# EXPERIMENTAL STUDY ON LOW DENSITY POLYETHYLENE INCORPORATED IN CEMENT FLY-ASH BRICKS

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**Abstract:** *Plastic trash is increasing day by day, becoming an eyesore and polluting the environment, particularly in high mountain settlements where rubbish collection is not available. Plastic is a fairly common substance that is used by almost everyone on the planet. Because it is compact and low in weight, plastic offers several advantages over other materials. The disposal of plastic is a major issue in its use. Plastic is composed up of non-biodegradable polymer compounds. Recycling is utilised to safeguard the environment while also successfully utilising the benefits of plastic. Materials such as cement, fly ash, and plastic powder are used in this project to make eco-friendly bricks. Low Density Polyethylene (LDPE), a thermoplastic produced from the monomer ethylene, was employed as the plastic powder. Three distinct cement compositions: Plastic powder in 50:30:20, 45:35:20, and 40:35:25 ratios. Compressive strength, water absorption, and efflorescence tests are all performed on bricks..*

**Key words:** Plastic, LDPE, compressive strength, cement, fly ash eco-friendly.

## 1. INTRODUCTION

### 1.1 General

Brick is a brick construction material that is used to form walls, pavements, and other features. The term brick originally referred to a clay unit, but it is today used to refer to any rectangular unit put in mortar. Clay-bearing soil, sand, and lime, as well as concrete ingredients, can be used to make bricks. Bricks come in a variety of classifications, types, materials, and sizes that vary by place and time period, and they are made in large quantities. Thousands of different sorts of bricks exist, each with its own name, size, forming process, origin, quality, texture, and/or materials.[1]To build bricks, we used cement, fly ash, and plastic powder in our project. Since 4000 BC, fire bricks, often known as false stone, have been used as one of the most durable and sturdy construction materials. Air-dried bricks, also known as mud bricks, have a longer history than burned bricks and contain a mechanical binder like straw. Bricks are poured in various types of mortar and are arranged in courses in various patterns known as bonds to bind the bricks together to make a robust structure. Unfired bricks, often known as mud bricks, are made from a damp clay-rich soil with binders such as straw or other materials. [3]They are let to air dry until ready to use. Because fired bricks are burnt in a kiln, they are extremely durable. Modern, burned clay bricks are made with soft mud, dry press, or extruded processes. Extruded or soft mud techniques, depending on the nation, are the most common since they are the most cost-effective.

### 1.2 Cement

Cement is a binder, a substance used in construction to bind materials together by setting, hardening, and adhering to them. Finely crushed powders have the critical feature of undergoing a chemical reaction (hydration) when mixed with water. For the aggregate particles, hydration creates a very hard and strong binding medium. Among the three goods, we utilised cement in the highest percentage. As a result, the mixed components have a binding property.

### 1.3 Fly ash

Fly ash, also known as flue ash or pulverised fuel ash, is a coal combustion product made up of particulates (fine particles of burned fuel) and flue gases that are forced out of coal-fired boilers. Fly ash particles are spherical in shape and range in size from 0.5 to 300 micrometres. ASTM C618 distinguishes between two types of fly ash: Class F and Class C.[2] The amount of calcium, silica, alumina, and iron in the ash is the main distinction between these classes. The fly ash used is Class F, which is pozzolanic in nature and contains less than 7% lime (CaO). Because Class F fly ash has pozzolanic qualities, it needs a cementing agent, such as Portland cement, quicklime, or hydrated lime coupled with water, to react and generate cementitious compounds.

**Fig 1.1Fly Ash**

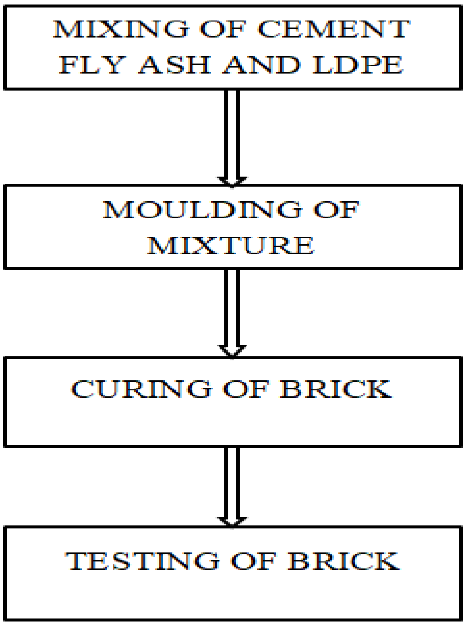
### 1.4 Low density polyethylene (LDPE)

LDPE (low-density polyethylene) is a thermoplastic manufactured from the ethylene monomer. The density of LDPE is defined as 0.917–0.930 g/cm3. Except for time and 90 °C (194 °F) for a short period of time. It comes in a variety of translucent and opaque colours and is both flexible and durable. Because LDPE has more branching

**Fig 1.2 LDPE**

(on around 2% of the carbon atoms), it has weaker intermolecular forces (instantaneous-dipole induced-dipole attraction), lower tensile strength, and higher resilience than HDPE. Due to the side branches, its molecules are less closely packed and less crystalline, resulting in a lower density. strong oxidising agents, it is hardly reactive at ambient temperature, and some solvents cause swelling. It can endure temperatures of 80 °C for an extended period of

## 2. METHODOLOGY




## 3. PROCEDURE:

1. First, varying proportions of cement, fly ash, and LDPE plastic powder are taken according to the requirements.

2. They are well combined in a tray.

3. Add the needed amount of water and thoroughly mix it together.

4. The material is pressed into a brick mould and allowed to dry for 24 hours.

5. The brick is then removed from the mould after 24 hours and left to cure for 7 days in the curing tank.

6. The brick is evaluated for compression strength using a UTM machine after 7 days.

7. The efflorescence and water absorption of the bricks are also checked.

## 4. Proportion of Bricks

Three distinct proportions of cement fly-ash and low density polyethylene are explored below at varied ratios for each component

### 4.1 Proportion 1

**Table 1 Proportion 1**

| Materials | Percentage in mixture | Quantity in kg |
|---|---|---|
| Cement | 50 | 3.75 |
| Fly ash | 30 | 1.076 |
| LDPE Powder | 20 | 0.44 |

### 4.2 Proportion 2

**Table 2 Proportion 2**

| Materials | Percentage in mixture | Quantity in kg |
|---|---|---|
| Cement | 45 | 3.39 |
| Fly ash | 35 | 1.255 |
| LDPE powder | 20 | 0.4 |

### 4.3 Proportion 3

**Table 3 Proportion 3**

| Materials | Percentage in mixture | Quantity in kg |
|---|---|---|
| cement | 40 | 3.01 |
| Fly ash | 35 | 1.2558 |
| LDPE powder | 25 | 0.55 |

## 5. Testing of bricks

### 5.1 Compression Test

This is done to determine the bricks' compressive strength. This is also known as brick crushing strength. Three distinct proportions of bricks are taken to the laboratory for testing and are tested one by one. In this test, a brick is placed on the crushing machine and pressure is applied until the brick breaks.[7] It is taken into account the ultimate pressure at which bricks are crushed. Each of the three brick specimens is tested individually, and the average result is used to determine the compressive /crushing strength of the brick.

**Table 4 Result**

| S.NO | RATIO OF C :F :P (%) | COMPRESSIVE STRENGTH N/mm^2 |
|---|---|---|
| 1 | 50 : 30 :20 | 12.15 |
| 2 | 45 : 35 :20 | 12.86 |
| 3 | 40 : 35 :25 | 12.19 |

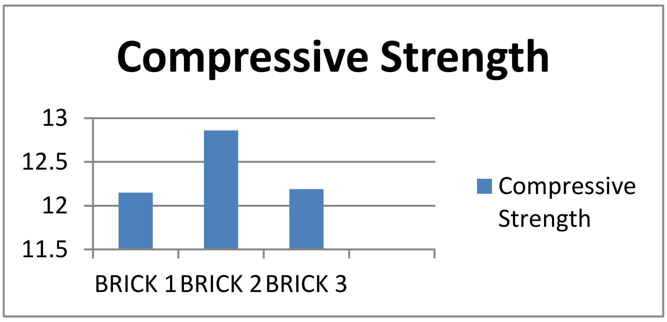



**Fig 5.1 Compressive Strength**

**Fig 5.2 Testing**

### 5.2 Water absorption Test

The bricks are first weighted in a dry state before being immersed in water for 24 hours. They are removed from the water and wiped clean with a cloth. The percentage difference between dry and wet bricks is then calculated.

**Table 5 Percentage of Water Absorption**

| S.NO | RATIO OF C : F : P | WEIGHT OF DRY BRICK | WEIGHT OF WET BRICK | % OF WATER ABSORPTION |
|---|---|---|---|---|
| 1 | 50 : 30 :20 | 2.48 | 2.54 | 2.41 |
| 2 | 45 : 35 :20 | 2.64 | 2.65 | 0.37 |
| 3 | 40 : 35 :25 | 2.54 | 2.56 | 0.78 |

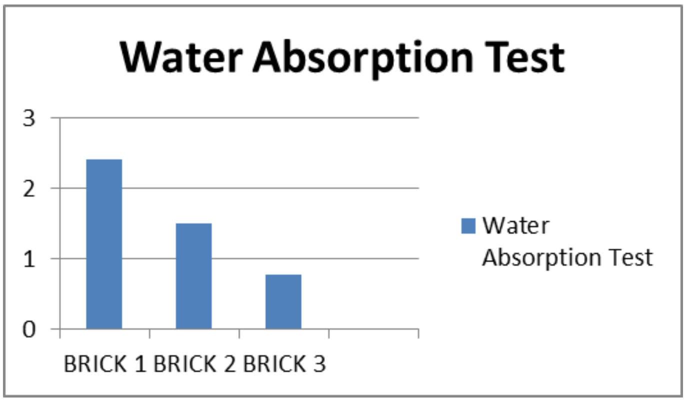



**Fig 5.3 Water Absorption Test**

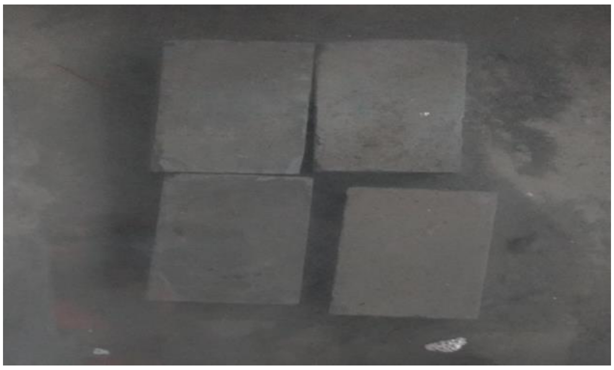


**Fig 5.4 Curing**

### 4.3 Efflorescence Test

Alkalis in bricks are damaging, and when they absorb moisture, they form a grey or white layer on the brick surface. This test is used to determine the presence of alkalis. In this test, a brick is submerged in fresh water for 24 hours before being removed from the water and allowed to dry in the shade. Because the plastic mixed bricks have a low alkali content, a small white spot appears on the surface.

**Fig 5.5 Efflorescence Test**

### 4.4 Hardness test

In this test, a scratch is formed on the surface of the bricks with a steel rod (any hard object can be used), which makes it impossible to infer that the bricks are hard. This demonstrates that the brick is of great grade.

## 5. Result

According to the findings, the brick with a 45:35:20 mix of cement, fly ash, and plastic powder has a high compressive strength of 12.86 N/mm2 and a low water absorption percentage of 0.37 percent. Thus, utilising plastic powder in cement fly ash bricks can improve strength while also being environmentally benign. Thus, the goal of minimising hazardous plastic waste by recycling it into powder and using it in brick manufacturing has been realized.

## 6. Conclusion

Plastic cement bricks have a number of advantages, including cost efficiency, the removal of waste products, which eliminates the problem of dumping plastic, the reduction of greenhouse gas emissions by converting flue gases into synthetic oil, and so on. This strategy is appropriate for nations where it is difficult to dispose of or recycle plastic garbage. When compared to its predecessors, the natural resources used to manufacture Plastic cement bricks are significantly lower. The cost of production is further decreased by substituting fly ash for cement. Because of the multiple benefits, more research into the quality and durability of plastic cement bricks is needed.

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