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An Experimental Investigation of Rice Hask Ash and Sugercane Bagasse ash Clay Bricks

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***Abstract*:- Rice husk ash and bagasse ash bricks can be extensively used in all building constructional activities similar to that of common burnt clay bricks. The rice husk ash and bagasse ash bricks are comparatively lighter in weight and stronger than common clay bricks. The object of this investigation regarding rice husk ash and bagasse ash bricks, properties. Laboratory experiments were carried out on clay bricks with replacement of rice husk ash and bagasse ash. Rice husk and bagasse ash bricks are lighter in weight and more compressive strength at 10 % replacement. An Agreement diagram is plotted where the variation of actual vs. predicted values of compressive strength lies between ± 5 % error.**

Keywords: Rice husk ash Bricks, Bagasse ash Bricks

INTRODUCTION

The need for locally manufactured building materials has been emphasized in many countries of the world. There is an imbalance between the expensive conventional building materials coupled with the depletion of traditional building materials. Production of clay bricks requires consumption of coal leading to greenhouse gas emissions. There are different categories of the bricks, depending upon the admixtures and raw material used for making bricks. The primary raw material used for bricks is the soil, which is often taken from prime agricultural land, causing land degradation as well as economic loss due to diversion of agricultural land. Use of traditional technologies in firing the bricks results in significant local air pollution. The clay brick industry in India produces over 180 billion clay bricks annually with a strong impact on soil erosion and unprocessed emissions. At the same time, the thermal power plants in India continue to produce a huge amount of fly ash, disposal of which poses significant challenges for the power plants.

Production of consumption of burnt clay bricks is still common in many parts of the world. China is considered as the first country in the production of bricks (More A. et al. 2014). Similarly, India is the second largest brick producing country. Extensive utilization of natural resources like clay has caused an alarming situation. Moreover day by day increasing waste generation is also causing environmental problems. Different waste material have been investigated in the production of bricks with improving performance(Tanvir Hossain et al. ,2011, Ajay kumar et al., 2012, Vamsi A. et al. 2012, Amin R. et al. 2013, Watile R. et al. 2015, Kuklkarni A. et al. 2013, Singh A., 2015). The use of Rice husk Ash and Bagasse ash materials derived from mill waste is growing all over the world. One of the most environmentally responsible ways of meeting the challenges of use of these ash wastes in useful ways. The main objective of the present work is to investigate the effect of using Rice husk Ash and Bagasse ash bricks and clay bricks on compressive strength.

MATERIAL AND METHODOLOGY

In this dissertation, an attempt is made to study the effect of rice husk ash and bagasse ash on the properties of clay – rice husk ash and bagasse ash fire bricks. The rice husk ash and bagasse ash for this purpose is collected from the rice mill in Kurukeshtra and sugar cane mill of Indri. The rice husk ash and bagasse ash is mixed with the soil for making the brick, at a local kiln site. The mixtures of clay available at the site and the rice husk ash and bagasse ash with different percentage by weight are prepared. These mixtures are mixed thoroughly by adding the appropriate amount of water and used to make the bricks of clay, rice husk ash and bagasse ash with different proportions.

BRICKS

Three types of different bricks were used. The first type is fired clay bricks, the second is Clay rice husk ash bricks and the third one is clay bagasse ash bricks. The size of the bricks is 215 mm × 95 mm × 75 mm.

CLAY RICE HUSK ASH BRICKS:

Clay rice husk ash bricks can be extensively used in all building constructional activities similar to that of common clay bricks.

EXPERIMENTAL PROGRAMME

In the present study, Clay rice husk ash bricks, clay bagasse ash bricks and clay bricks are subject to the following tests to find out its suitability for the construction work. Crushing and water absorption test was conducted on 9 sets of samples. In each sample, 4 bricks are tested for analyzing their results.

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Figure 1. Clay bricks

ABSORPTION TEST:

This test is carried out to determine the amount of water absorbed by the brick. When immersed in water for a period of 24 hours it should not, in any case, exceed 20% of the weight of dry brick. This test is carried out for all the samples of clay fly ash bricks and clay bricks.

Figure 2. Water absorption tank

Water absorption

Sr. No.	% Rice husk ash	% of Bagasse ash	Water absorption (%)				Average
			SA-1	SA-2	SA-3	SA-4	
1	0	0	17.15	18.47	19.42	20.82	18.97
2	5	0	14.28	14.9	15.7	15.1	15.00
3	10	0	15.8	14.8	15.3	15.9	15.45
4	15	0	14.3	16.12	15.7	15.4	15.38
5	20	0	14.6	14.8	16.4	15.7	15.38
6	0	5	14.1	16.1	15.8	16.2	15.55
7	0	10	17.2	16.4	16.8	17.6	17.00
8	0	15	17.6	18.8	19.8	17.7	18.48
9	0	20	16.78	16.9	16.2	17.4	16.82
10	2.5	2.5	17.42	17.56	18.32	17.94	17.81
11	5	5	16.81	17.13	16.95	17.37	17.07
12	7.5	7.5	16.24	15.93	15.85	16.48	16.13
13	10	10	15.28	16.54	16.58	15.94	16.09

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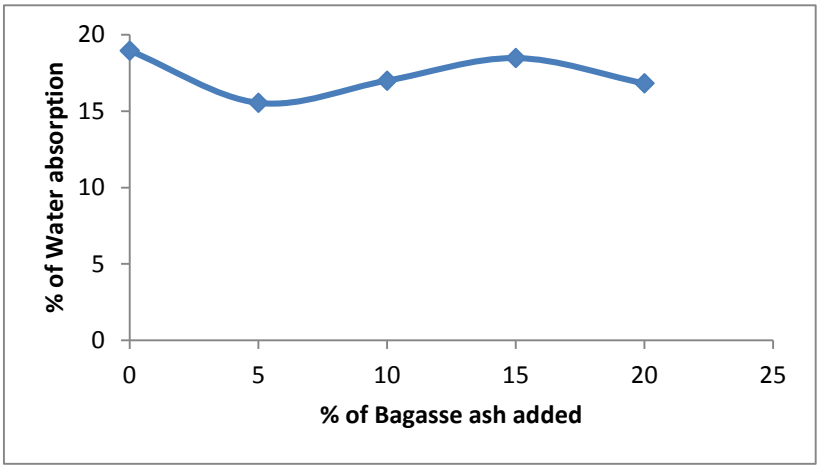

Figure 3. %Water absorption of Bagasse ash bricks

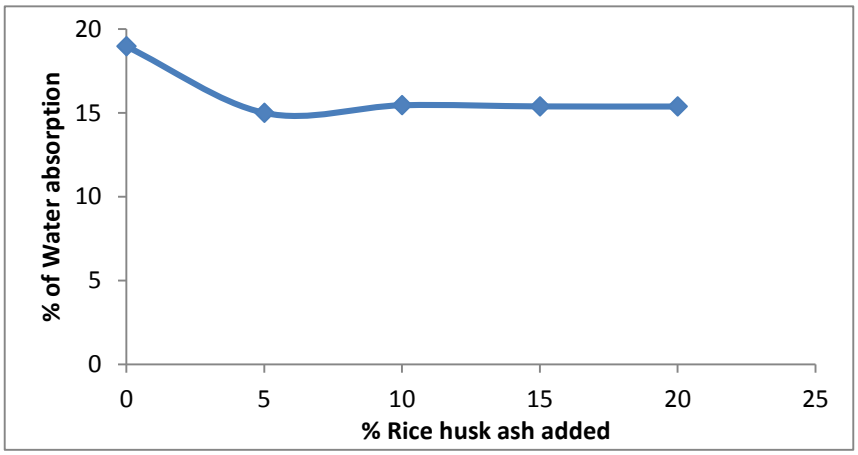

Figure 4. % Water absorption of rice husk ash bricks.

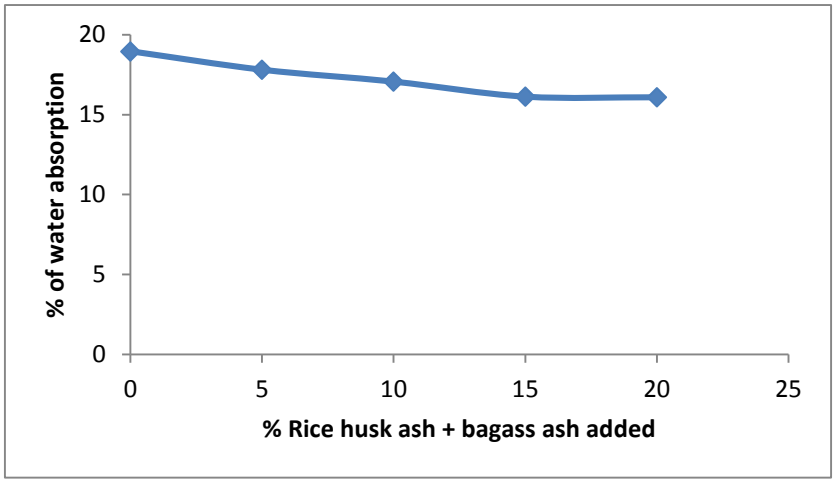

Figure 5. % Water absorption of rice husk ash & bagasse ash bricks.

Fig 3, 4 & 5 shows that an increase in rice husk ash & bagasse ash bricks percentage on Bricks its absorbs less. All the samples have absorbed less than 20 % water so all the bricks are class I.

HARDNESS TEST:

This test is carried out to see that the brick is sufficiently hard or not. We can judge hardness of the brick by making an impression on the surface of the brick with the help of a finger nail. This test is carried out for all samples of Rice husk ash bricks, bagasse ash bricks and clay bricks.

Table no 3, 2

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Normal Bricks	Clay Rice husk ash Bricks	Clay Bagasse ash Bricks
A dull impression after scratching with the help of a finger nail.	No impression after scratching on the surface of brick.	No impression after scratching on the surface of brick.

This test is conducted for finding out the presence of soluble salts in a brick when it is immersed in water for 24 hours and taken out and allowed to dry in shade. Absence of gray or white deposits on its surface indicates absence of soluble salts. If the white deposits cover about 10%surface, the efflorescence is said to be slight and it is considered as moderate, when the white deposits cover about 50% of the surface. If gray or white deposits are found on more than 50% of the surface, the efflorescence becomes heavy and it is treated as serious, when such deposits are converted into powdery mass. This test is carried out forth Clay rice husk ash bricks, clay bagass ash bricks and clay bricks.

Figure 6. Rice husk ash bricks and bagasse ash bricks before testing

Normal Bricks	Rice Husk Ash Bricks	Bagasse Ash Bricks
Slight to moderate	The gray deposit is less than 10 %.	The gray deposit is less than 10 %.

SOUNDNESS TEST:

This sound is carried out to find out that a clear ringing sound is produced or not when the two bricks are stuck with each other without breaking any of the two bricks. If the two bricks are not broken after sticking with each other and a clear ringing sound is produced then it means that the bricks are sufficiently sound. The procedure of this test is self-explanatory.

Normal Bricks	Rice Husk Ash Bricks	Bagasse Ash Bricks
Good	A clear ringing sound produced. (Good)	A clear ringing sound produced.(Good)

SHAPE AND SIZE TEST:

This test is done to examine the texture of the brick when the brick is broken. It is seen that the texture of the brick is homogeneous, compact and free from any defects such as holes, lumps etc. or not. Mainly the defects such as holes, lumps should not be there.

Size of Brick	Length mm	Width Mm	Height mm	Plane Area mm sq
1	215	95	75	20425

COMPRESSIVE STRENGTH TEST:

This is the main test conducted to test the suitability of the brick for construction work. This test is executed with the help of compression testing machine. A brick is placed in a compression testing machine. It is pressed till it breaks.

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Figure 7. Compressive testing machine

Then the compression strength of the brick is recorded from meter of the compression testing machine. A brick after undergoing compression test, this test is carried out on all Clay rice husk ash bricks, clay bagasse ash bricks and clay bricks

Compressive strength

Sr. No.	% of Rice husk ash added	% of Bagasse ash added	Compressive strength (N/mm2)				Average
			SA-1	SA-2	SA-3	SA-4	
1	0	0	4.32	4.4	4.36	4.8	4.47
2	5	0	4.87	4.9	4.82	5.12	4.93
3	10	0	4.31	4.18	4.2	4.25	4.24
4	15	0	4.12	3.9	4.4	4.04	4.12
5	20	0	3.6	3.9	3.7	4.2	3.85
6	0	5	4.9	5.31	5.12	4.9	5.06
7	0	10	5.24	5.48	5.2	5.8	5.43
8	0	15	5.4	4.8	5.1	5.13	5.12
9	0	20	5.16	4.9	4.86	4.4	4.83
10	2.5	2.5	4.8	5.22	5.23	5.48	5.18
11	5	5	5.67	5.38	5.87	6.72	5.91
12	7.5	7.5	5.43	4.9	4.97	5.23	5.13
13	10	10	4.8	4.73	5.06	4.85	4.86

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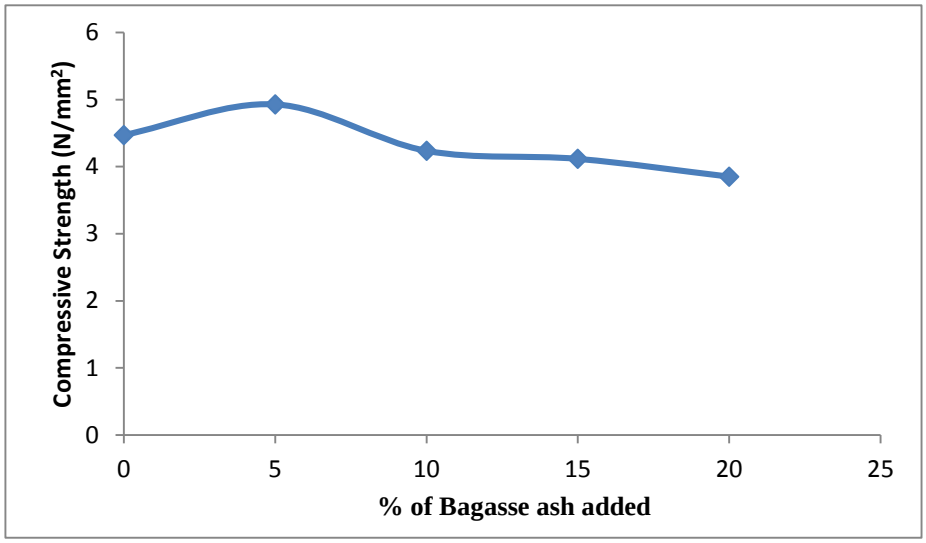

Figure 8. Compressive Strength of Bagasse ash Bricks.

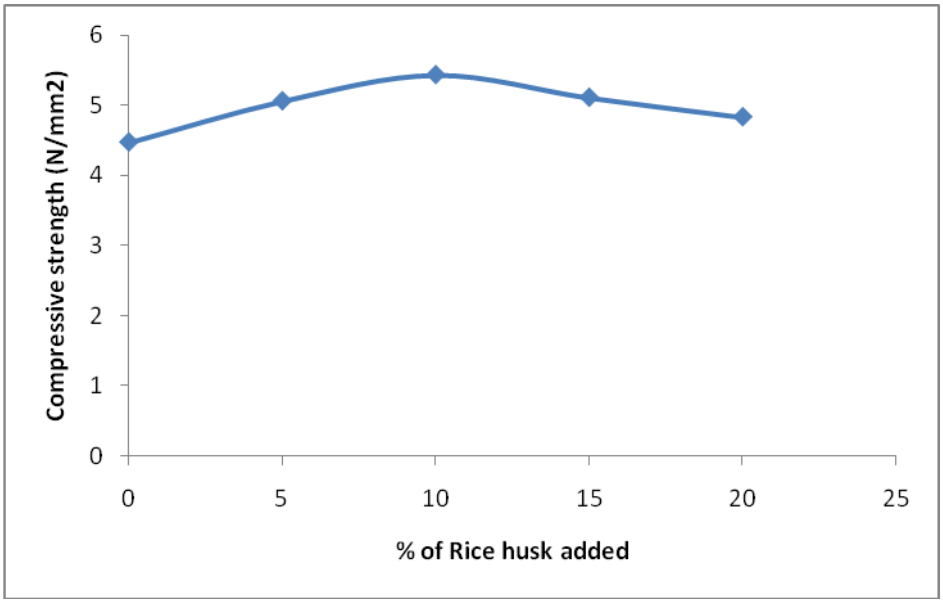

Figure 9. Compressive Strength of Rice husk ash Bricks.

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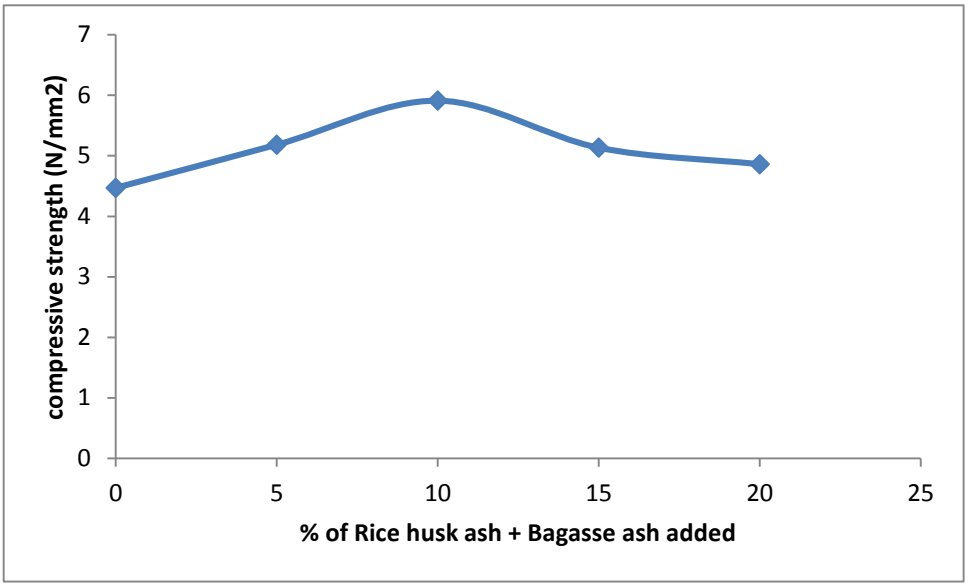

Figure 10. Compressive Strength of Rice husk ash+ Bagasse ash Bricks.

Adding of Rice husk ash+ Bagasse ash in clay bricks it shows more compressive strength. On adding 10 % Rice husk ash+ Bagasse ash in bricks its shows 32 % more compressive strength than clay bricks.

MODELLING RESULTS

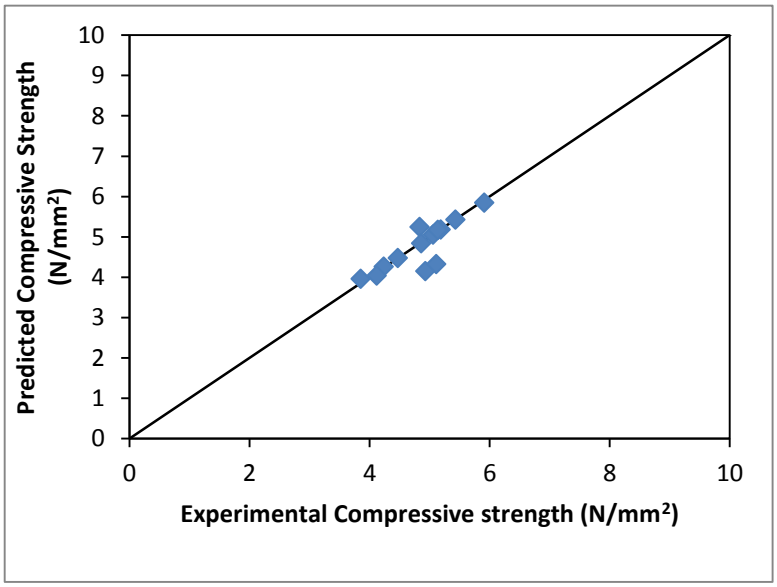

Figure 11. Actual Vs. predicted Compressive Strength

The agreement diagram actual vs. predicted compressive Strength. It shows that all the variation between model prediction and actual values lies between $\pm$ 5 %.

CONCLUSIONS

- Rice husk and bagasse ash bricks are lighter in weight and more compressive strength at 10 % replacement.
- At 10% bagasse ash adding shows more compressive strength in all the samples having compressive strength 5.43 (N/mm^2).
- At increase in 10 % Rice husk and bagasse ash in bricks its shows 32.24 % more compressive strength than clay bricks.
- By using Neuro intelligence a model is developed which shows similar results as observed.
- An Agreement diagram is plotted where the variation of actual vs. predicted values of compressive strength lies between $\pm$ 5 %.
- There is no impression on Rice husk and bagasse ash bricks after scratching with the help of a finger nail.

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