International Journal of Scientific Research in Science, Engineering and Technology
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Comparative Analysis between Fly Ash Brick and Conventional Clay Brick

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ARTICLEINFO

Article History:
Accepted: 10 June 2023
Published: 22 June 2023

Publication Issue
Volume 10, Issue 3
May-June-2023

Page Number
552-555

ABSTRACT

Fly ash is the by-product of coal combustion collected by the mechanical or electrostatic precipitator (ESP) before the flue gases reach the chimneys of thermal power stations in very large volumes. All fly ash contains significant amounts of Silicon dioxide (SiO2), Aluminum oxide (Al2O3), Iron oxide (Fe2O3), Calcium oxide (CaO), and Magnesium oxide (MgO) however, the actual composition varies from plant to plant depending on thecoal burned and the type of burner employed. Fly ash also contains trace elements such as mercury, arsenic, antimony, chromium, selenium, lead, cadmium, nickel, and zinc.

Keywords: Fly Ash Brick, Clay Bricks

I. INTRODUCTION

Production of burnt clay bricks requires consumption of coal leading to green house gas emissions. The primary raw material used for bricks is the soil, which is often taken from prime agricultural land, causing land degradation as well as economic loss due to diversion of agricultural land.

Use of traditional technologies in firing the bricks results insignificant local air pollution. The burnt clay brick industry in India produces over 180 billion clay bricks annually with a strong impact on soil erosion and unprocessed emissions.

At the same time, the thermal power plants in India continue to produce a huge amount of fly ash, disposal of which poses significant challenges for the power plants. Production of building materials, particularly bricks using fly ash is considered to be one of the solutions to the ever-increasing fly ash disposal problem in the country.

Although there exist several technologies for producing fly ash bricks, the one that is gaining popularity is the FaL-G technology. The FaL-G technology works with the strength of fly ash, lime and gypsum chemistry.

The slow chemistry of fly ash and lime is manoeuvred by tapping ettringite phase to its threshold limits through sufficient input of gypsum. Therefore, FaL-G does not require heavy duty-press or autoclave, which is otherwise required in case of only fly ash and lime. The FaL-G process completely eliminates the thermal

treatment (except open air drying) and does not require combustion of any fossil fuel.

This literature review aims to explore the various aspects of fly ash bricks, including their manufacturing process, properties, benefits, challenges, and recent advancements. Basu majumdar et al., in 2004 has studied that the fly ash and lime has some cementation properties when they react together. He also observed that when lime mixed with oxides such as silica, alumina and iron oxides of fly ash it starts to form different bearing phase and these phases when reacted with water turns into hydrated forms.

Ravi Kumar et.al., 2014 has studied the behavioural properties of fly ash bricks by taking fly ash, cement, gypsum, sand and lime in various different concentrations. Various tests such as compression test, water absorption test, weight test was performed to compare these bricks with the normal bricks. While comparing, the fly ash bricks has shown more compressive strength than the normal conventional bricks.

Fly ash bricks are a sustainable alternative to traditional clay bricks, as they utilize industrial by products, specifically fly ash, a fine powder obtained from coal combustion in thermal power plants. Fly ash brick production helps in the efficient utilization of waste materials, reduces environmental pollution, and conserves natural resources. This literature review aims to explore the various aspects of fly ash bricks, including their manufacturing process, properties, benefits, challenges, and recent advancements.

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II. METHODS AND MATERIAL

1. Fly ash, lime, sand and gypsum are manually fed into a pan mixer where water is added in the required proportion for intimate mixing. The proportion of the raw material is generally in the ratio 60-80% of fly ash 10-20% lime, 10% Gypsum and 10% sand, depending upon the quality of raw materials.
2. The materials are mixed in pan mixture. After mixing, the mixture is conveyed through belt conveyor to the hydraulic/mechanical presses.

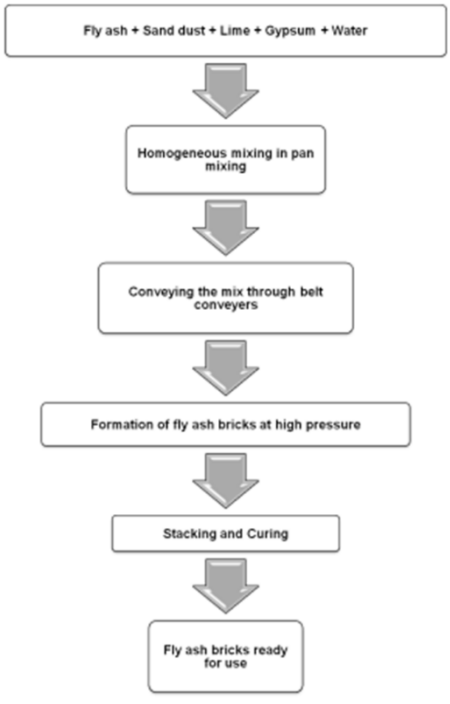

Fig. Flow Sheet for the manufacture of FaL-G Bricks

3. The homogenized mortar taken out of roller mixer is put into the mould boxes. Depending on the type of machine, the product is compacted under vibration / hydraulic compression etc.
4. The green bricks are dried up under sun from 24 to 48 hours, depending whether lime route or cement route; the dried- u p bricks are stacked and subjected for water spray curing once or twice a day, for 7-21 days, depending on ambience.
5. The bricks are tested and sorted before dispatch.

III.RESULTS AND DISCUSSION

Fly ash utilization in the country has remained less than 30% during the past 5 years andit might take several years to reach the final goal of cent percent utilization. It is estimatedat present nearly 160 million ton fly ash is produced every year, out of which hardly 40- 50 % is used in all possible applications. To utilize such a huge quantity of ash, we have to take necessary actions from government side and from nongovernment side for utilization point of view. Based on the results for the experiments done on Fly ash lime brick, Compressive strength = 54.25 kg/cm2 % Water absorption = 19.26 %

TABLE I

STRENGTH COMPARISION

S.No	Comparision table for fly ash and clay brick			
	Description	**Clay brick**	**Fly ash brick**	**Remarks**
1	Colour	vary	Uniform	Good appearance
2	Density	1600-1700 kg/m3	1700-1850 kg/m3	Higher loa bearing
3	Compressive Strength	30-35 kg/cm3	55-100 kg/cm3	Higher load bearing
4	Water Absorption	15-25 %	10-14 %	Less dampness
5	Dimensional Stability	very Low Tolerance	High tolerance	Saving in morta upto 25%
6	Wastage During Transit	Up to 10 %	Less than 2 %	Saving in Cost Up to 8 %
7	Plastering	Thickness Vary on the Both Sides of Walls	Even on Both Sidesof Walls	Saving in PlasterUp to 15 %

IV.CONCLUSION

Fly ash bricks have many advantages like :
Light weight
Economical
Environmental friendly
Saving of fertile land, pure water
More compressive strength
Use of wastage etc.

Thus, Fly ash brick is one of the best uses of fly ash. It may be concluded that the use of fly ash in brick manufacturing industry is techno-economically viable, if utilized by application of optimum technologies, which are available with commensurate levels of automation and capacity generation.

Fly ash brick manufacturing is a potential field of application wherein large-scale utilization of fly ash is possible. From the previous chapters it can be understood that fly ash bricks are better alternative to conventional burnt clay bricks in structural, functional and economic aspects.

This industry has the potential to consume at least 50% of the ash production in India. By use of this aspect we

can convert waste into wealth. After looking into all the facets of fly ash brick industry and its different applications in the previous chapters, in the end it is a request to all the government and nongovernment organizations involved in generation, research and development and utilization of fly ash, to extend all possible help in terms of technology, resources or finance to the entrepreneurs who are trying to come forward to set their plants in spite of tough competition and numerous set back in marketing. If this much could be done, it will prove to be a big stepping stone towards the present need of sustainable development.

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Cite this article as :

Pooja Bhandari, Saugat Singh, Udit Narayan, Gaurav Bohara, Rakesh Kr Mandal, "Comparative Analysis between Fly Ash Brick and Conventional Clay Brick", International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Online ISSN : 2394-4099, Print ISSN : 2395-1990, Volume 10 Issue 3, pp. 552-555, May-June 2023.
Journal URL : https://ijsrset.com/IJSRSET23103154