have a higher strength than regular bricks.

1.1 Structure

FalG (Fly ash, Lime, and Gypsum) bricks are made by mixing fly ash, lime, gypsum, and water in a specific ratio, and then compressing the mixture into brick-shaped molds. The resulting bricks are then allowed to cure, which causes a chemical reaction between the fly ash and lime that results in the formation of a hardened material.The structure of FalG bricks is similar to that of conventional clay bricks, but with some differences. The primary difference is that FalG bricks are composed of a different mixture of materials, and the manufacturing process involves a chemical reaction between the fly ash and lime that results in the formation of a new material.The structure of FalG bricks typically consists of a porous, lightweight material with good thermal insulation properties. The bricks have a rough surface and are generally lighter in color than conventional clay bricks. They have a rectangular shape with sharp edges and are available in various sizes, depending on the mold used during the manufacturing process

COLLECTION OF RAW MATERIALS

1) FLYASH: Fly ash is the finely divided residue that results from the combustion of pulverized coal and is transported from the combustion chamber by exhaust gases.

2) **LIME:Lime** is a calcium-containing inorganic material composed primarily of oxides and hydroxide, usually calcium oxide and/or calcium hydroxide.

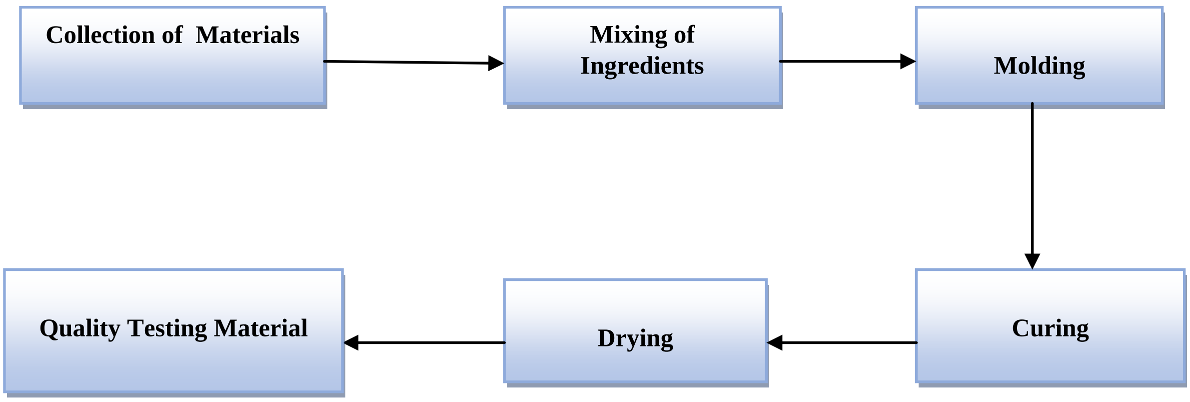
3) **GYPSUM:** Gypsum is a soft sulfate mineral composed of calcium sulfate dihydrate, with the chemical formula $CaSO_4 \cdot 2H_2O$. It is widely mined and is used as a fertilizer and as the main constituent in many forms of plaster, blackboard or sidewalk chalk, and drywall.

4) **CEARMIC WASTE:**Ceramic waste powder (CWP), produced during the process of polishing ceramic tiles, is dumped in landfills and can cause soil, air and groundwater pollution leading to serious environmental problems

5) **STEEL SLAG**: Steel slag, a by-product of steel making, is produced during the separation of the molten steel from impurities in steel-making furnaces.

6) **RECYCLED AGGREGATE:**Recycled aggregates are developed from the reprocessing of materials that have been originally used in construction. They include sand, gravel, crushed stone, and asphalt. Essentially, the term refers to **materials that have been previously used in construction**.

1.2 Flow chart



Proportions of the Materials

Name of the Material	**Percentage**
Fly ash	15%
Lime	20%
Gypsum	1%
Ceramic Waste Slag	20%
Steel Slag	20%
Recycled Aggregate	24%

1.3 Construction of references

FABRICATION PROCESS

Flag bricks are a type of building material that are typically made from a mixture of clay, sand, and water. The fabrication process of flag bricks involves several stages that are designed to transform the raw materials into a finished product that is strong, durable, and aesthetically pleasing.The first stage of the fabrication process is raw material selection. The quality and composition of the raw materials can have a significant impact on the quality of the finished product. The clay and sand are typically sourced from quarries or mines, and are carefully selected based on their properties such as plasticity, strength, and color.Once the raw materials have been selected, they are mixed together with water to create a consistent and workable mixture. This mixture is then shaped into brick forms using molds, which can be made of wood, metal, or other materials.Themolded bricks are then allowed to dry naturally in the sun or in a kiln. This process removes excess moisture and hardens the bricks. The dried bricks are then fired in a kiln at high temperatures, which causes the clay to vitrify and form a hard, durable brick.After firing, the bricks are allowed to cool slowly to prevent cracking and breakage. They are then sorted by size, shape, and quality, and some bricks may need to be cut to size or shape using a brick saw or other cutting tool. The finished bricks are packaged and prepared for transportation to construction sites, where they are used in a variety of building projects.

Tests Conduted:

Technical Specification of Fly Ash Brick as per IS: 12894-2002 which comes under the following parameters:

1. **Compressive Strength**: When tested according to IS 3495, the minimum average wet compressive strength of pulverized fuel ash- lime bricks should not be less than the one stipulated for each class in table 1 of IS: 12894. (Part 1). The wet compressive strength of every individual brick should not be less than 20% of the minimum average wet compressive strength prescribed for the relevant class of bricks.

2. **Drying Shrinkage:** When evaluated using the technique provided in IS 4139, the average drying shrinkage of three units should not exceed 0.15 percent. 3. Efflorescence Examination When tested in accordance with the technique outlined in IS 3495 (Part 3), the bricks must have an efflorescence value of no more than'moderate' up to Class 12.5 and'slight' for higher classes.

3. **Water Absorption :**When tested in accordance with the technique outlined in IS 3495 (Part 2), the bricks must have an average water absorption of no more than 20% by mass up to class 12.5 and 15% by mass for higher classes after 24 hours of immersion in cold water

1.4 Section headings

1. Introduction: Brief overview of the concept and history of FalG bricks
2. Raw Materials: Description of the key ingredients and their properties
3. Manufacturing Process: Detailed explanation of the process for making FalG bricks, including mixing, molding, curing, and drying
4. Properties and Characteristics: Discussion of the physical, mechanical, and thermal properties of FalG bricks, and their advantages and limitations
5. Testing and Quality Control: Overview of the testing methods used to ensure the quality and performance of FalG bricks
6. Applications and Uses: Description of the various applications and uses of FalG bricks, including in residential, commercial, and infrastructure projects
7. Environmental and Economic Benefits: Analysis of the environmental and economic benefits of using FalG bricks, such as reduced carbon emissions, waste reduction, and cost savings
8. Challenges and Future Directions: Discussion of the challenges facing FalG brick production and opportunities for future research and development in this field
9. Conclusion: Summary of the key points and implications of using FalG bricks as a sustainable construction material.

1.5 Footnotes

1. Fly ash is a byproduct of coal combustion and is widely available in many parts of the world. By using fly ash in the production of E blocks, waste material is diverted from landfills and put to productive use.
2. Lime is used in the mixture to provide a source of calcium, which reacts with the fly ash to form the binding material that holds
3. Gypsum is added to the mixture to regulate the setting time of the bricks and improve their strength and durability.
4. E blocks have a lower embodied energy and carbon footprint than conventional clay bricks, as they require less energy to produce and reduce the demand for virgin materials like clay and sand.
5. E blocks have good thermal insulation properties, which can help reduce heating and cooling costs in buildings and improve energy efficiency.
6. E blocks are typically lighter in weight than conventional clay bricks, which can make them easier to handle and transport.
7. The use of E blocks can help reduce air pollution and greenhouse gas emissions associated with traditional brick production, as well as promote sustainable and circular economies.
8. The quality of E blocks can vary depending on the quality of the raw materials, the manufacturing process, and the curing and drying conditions. Therefore, it is important to ensure that FalG bricks are manufactured according to the required quality standards and tested for their properties and durabilit

Illustrations

Fly ash, water, quicklime or lime sludge,and gypsum are the main constituents. Autoclaving enhances the hardness of the block by facilitating rapid cement curing. Gypsum is a long-term strength builder. Because of the chemical reaction caused by the aluminium paste, AAC has a characteristic porous structure, lightness, and insulating qualities. The aforementioned characteristics distinguish it from other lightweight concrete materials. The end result is a lighter block, less than 40% the weight of standard Bricks, with comparable strengths. The specific gravity remains between 0.6 and 0.65. Using these blocks in structures minimizes dead load, allowing for 30 to 35% savings in structural steel and concrete.

2. Equations

1. Compressive Strength (mpa) = Load /Area
2. Water absorption = W2-W1/W1*100

W1= Dry weight

W2=Wet weight

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With Sincere Regards, J. Ramsai,**. Sai Krishna,** Sk. Basheer

5. Appendix

1. Testing Standards: A list of the testing standards that are commonly used to evaluate the properties and quality of FalG bricks, such as ASTM C67/C67M-17 Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile and ASTM C1293-17 Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction.

2. Case Studies: Examples of construction projects that have used FalG bricks, along with details on the benefits and challenges of using this material in each case. These could include case studies from different countries or regions, or different types of building projects, such as residential, commercial, or infrastructure.

3. Technical Data: Tables or charts summarizing the physical, mechanical, and thermal properties of FalG bricks, along with comparisons to conventional clay bricks or other construction materials.
4. Glossary: A list of technical terms and definitions related to the production, properties, and use of FalG bricks, to help readers understand the terminology used in the main text.
5. Suppliers and Manufacturers: A list of companies that supply or manufacture FalG bricks, along with their contact information and any relevant certifications or accreditations.
6. Further Reading: A selection of additional resources, such as academic papers, reports, or books, that provide more detailed information on specific aspects of FalG bricks, such as their environmental impact, durability, or cost-effectiveness.

6. Conclusion

The initiative's purpose is to create the blocks out of industrial waste.The blocks should be sturdy while being reasonably priced. Because they are lighter in weight than FaLG bricks, they reduce the dead load of the building, cutting the overall cost of construction.Because of the homogeneous size of the bricks, the amount of mortar required for joints and plastering is reduced by over 50%, and the great strength virtually eliminates breaking during transport and usage. The various proportions of the E-bricks combination yield reasonable results. More bricks should be investigated to find relationships between the properties. Considering all of the test results, it is feasible to infer that E- Blocks may be used as a building material to reduce soil extraction from the earth (Brunt Clay Bricks).Switching from FaLG Bricks to E - Blocks might save us up to 20% in expenditures. These blocks are constructed of industrial waste and are environmentally friendly.

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