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Experimental Study on Production of Cement Bricks using Waste Materials

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Abstract –*Cement is one of the major producers of carbon dioxide, which is the main cause of global warming. During the manufacturing process of cement bricks the formation of clinker can be achieved only by heating the cement at very high temperature. This leads to the release of enormous amounts of carbon in the atmosphere. This CO_2 gas pollutes the environment. On the other hand, waste management became a major challenging problem across the world. In India nearly about 90 million tonnes of bagasse gets produced from sugar milling industry and at the same time rice husk waste is generated in large quantities in rice milling industry. Our experimental study deals with the implementation of Bagasse Ash and Rice Husk as an effective replacement for cement.*

Key Words: Bagasse Ash, Cement Brick, Rice Husk, Compressive Strength, Water Absorption

1. INTRODUCTION

Due to limited availability of natural resources and urbanization, there is a shortfall of conventional building construction materials. On the other hand, energy produced for the production of conventional construction materials pollutes air, water and land.

There is a strong demand for environmentally safe reuse and effective disposal method for bagasse ash and rice husk which otherwise creates land degradation and makes soil infertile. The ultimate disposal of bagasse ash and rice husk can be accomplished by using it an engineering construction material.

In the present study the main aim is to reduce the quantity of usage of cement in manufacturing of bricks so various attempts were made by using agricultural wastes rice husk and bagasse ash in varying fractions in the manufacturing of cement bricks.

2. OBJECTIVES

(a) To convert waste materials into construction materials.

(b) To encourage the wastes as eco-friendly materials.

(c) Replacement of cement with the rice husk ash and comparison of strength of concrete thus obtained with conventional concrete.

(d) Evaluating the water absorption capacity of bricks with varying proportions of usage of bagasse ash and rice husk.

3. MATERIALS USED

Fig -1: Raw Materials

Cement:

Cement used in this experimental work is Ordinary Portland Cement conforming to IS:4031-1998.The O.P.C. was classified into 3 grades- 33 grade, 43 grade and 53 grade.

Bagasse Ash:

Bagasse Ash is a residue which is obtained from the burning of bagasse in sugar producing factory. The burning of bagasse which a waste of sugarcane produces bagasse ash. Presently in sugar factories bagasse is burnt as a fuel so as to run their boilers. This material contains amorphous silica which is indication of cementing properties.

Rice Husk

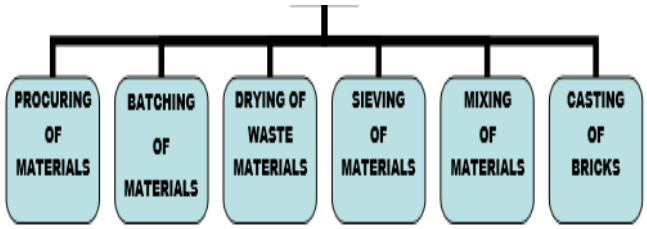
Rice Husk is an agricultural by product generated in rice milling industry. Rice Husk is found to be good material which fulfils the physical characteristics and chemical composition of mineral admixtures.

Water:

Water is an important ingredient of brick as it actually used for manufacturing of brick. Since it helps to bind all the ra w materials for giving proper mix. Water used for making brick should be free from impurities.

4. METHODOLOGY

4.1 Manufacturing of Bricks



4.1.1. Development of Bricks

(a) Cement + Sugar Cane Bagasse Ash

Table -1: Proportions of cement and bagasse ash bricks

Trial No.	Name of the brick for identification	Percentage of materials (%)	
		Cement	Bagasse Ash
1	CB	100	Nil
2	90C+10SCBA	90	10
3	80C+20SCBA	80	20
4	70C+30SCBA	70	30

(b) Cement + Rice Husk

Table -2: Proportions of cement and rice husk bricks

Trial No.	Name of the brick for identification	Percentage of materials (%)	
		Cement	Rice Husk
1	CB	100	Nil
2	90C+10RH	90	10
3	80C+20RH	80	20
4	70C+30RH	70	30

5. TESTING OF BRICKS (as per IS: 3495-1966)

5.1 Structure Test

In this test, a brick is broken and its structure is carefully examined. It should be homogeneous and free from defects like flaws, cracks and voids.

5.2 Shape and Size Test

To determine the shape and size of the brick 3 bricks are selected at random and they are stacked along length wise, width and along the height and they are closely inspected. It should be of standard size and its shape should be truly rectangular.

5.3 Colour Test

The brick should have uniform colour throughout.

5.4 Hardness Test

A good brick should be hard enough. No brick should have any impression on the surface. If it is scratched with a finger nail.

5.5 Soundness Test

Two number of bricks from the same proportion were struck with each other to observe the sound received from it. A good quality should brick should give metallic ringing sound when two bricks struck with each other.

5.6 Water Absorption Test

This test is conducted to determine the water absorption capacity of bricks. In this test, 5 bricks are selected at random from the sample. These bricks are dried in oven at 105^0C to 115^0C.

These bricks are taken from the oven and allowed to cool down to room temperature and weighed as w_1 units, these weighed specimens are immersed in water for 24 hours. After 24 hours the specimens are removed from water and wiped off excess water and weighed as w_2 units.

Water % by weight=$\frac{weight\ after\ soaking\ in\ water}{weight\ of\ dry\ specimen} x100$

$$= \frac{(w_2 - w_1)}{w_1} x100$$

The average of the 5 specimen results shall be taken as water absorption capacity of bricks.

5.7 Compressive Strength Test

In this test, 5 bricks are selected at random from the samples. The bricks are tested after immersed in water for 3 days normally.

The load is applied at uniform rate until the failure occurs, the maximum load at which the specimen fails is noted to determine the compressive strength of bricks.

Compressive strength of brick =$\frac{Maximum\ load\ at\ failure}{Loaded\ area\ of\ the\ brick}$

6. EXPERIMENTAL RESULTS

6.1 Compressive Strength of Cement & Bagasse Ash Bricks

Fig -1: Compressive Strength Test on Bricks

Table -3: Compressive Strength of cement and bagasse ash bricks

Trial No	Compressive Strength (N/mm²) @ 28 days
1	14
2	13.87
3	13.8
4	12.3

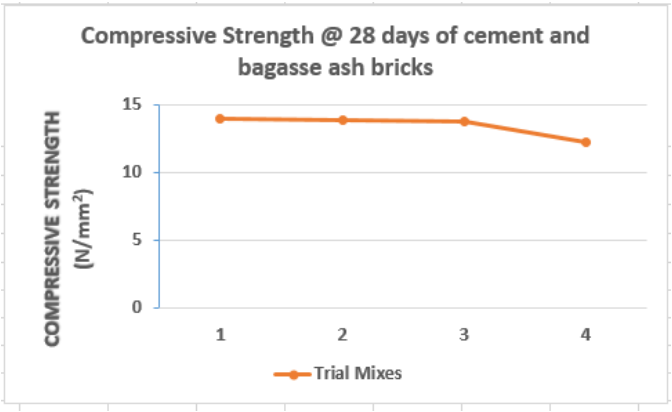


Chart -1: Compressive Strength of cement and bagasse ash bricks

6.2 Compressive Strength of Cement and Rice Husk Bricks

Table -4: Compressive Strength of cement and rice husk bricks

Trial No	Compressive Strength (N/mm²) @ 28 days
1	14
2	13.9
3	13.85
4	13.5

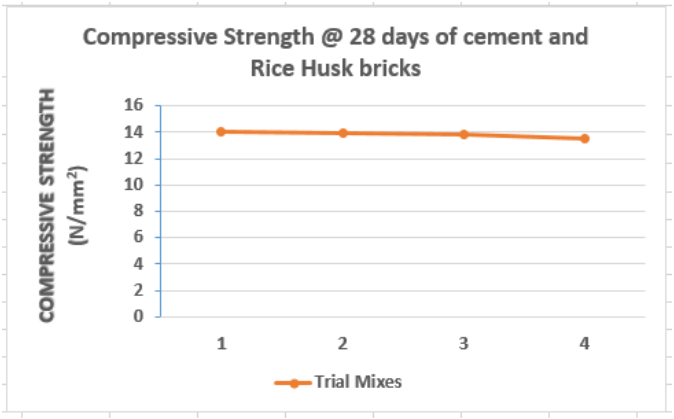


Chart -2: Compressive Strength of cement and rice husk bricks

6.3 Water Absorption of Cement and Bagasse Ash Bricks

Table -5: Water Absorption of cement and bagasse ash bricks

Trial No	Water Absorption (%)
1	17
2	15.5
3	15
4	15.3

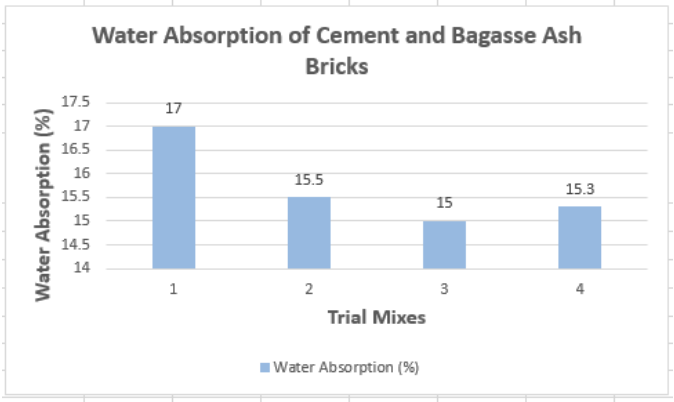


Chart -3: Water Absorption of cement and bagasse ash bricks

6.4 Water Absorption of Cement and Rice Husk Bricks

Table -6: Compressive Strength of cement and rice husk bricks

Trial No	Water Absorption (%)
1	17
2	14.7
3	14.3
4	15.0

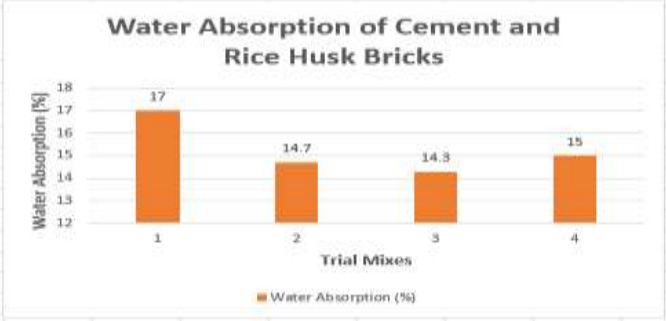


Chart -4: Water Absorption of cement and rice husk bricks

7. CONCLUSIONS

Based on the above experimental procedure and test, we conclude as;

1. Use of bagasse ash and rice husk in bricks can solve the disposal problem; reduce cost and produce Eco- friendly bricks.

2. The water absorption capacity of cement bricks is reduced with replacement of bagasse ash and rice husk.

3. There is no significant decrease in compressive strength of cement bricks upto 20% replacement of cement with bagasse ash and rice husk.

4. Rice husk ash can be added to cement as partial replacement of cement up to 20% without any significant reduction in the property of cement. This will result in reduction in the cost of concrete to some extent.

5. Bagasse can be added to cement as partial replacement of cement up to 20% without any significant reduction in the property of cement. This will result in reduction in the cost of concrete to some extent.

6. Environmental effects of wastes and disposal problems of waste can be reduced through this brick manufacturing process.

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