Effect of Partial Replacement of Marble Powder and Rice Husk Ash in Brick Material

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Abstract – The main aim of waste management system is to maximize economic benefits and at the same time protection of the environment. Marble processing industry generates a large amount of wastes mainly in the form of powder during sawing and polishing processes. These wastes are found to have environmental impacts and affect human health. Similarly rice mills generates large amount of rice husk which is then burnt to form an ash called rice husk ash.

It is also essential to develop alternate methods of brick manufacturing in order to reduce the use of precious clay soil in brick manufacturing, thus protecting it for agricultural use. Utilization of rice husk ash and marble powder in brick manufacturing is reported in this paper. Rise husk ash and marble powder are added as partial replacement for clay at three different proportions for the manufacturing of bricks. In this work 19cmx9cmx9cm bricks were cast for combination of clay, Rice husk and marble dust and results were found to be good.

Index Terms – Rice Husk Ash, Brick, Economic, Marble.

1. INTRODUCTION

Shelter is a basic human need and owning a house becomes a life long struggle as majority of Indians find housing costs prohibitively expensive. When considering the low income families who accounts for about 60-70% of Indian population, the problem seems to be even more serious. This brings out the need to reduce the cost of the housing and make it affordable for the ever growing population. Burnt clay bricks are being used widely and the most important building material in construction industry. In India consumption of the building industry is about 20000 million bricks and 27% of the total natural energy for their production. India is estimated to have 150000 brick kilns. Apart from this, Clay bricks available in some areas are poor in quality having lower compressive strength, higher water absorption, high efflorescence, higher wastage during transportation and handling, uneven surface etc. All these factors have forced the engineers to look for better materials capable of reducing the cost of construction. In this contest search for an alternative building material to clay bricks, numerous government agencies and research institutions have recommended the use of waste materials such as fly ash, Rise husk ash (RHA), Ground granular blast furnace slag (GGBS), marble powder etc., as an alternative building material in making bricks, blocks and tiles etc. Logically the unlimited use of clay is harmful to the society, as all the conventional clay bricks depend on good quality clay which is available in the agriculture fields. Clay taken from fields are more than 350 tonnes.

The main objective of the work is

- To find alternate source for the manufacture of bricks.
- To utilise industrial and agricultural wastes in brick making.
- To reduce the disposal of wastes in the environment.
- To determine the possibility of incorporating marble powder and rice husk ash in brick making.
- To determine the compressive strength of these bricks.

- To determine the physical properties of the bricks such as water absorption rate, hardness, dimensions soundness and structure.

2. LITERATURE REVIEW

[4] Presented an experimental investigation of effect of Rice Husk Ash on the properties of burnt clay bricks. The main aim of this work was to be comparing the compressive strength of the bricks. The pozzolonic activity of Rice Husk Ash is effective in improving the strength. The resulting Rice Husk Ash can be used as a replacement of cement in concrete. Finally they concluded that the brick having Rice Husk Ash an Admixtures shoed lower compressive strength and higher percentage of water absorption when compared to the conventional clay bricks.

The preparation of bricks in partial and fully replacement of clay. The engineering properties like compressive strength, water absorption, and size and shape were studied. The Rice Husk Ash used in plain cement concrete often achieves economy and cast savings. Rice Husk Ash was replaced up to 20% into the clay materials production to bricks. The compressive strength of Rice Husk Ash brick at 20% is 40 -45 kg/cm^2. Bulk utilization of Rice Husk Ash helps in solving the pollution problem and concluded that the optimum proportion (RHA +CLAY) was 30% and 70% as the bricks exhibited high compressive strength and low brick weight [3]

[1] Investigated the effect of bricks using Rice Husk Ash. The test such as compressive strength, density, water absorption, SEM, Economic analysis was under taken to determine the effects that caused in bricks. Based on the test result, 6% of Rice Husk Ash and 2% of lime with alluvial silts achieved the progressive strength when compared to other proportion. They concluded that the Rice Husk Ash mixed bricks are showing higher water absorption then the conventional bricks.

3. METHODOLOGY AND MATERIALS

The test were conducted by starting the first test of collection of data Rice Husk Ash is collected from a rice mill in Thanjavur and marble powder from Thanjavur. From the review of literature we are testing the materials and analyse the properties. The mix proportions of brick were modified by using rice husk ash and the marble powder as a partial replacement of materials. The specimen was cast by replacing bricks with 10% to 15% of rice husk ash and marble powder and remaining percentage 75% to 80% were covered by clay. The size of the brick used in this work was 19cm x 9cm x 9cm.

All the procedures were carried out as per Indian standard, compression strength test; water absorption, Hardness and Effloresces test were performed.

CLAY

The clay material for brick samples is taken from one of the brick manufacturing plant in Thanjavur district.

MARBLE POWDER

Marble powder of specific gravity 2.25 is used

RICE HUSK ASH

Ash of rice husk with specific gravity 2.2 is used in this work

4.MIX PROPORTION

Mix proportion are tabulated in Table 1,2,3

Table 1 Mix proportion of type (I) brick

SL. No	Materials	Mix proportion (%)
1	Clay	80%
2	Marble powder	10%
3	Rice husk	10%

Table 2 Mix proportion of type (II) brick

SL.No	Materials	Mix proportion (%)
1	Clay	75%
2	Marble powder	10%
3	Rice husk	15%

Table 3 Mix proportion of type (III) brick

SL. No	Materials	Mix proportion (%)
1	Clay	75%
2	Marble powder	15%
3	Rice husk	10%

CLAY PREPARATION

TEMPERING

Adding water to the clay soil in order to make it more workable is called tempering. Too much water added to the clay mix will decrease quality, quantity, though.

DISINTEGRATION AND CRUSHING

Disintegration or weathering is an alternative to tempering. It involves allowing clay to dry in the sun and accept moisture from rain and dew. The consistent drying and moistening of clay will turn clay to a plasticity and workability appropriate for brick making.

MIXING

Mixing is done to make the clay soil homogenous and smooth. There are different techniques to do this which includes using animal power or letting humans mix the clay with their feet. It reduces cracking during drying and reduces fuel usage during firing.

MOULDING THE BRICK

When determining the size of a mould for brick making, a necessary consideration must be shrinkage. Bricks will shrink when drying, so the mould size must be larger than the intended finished brick.

In slop moulding, a wet clay mixture is used-the mix is put in to a rectangular from without a top or bottom. A problem with these techniques is the brick may deform under its own weight and the surface can be marked easily because the mix is so wet.

Sand moulding utilizes a drier clay mix, formed in to a wedge and thrown into a mould. A bow cutter will be used to smooth the top of the brick, and the form will can be released because of a hinged bottom. Since the clay is drier, the brick can be moved with wooden pallets which can reduce the amount of surface marks.

DRYING THE BRICKS

Drying is usually done by placing the bricks in sheds with open sides so as to ensure free circulation of air and protection from bad weather. The bricks are allowed to dry till they are left with 5 to 7 (%) moisture content. The drying period usually varies from 7 to 14 days. The moulded bricks are dried due to the following reasons.

If damp bricks are taken directly to burning then they, are likely to be cracked and distorted. To increase the strength of raw bricks so they can be handled and stacked in greater heights in the kiln for burning without damage.

FIRING THE BRICKS

A clamp is a field kiln built from green bricks that will be fired. Clamps vary with size and shape must be oriented with respect to wind direction. Once a clamp is laid out and constructed, it must be insulated. Finally, the process of firing the clamp will take place in several steps. First, pre-heating, or water-smoking, will remove the water leftover from the drying process. This process is till physical. Finally, for the cooling stage, the temperature must be slow and steady. A clamp may take two weeks to cool.

4. RESULTS AND DISCUSSION

The compression test results are tabulated in table 4

Table 4 COMPRESSIVE TEST FOR TYPE (I,II,III) BRICK

Sl.No	Average compressive strength of Type I Brick (N/mm^2)	Average compressive strength of Type II Brick (N/mm^2)	Average compressive strength of Type III Brick (N/mm^2)
1	4.63	4.10	3.22

WATER ABSORPTION TEST

The bricks when tested in accordance with the procedure lay down in IS 3495 (Part 2): 1976 after immersion in cold water for 24 hours shall have water absorption not than 20%. Water absorption type I was found to be 15%, Type II 17.23%,and Type III Bricks were found to be 22.5%. Effloresces were found to be NIL. Hardness test was found to be Good.

5. CONCLUSION

After conducting experiment and testing the bricks, the following conclusions are achieved.

- The marble powder-RHA-clay bricks offer strengths at par with conventional clay bricks.
- The optimum percentage of mixture of marble powder, rice husk ash and clay offering high strength is found to be clay 80% + marble powder 10% + RHA 10% (type I brick).
- The incorporation of marble powder has negligible effect on the mechanical properties, as these bricks yield similar mechanical and physical properties as that of conventional clay bricks.
- Increase in the percentage of rice husk ash decreases the compressive strength of the bricks.
- These bricks have low water absorption rates. Increase in the percentage of rice husk ash increases the water absorption rate.
- These bricks have reduced weight when compared with that of conventional clay bricks.

- As the weight of the brick reduces considerably, the weight of the superstructure and the weight which falls on the soil reduces.
- The good quality bricks are with sharp edges, controlled dimensions and offer a plain and even finish.
- They are resistant to wear and tear which makes suitable for the internal and external uses.
- These bricks can be made in different sizes or shapes, so these can be used in building construction.
- These bricks proved to be quite economical when produced in the vicinity of marble processing industries and rice mills.
- These bricks are easy to produce as their manufacturing process is simple.

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