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Comparative Study of Compressive Strength of Bricks Made With Various Materials to Clay Bricks

Ashish Kumar Parashar*, Rinku Parashar**

*Institute of Technology, GGV (Central University), Bilaspur (CG), INDIA
Email: ashu_cg9308@yahoo.com

**National Institute of Technology, Raipur (CG), INDIA
Email: rinku_p2008@yahoo.in

Abstract- The need for locally manufactured building materials has been emphasized in many countries of 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, Wood Ash, Fly Ash even cement was used to manufacture bricks. The main aim of this project was to compare the compressive strength of the bricks, so for this purpose different percentage of materials were separately added 4%, 8%, 12% & 16% 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, clay, Fly Ash & Cement was determined. Before manufacturing the bricks, different properties of the materials (clay, wood ash, rice husk, cement & Fly ash) like sieve analysis, specific gravity was also verified . After that bricks were made & sun dried and some bricks were oven dried & then with the help of Compression Testing Machine (C.T.M.) finely their compressive strength was calculated. From this test in this project work it was concluded that the wood ash was that waste material, which gave the highest compressive strength. The effects of the addition of rice husk (for burning out) and wood ash admixtures by percent-clay mix was also investigated. The admixtures were added in various combinations of proportions by weight (from 4 to 16%). The wood ash admixture, in line with its pozzolanic nature, was able to contribute in attaining denser products with higher compressive strengths, higher softening coefficients, lower water absorption rates, lower saturation

Index Terms- Bricks, Rice Husk, Wood Ash, Fly Ash, Cement, Clay, Compressive Strength

I. INTRODUCTION

The need for locally manufactured building materials has been emphasized in many countries of the world. There is imbalance between the expensive conventional building materials coupled with depletion of traditional building materials. To address this situation, attention has been focused on low-cost alternative building materials. Bricks are masonry units composed of inorganic non-metallic material and are widely used as building components all over the world. The bricks could be sun-dried or burnt. Burnt bricks are usually stronger than sun-dried bricks, especially if they are made of clay or clayey material. There are different categories of the bricks, depending upon the admixtures and raw material used for making bricks. It is also common that certain admixtures are added to burnt brick raw mixes to produce different effects in the finished product. A second category of admixtures includes organic matter, such as rice husks, sawdust, coal, etc., which burn out when the bricks undergo firing. This category of admixtures serves three purposes:

1. As they burn out they leave pores in the product. This permits the control of the bulk density of brick products and help in producing lighter and more porous bricks.
2. The second purpose is that they result in more uniformly burnt bricks, especially when the firing is being done outside of factory conditions, in which case inability to reach the minimum desired temperature of 1000 °C results in un-burnt cores especially in solid bricks.
3. The pores produced as the admixtures are burnt out permit the heat to reach into the innermost part of the core, thereby avoiding un-burnt cores, while the admixtures on their own part serve as extra fuel which provides more heat for the firing.

Overall, there is a reduction in fuel and power expenditures. The temperature to which the brick is fired during burning is of paramount importance. The higher the firing temperature, the higher is the quality of the finished product. The third category of admixtures is the consolidating substances or fusing agents. These admixtures are added to increase the bond between the particles and thus the strength of the brick. Such admixtures are either cementitious or pozzolanic materials. Pozzolanic materials include the traditional lime. The recent non traditional pozzolanic admixtures used for brick production include rice husk ash, sawdust ash and wood ash. The materials which were used in bricks, their properties and different test & their compressive strength after the whole process, are described below.

II. MATERIALS USED FOR MAKING BRICKS

2.1 WOOD ASH:

Wood 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. Wood ash is composed of both organic and inorganic compounds. The physical and chemical properties of wood ash, which determines its beneficial uses, are influenced by species of the wood and the combustion method.

Advantages of Wood 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.

2.2 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.

2.3 CEMENT

In the most general sense of the word, cement is a binder, a substance that sets and hardens independently, and can bind other materials together. The chemical reaction that results when the anhydrous cement powder is mixed with water produces hydrates that are not water-soluble.

2.4 FLY ASH

Fly ash is one of the residues generated in combustion, and comprises the fine particles that rise with the flue gases. Ash which does not rise is termed bottom ash. In an industrial context, fly ash usually refers to ash produced during combustion of coal. Fly ash is a waste material after burning of coal. Fly ash bricks are the stronger than other bricks. Fly ash bricks contain only cement, water and fly ash, but we are adding different percentages of fly ash in the clay brick.

2.5 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. These are the materials which we are using for different types of bricks.

III. MATERIALS TESTING

3.1 SIEVE ANALYSIS:

The grain size characteristics of soils that are predominantly coarse grained are evaluated by a sieve analysis. A nest of sieves is prepared by stacking test sieves one above the other with the largest opening at the top followed by sieves of successively smaller openings and a catch pan at the bottom.

3.2 SPECIFIC GRAVITY:

The object of the test is to determine the specific gravity of materials passing through 4.75 mm IS sieve by Pycnometer.

TABLE NO.3.1 SPECIFIC GRAVITY OF MATERIALS USED:

S.No.	Materials	Specific gravity
1	Clay	2.16
2	Wood Ash	2.16
3	Rice Husk	0.43
4	Cement	3.16
5	Fly Ash	2.31

IV. ANALYSIS & RESULTS

4.1 BRICKS COMPRESSIVE STRENGTH

TABLE NO. 4.1 COMPRESSIVE STRENGTH OF BRICKS

Percentage of materials	Compressive Strength of Clay Bricks 4.4 N/mm^2			
	Compressive Strength of Various Materials Bricks (N/mm^2)			
	Wood Ash	Rice Husk	Cement	Fly Ash
4%	5.78	3.15	5.78	2.89
8%	6.31	3.68	6.31	2.36
12%	7.36	2.10	10.30	2.10
16%	10.0	1.05	12.63	1.57

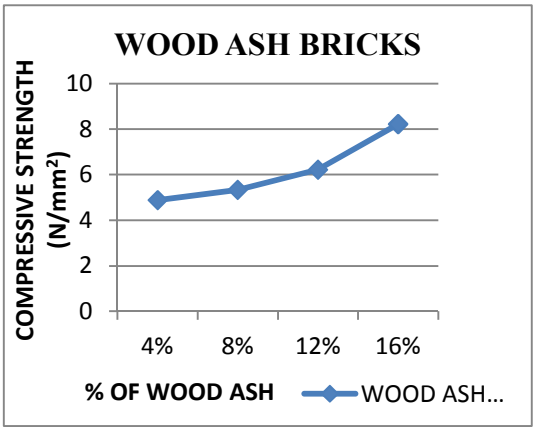

Figure 4.1: Compressive Strength of Wood Ash Bricks

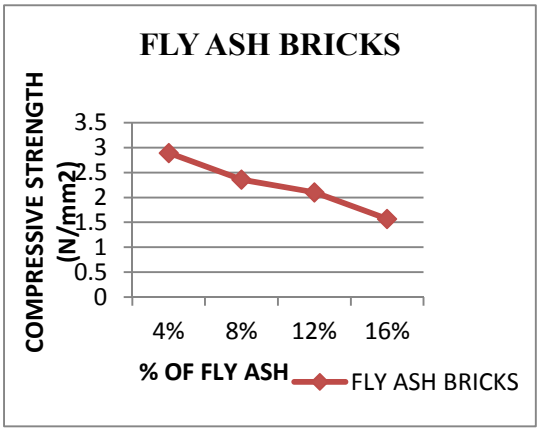

Figure 4.4: Compressive Strength Fly Ash Bricks

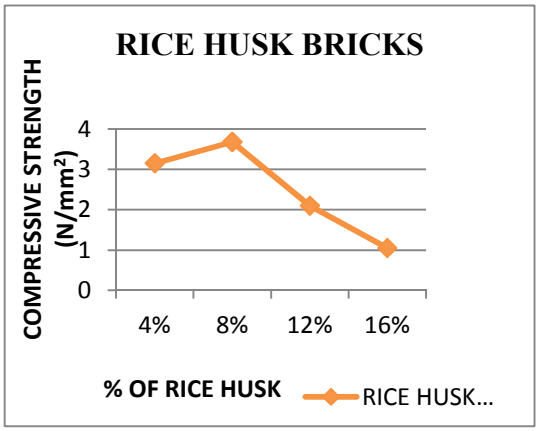

Figure 4.2: Compressive Strength Rice Husk Bricks

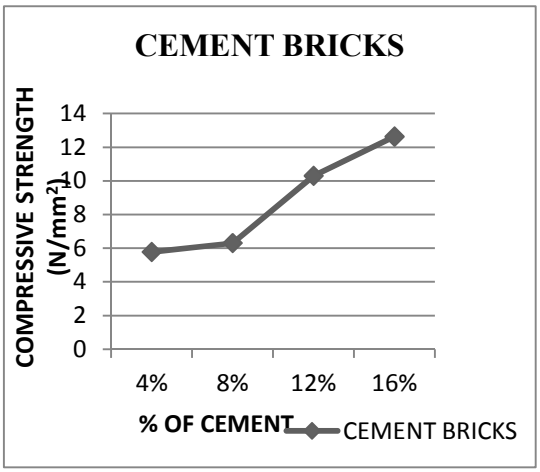

Figure 4.3: Compressive Strength Cement Bricks

Figure 4.5: Fly Ash Brick

Figure 4.6: Rice Husk Bricks

Figure 4.7: Cement Brick

Figure 4.8: Weighing of Brick

Figure 4.9: Before Failure of Brick

Figure 5.0: After Failure of Brick

V. CONCLUSION

The present research replicate the effect of waste product like Rice Husk, Wood Ash, clay, Fly Ash on compressive strength of brick and following results were obtained:-

The clay bricks gave the compressive strength of 5.26 N/mm^2, but when 4% of Wood ash was added by weight in the clay, then it gave the compressive strength of 5.78 N/mm^2, again while increasing the percentage of wood ash as 8%, 12%, 16% by weight the compressive strength of Wood Ash brick also increases respectively 6.31, 7.36, 10 N/mm^2.

While different percentage of rice husk 4%, 8%, 12%, 16% was added by weight in the clay, the compressive strength of bricks decreased. In the clay, when different percentage of cement was added 4%, 8%, 12% & 16% by weight the compressive strength of bricks also increased. When different percentage of fly ash 4%, 8%, 12% & 16% was added in the clay by weight, the compressive strength of bricks decreased

Thus from above study, this project concluded that, with the addition of waste material like wood ash in the clay, the compressive strength of bricks increases , but with rice husk & fly ash the compressive strength of bricks decreases. So for the economy purpose wood ash can be used in the place of cement.

Also when cement content was added in clay by weight, the compressive strength of bricks increased rapidly than with the wood ash. For different brick projects, we hope that this project will act as guidance in terms of compressive strength.

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