Eco-friendly fly ash composite brick: A novel approach towards Sustainable Development.

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ABSTRACT

Fly ash is generated in vast quantity as a sub product from fossil fuels as source for energy in the thermal plant production of electricity. Currently, 12-15% of the fly ash generation in other country is utilized in cement production and civil construction industry, with the out from this major issue and costly for disposal phenomenon. Due to development ecological concerns, it needs for cleaner technology; the management of fly-ash has become a significant problem facing the power production industry. For that context, many appraisals are actively functioning to find novel and improved techniques of combating the fly-ash waste disposal issue, specifically by establish its useful and economic application. One such type is gaining significant role in many zones of the world is the application of fly ash in brick manufacturing. This chapter explains the potential for utilization of fly-ash is a cheap constituent in the production of common constructional building blocks. Scaled down pressed blocks were prepared by varying percentage of fly-ash, sand, lime-stone, gypsum, LDPE (low density polyethylene) and water. Fired, temperature controlled and air-cured blocks were estimated for their characteristics along with mechanical properties including water absorption and durability. Chapter contains the analytical values and effects of different variables are discussed.

Keywords—Fly-ash, Brick, mechanical properties, Waste disposal.

**Outline**

Preamble of the chapter

Aim of the Chapter

Methodology adopted in the chapter

Chapter Analytical results

Production of Bricks

Conclusion of the Chapter

**INTRODUCTION**

Fly ash is produced by combustion of coal, which occurs in thermal-power plants. It consists of small, solid particles that are carried away in the flue gas and collected by electrostatic precipitators or baghouses before being released into the atmosphere. Fly-ash is generally composed of silicon dioxide (SiO2), Oxides of aluminum, calcium and magnesium.

Composite fly-ash is produced in a large quantity especially in thermal industries. Plastics are produced in large quantity with the population. The suitable disposal of plastic bags has highlighted into a chief issue. The waste from plastics in household is more and increases with era. These waste cause severe ecological changes and creates many issues. The key aim of this chapter is to replace those plastics with varied fly-ash content in the production of blocks industry. This chapter describes the fly-ash blocks are casted using powdered plastics varied with the 20% with an interval of 5%. Fly-ashes blocks are manufactured using plastics and subjected for various experimental variables like compressive strength, water absorption and efflorescence. The durable characteristics of composite blocks containing with composite materials, it describes the elements and considerations of design for the concrete block by incorporating plastic bag. It is economically viable, when compared with the normal fly-ash blocks.

This chapter contains, main objectives are to manufacture fly ash based brick as a measure of reusing fly ash waste. To develop the composite fly ash brick, study different mechanical variables strength, dimensional stability and water absorption. Finally, the cost-effectiveness was compared with the traditional bricks.

Materials used in the study are Fly ash, sand, LDPE (low density polyethylene), gypsum, water, limestone. Weighing machine or Oven, mold etc.

# Methodology adopted in the study is

# Collection of Raw Material (fly ash)

Fly ash is a by-product of burning coal in thermal power plants, and it can be collected and reused in various applications. The collection of fly ash typically involves the use of electrostatic precipitators (ESPs) or baghouses, which are devices that capture the fly ash particles from the flue gases before they are released into the atmosphere. In an ESP, the fly ash particulate get charged and afterwards drawn to electrodes, where they are collected and removed. In a baghouse, the flue gases are passed through fabric filters, which trap the fly ash particles. The collected fly ash can then be transported to storage facilities for further processing and use.

# Mixing of Raw Materials

Composite ash bricks are made by mixing a combination of raw materials that include fly ash, sand or stone dust, lime, gypsum, And Low-Density Polyethylene.

# Fly Ash

Majorly fly ashes are obtained from industries like thermal power plants where coal is burned to produce. The ash is collected from the exhaust gases and stored in silos for further use. The fly ashes are then sieved to remove any large particles and formed a slurry when combined with water.

# m- sand

m- Sand is added to the fly ash slurry in a specific proportion. The purpose of adding sand or stone dust is developed with the strength and durability of the bricks.

# Lime

Lime is added to the mixture in a specific proportion to provide the necessary binding properties to the bricks. The lime is reacted with the silica present in the fly ash and forms a complex compound that acts as a binder.

# Gypsum

Gypsum is added to regulate the setting time of the fly ash blocks. Gypsum also helps to prevent the cracking of bricks during the drying process.

# Low density polyethylene

Low density polyethylene acts as a binding agent in the composite, helping to improve the strength and durability of the resulting brick.

# Moulding

The mixture is then poured into moulds of desired shapes and sizes. The moulds are generally made of metal or plastic.

# Curing

The curing process of fly ash bricks is a crucial step that helps to enhance their strength and durability.

# Water curing

After the bricks are moulded, they need to be kept moist for at least seven days. This process is known as water curing. During this period, the bricks are covered with wet gunny bags or straw to prevent evaporation of moisture.

# Drying

After the water curing process, the bricks are taken out of the moulds and kept in a shady area for drying. This process takes around 7-10 days depending on the weather conditions. During this period, the bricks should be kept away from direct sunlight to prevent cracking.

# Natural cooling

After the steam curing process, the bricks are taken out of the chamber and allowed to cool naturally. This process takes around 24 hours. The bricks should not be cooled suddenly as it may lead to cracking.

# Demoulding

Demoulding of fly ash bricks is an important step in the brick-making process, as it involves removing the newly formed bricks from their moulds without damaging them.

**TESTING PROCEDURE**

# SHAPE AND SIZE TEST

Bricks' dimensions and shapes are to be carefully calculated. The size of each block applied in construction in uniform condition. Bricks have only a rectangular outline and separate edges. The dimensions of a standard size are 19 cm long by 9 cm wide by 6 cm high. Conducted this experiment by randomly selecting 20 fly-ash bricks from bunches. Stack the bricks with length, breadth, and height, and then make a comparison. Since, all the bricks are in same proportion are allowed.

# TEST FOR COMPRESSIVE STRENGTH

Bricks's capacity for crushing was estimated using compression testing machine. After placing the brick, applied force on the composite materials until it breaks. The load is which breaked the brick was noted and crushing strength value of the brick can be calculated. The Crushing strength value of the brick is 3.50 N/mm2. If the value is less than 3.50 N/mm2, then this brick is not used in construction. Generally the brick crushing strength value is expressed in N/mm2, and it is the proportion of the brick's area to its maximum load.

**Table 3.1 Material ratio for the composite brick test**



**Table 3.2 Stresses in Fly-ash Composite Brick applying Different percentage of materials**



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| --- | --- |
| *Fig 3.1:Sample 1: Load Vs Stress graph*  | *Fig 3.2: Sample 2:Load Vs Stress graph*  |
| Fig 3.4 : Sample 3: Load Vs Stress graph  | Fig 3.5: Sample 4: Load Vs Stress graph for  |

# TEST FOR WATER ABSORPTION

Brick is tested for water absorption to understand the percentage of moisture is present and adsorbed in varied conditions. Dry brick samples are taken, initial weight was noted. The quantity of water absorption in good quality blocks showing greater than 20% of the dry brick's weight. *% Water Absorbed = [(Wt - Wo) / Wo] \* 100*

*Where: Wt = weight of the material after being immersed in water*

*Wo = initial weight of the material before immersion in water*

*For,*

Sample 1 - [2100.19 – 2395.5/ 2395.5] \* 100 =16.502%

Sample 2 - [1850 – 2006.1/ 2006.1] \* 100 =7.78%

Sample 3 - [1500 – 1690.8/ 1690.8] \* 100 =11.28%

Sample 4 - [1500 – 1681.7/ 1681.7] \* 100 =10.80%

**COST ESTIMATION**

**Table 4.1: Cost estimation**



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