EXPERIMENTAL STUDY ON LIGHTWEIGHT BRICKS USING RICE HUSK AND SAWDUST

1,*N.Silpa, 2R.S.Gandhimathi and 3L.Balasuganya

1Assistant Professor, Department of Civil Engineering, Annapoorana Engineering College, Salem – 636308, Tamilnadu, India
2Associate Professor, Department of Civil Engineering, Annapoorana Engineering College, Salem – 636308, Tamilnadu, India
3Assistant Professor, Department of Civil Engineering, Annapoorana Engineering College, Salem – 636308, Tamilnadu, India

Received 25th January 2019; Accepted 20th February 2020; Published online 30th March 2020

ABSTRACT

The need for locally manufactured building materials has been emphasized in many countries around the world because of their easy availability & low cost. Bricks also have been regarded as one of the longest lasting and strongest building materials used throughout history. Ordinary building bricks are made of a mixture of clay, which is subjected to various processes, differing according to the nature of the material, the method of manufacture and the character of the finished product. After being properly prepared the clay is formed in moulds to the desired shape, then dried and burnt. On seeing the present day demand for bricks, an attempt was made to study the behavior of bricks manufactured using, different waste materials like Rice Husk & Sawdust ash was used to manufacture bricks. The main aim of this project is to compare the compressive strength of the bricks, so for this purpose different percentage of materials were separately added 10%, 15%, 20% and 30% by weight and then the compressive strength of the bricks was established, and then with the help of graph a comparison between compressive strength of bricks, made out of Rice Husk, Wood Ash and Clay.

Keywords: Brick, proposition, ricehusk, sawdust.

INTRODUCTION

Since the large demand has been placed on building material industry especially in the last decade owing to the increasing population which causes a chronic shortage of building materials, the civil engineers have been challenged to convert the industrial wastes to useful building and construction materials. Accumulating of unmanaged wastes especially in developing countries has resulted in an increasing environmental concern. Recycling of such wastes as building materials appears to be viable solution not only to such pollution problem but also to the problem of economic design of buildings. The increase in the popularity of using environmentally friendly, low-cost and lightweight construction materials in building industry has brought about the need to investigate how this can be achieved by benefiting to the environment as well as maintaining the material requirements affirmed in the standards. The physical and chemical properties of wood sawdust vary significantly depending on many factors such as geographical location and industrial processes. Hard woods usually produce more dust than soft woods, and the bark and leaves generally produce more wood dust than the inner wood parts of the tree. On average, the wood sawing results in 5–10% dust. Currently, the blocks of limestone are extracted via chain saw, diamond wire and diamond saws from quarries and then the blocks are cut into smaller suitable sizes to be used as building material. Rice husk ash is obtained by burning rice husk. Physical properties of RHA are greatly affected by burning conditions. When the combustion is incomplete, large amount of UN burnt carbon is found in the ash. Large amount of UN burnt carbon is found in the ash. When combustion is completed, grey to whitish ash is obtained. The amorphous content depends on burning temperature and holding time. Optimum properties can be obtained when rice husks are burnt at 500 - 700° C and held for short time, this temperature at which the husk is being burnt is less than that required for formation of clinkers in cement manufacturing process, the resulting ash can be used as a replacement of cement in concrete.

Characteristics of Good Clay Bricks

The brick should have uniform size and plane, rectangular surfaces with parallel sided and sharp straight edges. The brick should have uniform deep red color as indicative of uniformity in chemical composition and toughness in the burning of the brick. The brick should have uniform deep red color as indicative of uniformity in chemical composition and toughness in the burning of the brick. The surfaces should not be too smooth to cause slipping of mortar. The brick should have pre compactness and uniform texture. A fracture surface should not show fissures, holes, griss or limes. Water absorption should not exceed 20% of its dry weight when kept immersed in water for 24 hours. The average crushing strength should not be less than 20% of strength of any of the bricks.
Brick earth should be free from stones, organic matters, salt, etc.

MATERIALS AND METHODOLOGY

Sawdust ash

Sawdust ash is a by-product created during the combustion of wood products for energy production at pulp and paper mills, sawmills and wood-product manufacturing facilities. Sawdust ash is composed of both organic and inorganic compounds. The physical and chemical properties of sawdust ash, which determines its beneficial uses, are influenced by species of the wood and the combustion method.

Advantages of Sawdust ash Bricks

1. Due to high strength, practically no breakage during transport & use.
2. Due to uniform size of bricks mortar required for joints & plaster reduces almost by 50%.
3. Due to lower water penetration seepage of water through bricks is considerably reduced.
4. These bricks do not require soaking in water for 24 hours. Only sprinkling of water before use is enough.

Rice husk

India has a major agribusiness sector which has achieved remarkable successes over the last three and a half decades. Rice husk a major by-product of the rice milling industry, is one of the most commonly available materials. Rice husk is an agricultural residue abundantly available in rice producing countries. The husk surrounds the paddy grain. During milling of paddy about 78% of weight is received as rice, broken rice and bran. Rest 22% of the weight of paddy is received as husk. India is a major rice producing country, and that’s why the husk generated during milling can be easily available and can be used for bricks.

Clay

Due to the increasing cost of cement, the Forest Products and Industries Development Commission (FORPRIDECOM) conducted a research that will produce blocks from soil and water. Clay particles because of their fineness of division must expose a large amount of external surface. There are also internal surfaces as well, the sum of which usually greatly exceeds that of a superficial character.

Methodology

The method adopted is shown in the figure 1.

EXPERIMENTAL PROCEDURE

Collection of Ash

The collection of the ash is done from mills.

Sieving

The sieve is done by microns. The particles retained in microns sieve are collected and stored in a dry place.

Mixing

The mix ratio of the mix was taken as 5:5, 6:4, and 7:3. That is one part of “SOIL” and other part is “RICE HUSK ASH” & “SAW DUST ASH”. The addition of water is not based on the ratio and it is based on the visual perception. The water content should be in such a limit, so that the mix is in plastic state.

Casting

The dimensions of the mould are 220x75x100 mm, which is the non-modular size of the brick is 190x90x90mm. The mould is
well oiled before placing mixture. Then the mixture is placed in two layers. Then the top surface of the mould is cleaned for the extra mix and is demoulded after few seconds.

**Burning**

The samples are burnt in “BULL’S TRENCH KILN”. The bricks are arranged in such a way as its easily removable after the process.

![Fig.5 Bull Trench Kiln](image)

**TESTING OF BRICKS**

**Determination of Compressive Strength**

The crushing quality of bricks is of little value in determining the strength of a masonry wall. Six bricks are taken for the compressive strength test although it may be found that an individual brick varies by 20% or more from the average, the permissible stresses allowed for load bearing walls take account for this, being based on an average strength of six bricks. It is therefore unnecessary and uneconomical to insist that every bricks are above certain strength. As a criterion of structural strength for brick, the transverse failure in a wall or pavement is likely to occur on account of improper abetment. For testing bricks for compressive strength for a sample the two bed faces of bricks are ground to provide smooth, even and parallel faces. The bricks are then immersed in water at room temperature for 24 hours. These are then taken out of water and surplus water on the surfaces is wiped off with cotton or a moist cloth. The specimen is placed in a compression testing machine with flat faces. Load is applied at a uniform rate till failure. The maximum load at failure divided by the average area of bed faces gives the compressive strength.

\[
\text{Compressive Strength (N/mm}^2) = \frac{\text{Maximum load at failure (N)}}{\text{Average area of bed faces (mm}^2)}
\]

The average of results shall be reported. The compressive strength of any individual brick tested in the sample should not fall below the minimum average compressive strength specified for the corresponding class of brick by more than 20%.

![Fig.6 Compression Test](image)

**24 Hour Water Absorption Test**

Dry oven are put in oven at a temperature of 1050°C to 110°C till these attain constant mass. The weight (W1) of the bricks is recorded after cooling it to room temperature. The bricks are then immersed in water at a temperature of 27°C±2°C for 24 hours. The specimen are taken out of water and wiped with a damp cloth. 3 minutes there after it is again weighed and recorded as W2.

The water absorption in percentage is:

\[
\text{Water Absorption (\%)} = \frac{W2 - W1}{W1} \times 100
\]

The average water absorption shall not be more than 20% by weight up to class 12.5 and 15% by weight for higher classes.

![Fig.7 water absorption test](image)

**Efflorescence Test**

The ends of the brick are kept in 150mm diameter porcelain or glass dish containing 25mm depth of water at room temperature (20°C to 30°C) till the entire water is absorbed or evaporated. Presence of efflorescence is classified as below.

1) Nil- when the deposit of efflorescence is imperceptible.
2) Slight- when the deposit of efflorescence does not cover more than 10% of the exposed area of the brick.
3) Moderate- when the deposit of the efflorescence is more than 10% but less than 50% of the exposed area of the brick.
4) Heavy- when the deposit of the efflorescence is more than 50% but the deposit do not powder of flake away the brick surface.

The specification limits of the efflorescence to be not more than moderate (10 to 50%) up to class 12.5 and not more than slight (less than 10%) for higher classes.

**RESULTS AND DISCUSSIONS**

The brick obtained in various proportions is tested for compression and other physical characters .And the result is tabulated in below tables.
Table 1. Compressive Strength of Rice husk Ash Brick

<table>
<thead>
<tr>
<th>Test</th>
<th>% Of Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10%</td>
</tr>
<tr>
<td>Rice husk ash</td>
<td>3.68</td>
</tr>
<tr>
<td>Rice husk ash</td>
<td>8.30</td>
</tr>
<tr>
<td>Unit weight (kg/m³)</td>
<td>1602</td>
</tr>
</tbody>
</table>

Table 2. Compressive Strength of Sawdust ash brick

<table>
<thead>
<tr>
<th>Test</th>
<th>% Of Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10%</td>
</tr>
<tr>
<td>Saw dust ash</td>
<td>7.50</td>
</tr>
<tr>
<td>Saw dust ash</td>
<td>8.90</td>
</tr>
<tr>
<td>Unit weight (kg/m³)</td>
<td>1742</td>
</tr>
</tbody>
</table>

The variations of strength according to the percentage of added ashes were observed and compared. The compressive strength alone for both the added ashes are plotted in graph no. 1.

While different percentage of saw dust ash of 10%, 15% and 20% was added by weight in the clay, the compressive strength of bricks decreased.

Thus from above study, this project concluded that, with the replacement of waste material like rice hush ash in the clay, the compressive strength of bricks increases, but with saw dust ash the compressive strength of bricks decreases.

So, for the economy purpose rice hush ash is used in the replacement of clay.

REFERENCES


******

CONCLUSION

The present research replicate the effect of waste product like Rice Husk and sawdust Ash on compressive strength of brick and following results were obtained

The clay bricks gave the compressive strength of 5.26 N/mm², but when 10% of rice hush ash was added by weight in the clay, then it gave the compressive strength of 7.5 N/mm², again while increasing the percentage of rice hush ash as 15% and 20% by weight the compressive strength of rice hush brick decreases by 4 and 3.3 N/mm².