ABSTRACT:
Increasing concern about the global warming, primarily due to deforestation has led to the ban on use of clay brick by government in buildings construction. Subsequently, a large action plan for the development use of fly ash bricks substitute has resulted in creation of more awareness about the use of fly ash based building materials. In the past one decade or so the joint efforts by R & D organizations, private industries and funding agencies provided the much needed thrust for the actual transfer of technical know-how and product to the end users. Most of the developing countries are very rich in agricultural and natural fibre. Except a few exceptions, a large part of agricultural waste is being used as a fuel. India alone produces more than 400 million tonnes of agricultural waste annually. It has got a very large percentage of the total world production of rice husk, jute, stalk, jute fibre, banana fibre and coconut fibre. All these natural fibres have excellent physical and mechanical properties and can be utilized more effectively in the development of building materials (Inclusion in fly ash bricks) for various applications.

Keywords:
Natural Fibre; Jute Fibre; Banana Fibre; Fly Ash Bricks; Compressive Strength; Water Absorption

1. INTRODUCTION

FLY ASH is a finely divided residue resulting from the combustion of ground or powdered bituminous coal or sub bituminous coal (lignite) and transported by the flue gases of boilers fired by pulverized coal or lignite. Fly ash is a waste by-product material that must be disposed of or recycled. It consists mainly of spherical glassy particle ranging from 1 to 150 µm in diameter, of which the bulk passes through a 45- µm sieve.
CLASS C FLY ASH:

Fly ash produced from the burning of younger lignite or sub-bituminous coal, in addition to having pozzolonic properties, also has some self-cementing properties. In the presence of water, Class C fly ash will harden and gain strength over time. Class C fly ash generally contains more than 20% lime (CaO). Unlike Class F, self-cementing Class C fly ash does not require an activator. Alkali and Sulphate (SO₄) contents are generally higher in Class C fly ashes.

Class C has \( \text{SiO}_2 + \text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3 = 50\% \)

CLASS F FLY ASH:

The burning of harder, older anthracite and bituminous coal typically produces Class F fly ash. This fly ash is pozzolonic in nature, and contains less than 10% lime (CaO). Possessing pozzolonic properties, the glassy silica and alumina of Class F fly ash requires a cementing agent, such as Portland cement, quicklime, or hydrated lime, with the presence of water in order to react and produce cementitious compounds. Alternatively, in addition of a chemical activator such as sodium silicate (water glass) to a Class F ash can leads to the formation of a geo-polymer.

Class F has \( \text{SiO}_2 + \text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3 = 70\% \)

2. EXPERIMENTAL MATERIALS

a) Fly Ash (Class F)

An Experimental work was carried out with Class F type of Fly Ash. The chemical compositions of Fly Ash are given in following Table 1.

b) Lime

An Experimental work is carried out with Acetylene carbide waste lime. The chemical compositions of lime are shown in following Table 2.

c) Jute Fibre

The fibres are extracted from the ribbon of the stem. When harvested the plants are cut near the grouted with a sickle shaped knife. The small fibres, 5 mm, are obtained by successively rating in water, see Figure-2 beating, stripping the fibre, from the core and drying. Due to its short fibre length, jute is the weakest stem fibre, although it withstands rotting very easily. It is used as packaging material (bags), carpet backing, ropes, yarns and wall decoration.
d) Banana Fibre

These fibres are extracted from the banana stem. The availabilities of this fibre from banana stem are 5 to 10%. The use of banana stem is very useful to produce paper, yarn, fabrics etc.

### SOURCE OF MATERIAL

<table>
<thead>
<tr>
<th>SR. NO</th>
<th>INGREDIENTS</th>
<th>SOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fly Ash</td>
<td>Nova, Ahmadabad, Gujarat</td>
</tr>
<tr>
<td>2</td>
<td>Sand</td>
<td>Bodeli, Gujarat</td>
</tr>
<tr>
<td>3</td>
<td>Quarry Dust</td>
<td>Sevaliya, Gujarat</td>
</tr>
<tr>
<td>4</td>
<td>Sludge Lime</td>
<td>Kota, Rajasthan</td>
</tr>
<tr>
<td>5</td>
<td>Jute Fibre</td>
<td>Sugam Hardware, Anand, Gujarat</td>
</tr>
<tr>
<td>6</td>
<td>Banana Fibre</td>
<td>Navsari Agriculture University, Navsari, Gujarat</td>
</tr>
</tbody>
</table>

### 3. EXPERIENTIAL METHODOLOGY

Various raw materials of brick mix in desired proportion are blended intimately in dry or wet form. In this Standard Mix proportion Natural are added 0.5%, 1%, 1.5%, 2% and 2.5% by weight of brick.
layers of the bricks, inside the closed cover.

The curing is continued for 15 days and the tarpaulin cover is removed. The bricks are then left in the stack for drying or heating the bricks stack.

The bricks are ready for dispatch after 22 days from the date of manufacture.

The comprehensive strength of the bricks produced from the brick-mix and the manufacturing process suggested here in will be 80 kg/cm² to 100 kg/cm².

It is observed that the bricks produced are found to be superior then that of conventional Red burnt clay bricks.

### Compressive Strength

**TABLE 4**

REASULTS OF COMPRESSIVE STRENGTH TEST

<table>
<thead>
<tr>
<th>Types of brick</th>
<th>Average Compressive Strength (N/mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 Days</td>
<td>14 Days</td>
</tr>
<tr>
<td>21 Days</td>
<td>6.123 5.078 6.614 5.903 5.180 5.086 5.170</td>
</tr>
</tbody>
</table>

**FIGURE 6: TESTING OF SAMPLE BRICKS**

**FIGURE 7: TYPES OF BRICKS V/S AVERAGE COMRESSIVE STRENGTH (N/mm²) AT 7, 14 AND 21 DAYS**

### Water Absorption Test

**TABLE 5**

RESULTS OF WATER ABSORPTION TEST

<table>
<thead>
<tr>
<th>Types of brick</th>
<th>Average Water Absorption (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 Days</td>
<td>14 Days</td>
</tr>
<tr>
<td>21 Days</td>
<td>13.231 12.125 10.192</td>
</tr>
</tbody>
</table>

Clay 18.234 17.264 14.231
5. CONCLUSIONS

After all the effort and present experimental work the following observation are made by replacement jute fibre and banana fibre in fly ash bricks with different percentage and conclude that….

a) Class F Fly ash is utilized in the brick manufacturing work as judicious decision taken by Engineers.

b) As the percentage of the jute fibre in brick increases, the compressive strength of the brick increases. In this experimental work 0.5% fibre addition in the brick gives the maximum strength 8.061 N/mm² after 21 days.

Also Banana fibre 0.5% addition in the brick gives the maximum strength 8.051 N/mm² after 21 days.

c) As the compressive strength of the brick increases, the water absorption of the brick decreases. In this experimental work maximum compressive strength after 21 days is 8.061 N/mm², where minimum water absorption is 10.236% after 21 days in Jute Fibre Fly Ash Brick.

d) As the compressive strength of the brick increases, the water absorption of the brick decreases. In this experimental work maximum compressive strength after 21 days is 8.051 N/mm², where minimum water absorption is 10.287% after 21 days in Banana Fibre Fly Ash Brick.

e) Use of fly ash and Natural fibre help in prevention of environmental degradation and use of agriculture land utilised in clay brick production.

REFERENCE


