

Utilization and effect of using rice husk ash for production of bricks

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Abstract: There is increasing demand for producing durable construction material. When rice husk is burnt the product obtained is rice husk ash. Due to its high pozzolanic action strength and durability of concrete is increased. Main advantage of using rice husk ash is when we add concrete it increases the corrosion resistance. It also acts as a good insulator. The main motive of research is investigating the feasibility in production of bricks by utilizing rice husk ash and effect rice husk ash has on compressive strength, flexural strength, water absorption, bulk density etc. The varying percentage of rice husk ash is used for studying features and also analyzing test results on bricks. Rice husk ash utilization in bricks production is cost effective. There is requirement of finding ways in reducing amount of solid waste using rice husk ash. The investigation also demonstrates a feasible way of utilizing rice husk ash (RHA) as a constituent in decent quality bricks production. Substitution level of rice husk ash when increases, decreases strength and bulk density bulk density and increases water absorption. The main motive of using rice husk ash (RHA) is producing bricks of decent quality.

1. INTRODUCTION

Brick is a widely used construction material in India. Bricks constitute inorganic non-metallic material and are widely used as building component all over the world. Bricks are considered as the strongest and longlasting building materials available locally. Ordinary bricks consists of a mixture of clay, which is subjected to different processes and it varies according to nature of material, method of manufacture. After it is properly prepared the clay is formed in moulds to get the desired shape, then dried and burnt. One major drawback of these conventional of these conventional bricks is involvement of environmental impact in manufacturing process. In this project, rice husk ash addition in bricks production is

studied. The risk husk ash is added in varying percentages, effect it has on the compressive strength, flexural strength, water absorption etc. is investigated. There is a need for reducing influence on environment due to brick making procedure as well as increase the overall performance of the brick so an alternative way is to be found out. Here, in this research the motive is to achieve the above mentioned improvements by using the admixture for the manufacturing process of bricks. The admixtures are added in such a manner that the bond between particles is increased which in turn increases strength of brick. The admixtures are cementitious materials. The pozzolanic materials consists traditional lime. The another type admixture include rice husk ash, saw dust, coal etc. which burns when the bricks experience firing. The advantages of adding the admixtures are as follows:

1. As the organic admixtures like saw dust, rice husk ash etc. burn it leaves behind pores in product. This allows control of bulk density of brick products as well as helps in light weight and porous bricks production.
2. Fuel and power expenditure included in brick making process are reduced.
3. The admixtures when added increases strength of the brick.

2. MATERIALS USED FOR STUDY:

2.1 Rice husk ash: Rice husk ash (RHA) is result we get after burning of rice husk. The burning conditions greatly affects properties of rice husk ash (RHA). Rice husk ash (RHA) contains 40% cellulose, 30% lignin and 25-30% hydrated silica available in non crystalline form. Due to its high pozzolanic action strength and durability of concrete is increased. The rice husk ash can be used as admixture in concrete if the rice husk is burnt in a specific manner. When rice husks are ignited at 500-700°C [reference no.2] for short time, the optimum features of rice husk ash can be obtained. The main motive of using rice husk ash (RHA) is producing decent quality bricks as well as the effect it shows on features of bricks. The rice husk ash shows pozzolanic action which is helpful in improving the strength.

2.2 Clay: Clay is used in brick making process. Clay used should have following properties:

- i. Clay becomes plastic when it combines with water
- ii. The clay used should have sufficient tensile strength to keep the molecules together.

The clay contains silica and aluminium compounds. The clays are classified into two types. They are calcareous and non calcareous clays. The calcareous clays are composed of calcium carbonate and when burns changes into yellow or cream colour. Non-calcareous clay consists of feldspar and iron oxides, and when it is burnt changes to brown, pink or red, depending on the quantity of iron oxide. The silica present in clay when heated at 900-1200°C [reference no.2] will change into solid state. Conversion procedure is called vitrification in which clay changes into crystalline structure. The vitrification process takes place so that the bricks achieve sufficient strength. It needs approximately 3 cubic metres [reference no.1] of clay soil to prepare 1000 bricks [reference no.1]

3. RESEARCH METHODOLOGY:

A brick is said to be good brick clay if pure clay and sand mixture is mixed with water in such a manner that it can easily be moulded as well as dried without cracking. Here the manufacturing of rice husk ash is to be investigated. Silica considered as main constituent of brick earth which contains in clay either as free or combined constituent. The silica that exists as the main constituent prevents the brick from shrinkage, cracking, hardness etc. In RHA a higher amount of silica is present that lowers weight of brick. Here the rice husk ash (RHA) has been collected from the rice milling boiler and the rice husk is utilized as fuel for boiling paddy. After collection of rice husk ash (RHA) they have been properly grinded in laboratory. After grinding, harmful element has been removed from rice husk ash (RHA).

Table 1. Composition of clay and rice husk ash (RHA): [3]

Substance	Clay	Rice husk Ash
SiO ₂	60.67	93.59
Al ₂ O ₃	15.18	0.54
Fe ₂ O ₃	7.61	0.82
K ₂ O	3.12	1.94
MgO	1.15	0.15
TiO ₂	1.18	0.07
CaO	0.79	1.45
Na ₂ O	0.56	0.01
SO ₃	0.55	1.94
MnO ₂	0.22	0.19
BaO	0.11	0.01
ZnO	0.01	0.04
ZrO	0.01	0.01

The experimental program categorised into two parts:

- 1) Partial replacement of clay by RHA: Here the rice husk ash (RHA) is combined with clay at different percentages from 10-80% and the fundamental properties of bricks like compressive strength, water absorption etc. are examined.
- 2) Fully replacing clay by waste material of different industries like RHA, lime and gypsum.

In this work, the waste products are used in the building construction to see the impact on the economy of building construction as well. Here rice husk ash is collected from four different places.

Measuring RHA by volume of brick clay:

The total volume of brick clay is taken. The rice husk ash (RHA) has been mixed with brick clay in various percentage by volume.

Preparation of Brick clay:

After the evaluation of the various volumes of rice husk ash (RHA) for the various treatments, the RHA has been combined with brick clay in the field. The thorough moulding has been done on ground.

Drying of brick:

It is essential to dry the bricks prior to burning, so that they are adequately hard enough to be handled and also kept in burning kiln without any injury. The moulded bricks are dried by resting them on their edges for sometime and then heaped in open order in long row and stacks.

Burning of bricks:

The bricks are burnt so that the hardness and strength is achieved. The bricks on burning also increase the density. These bricks experimented have been burned in clamps where the temperature is very high and then increased to about 2100°F.

MATERIAL TESTING:**4.1 SPECIFIC GRAVITY:**

The specific gravity test for all the materials were conducted utilizing the pycnometer for all the samples passing through 4.75mm IS sieve.

TABLE NO.2. SPECIFIC GRAVITY OF MATERIALS USED[2]

Sl No.	Material	Specific gravity
1	Rice husk ash	0.45
2	Clay	2.25

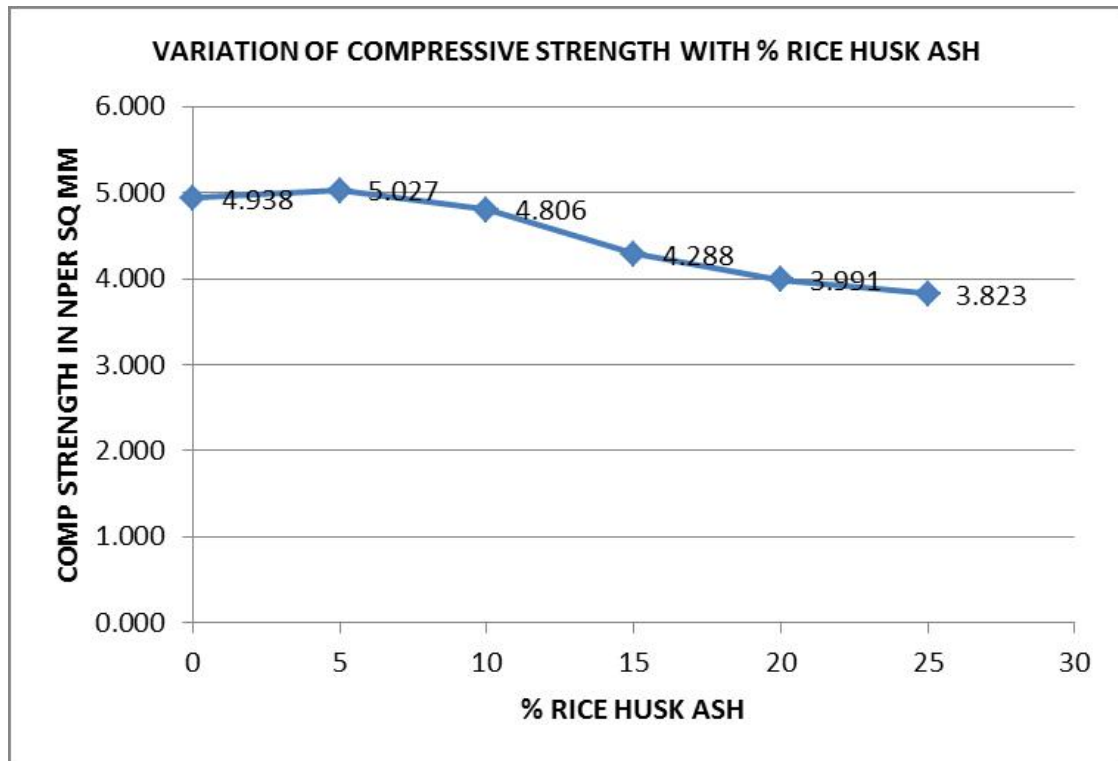
5.TEST RESULTS:**5.1 COMPRESSIVE STRENGTH TEST:**

The compressive strength of the samples prepared was evaluated by compression testing machine. In order to get good results for this research three samples of each composition were experimented and the average of the result is found out and also it is tabulated.

Table no.2 Compressive strength test results[4]

Sl No.	Type of sample	Avg compressive strength(Mpa)
1	100% clay	4.938
2	95% clay + 5% Rice husk ash	5.027
3	90% clay + 10% Rice husk ash	4.806
4	85% clay + 15% Rice husk ash	4.288
5	80% clay + 20% Rice husk ash	3.991
6	75% clay + 25% Rice husk ash	3.823

Fig 1. Compressive strength of Rice husk ash brick[4]



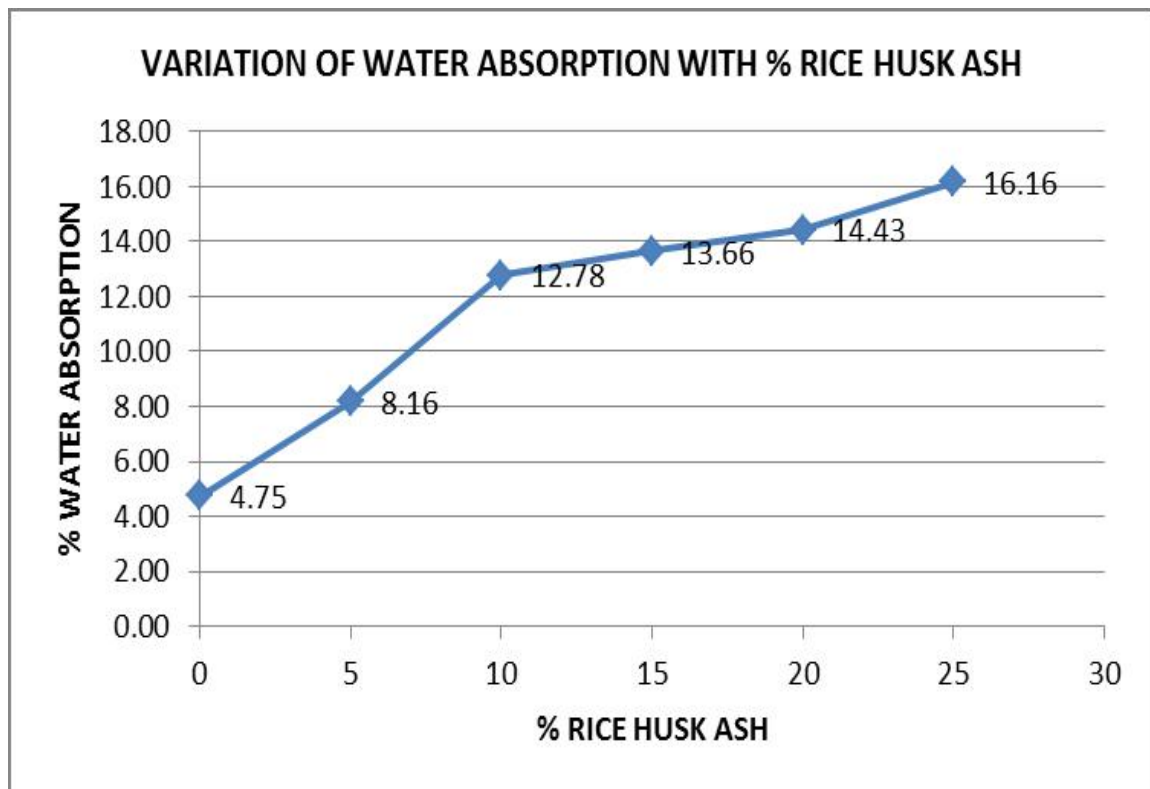
5.2 Water absorption test:

The water absorption test of brick is stated as weight of water, indicated as a percentage of dry weight, which is adopted by a given method. A 24 hour cold water immersion test was performed so that the water absorption test of samples are produced. In order to get good results 6 samples of each composition were experimented and the average of the results is tabulated.

Table No.3 Water absorption test results[6]

Sl No.	Type of sample	Water absorption(%)
1	100% clay	4.75
2	5% clay + 95% rice husk ash	8.16
3	10% clay + 90% rice husk ash	12.78
4	15% clay + 85% rice husk ash	13.66
5	20% clay + 80% rice husk ash	14.43
6	25% clay + 75% rice husk ash	16.16

Fig 2 Water absorption of Rice husk ash bricks[6]



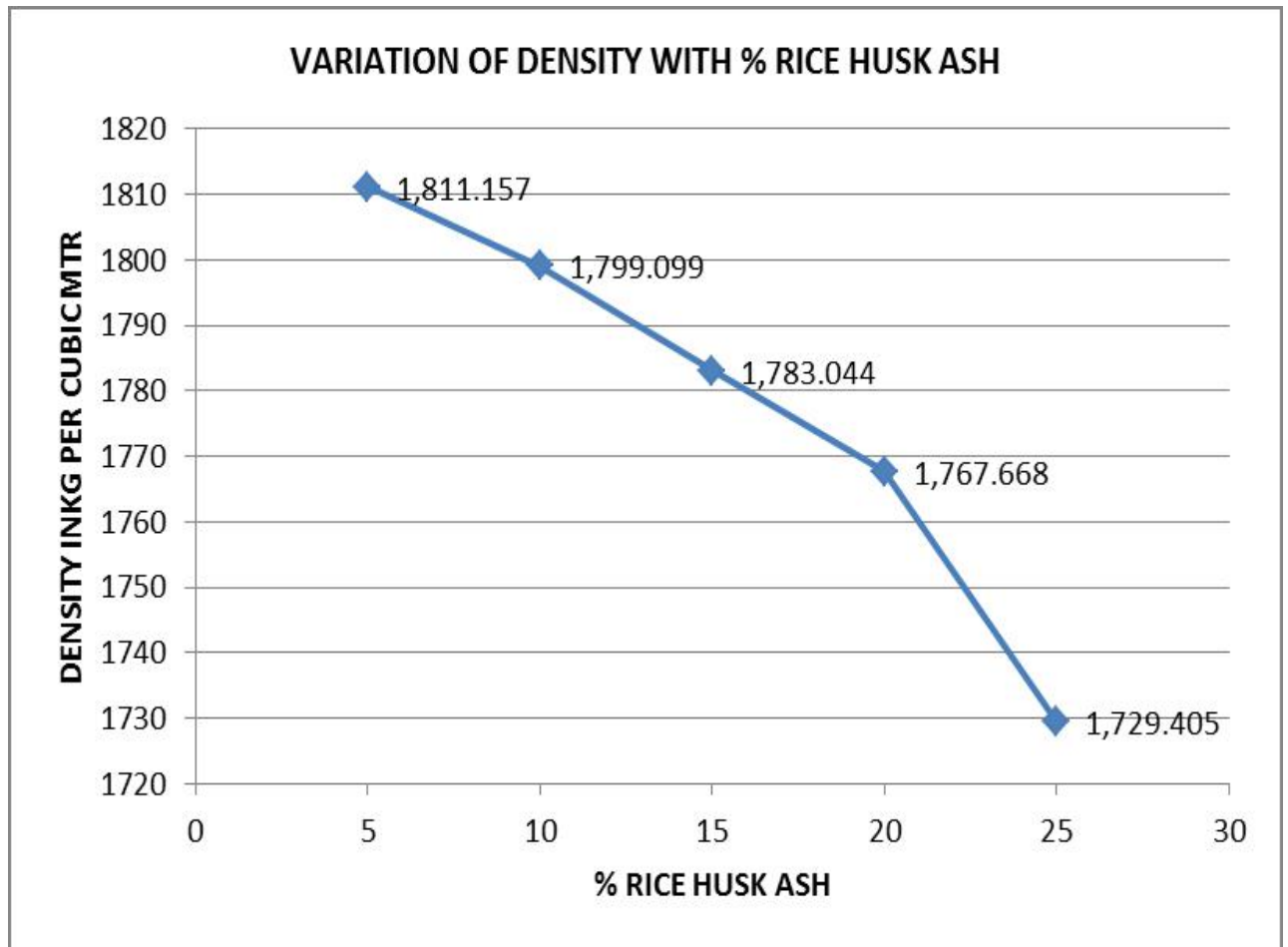
5.3 Bulk Density Test:

Bulk density of samples were determined by taking into account the dry weight and the gross volume of all the six samples to get good results. The average of these results are tabulated.

Table No.3 Bulk density test results[5]

Sl No.	Type of sample	Bulk Density (Kg per cubic metre)
1	100% clay	1828.707
2	95% clay + 5% rice husk ash	1811.157
3	90% clay + 10% rice husk ash	1799.099
4	85% clay + 15% rice husk ash	1783.044
5	80% clay + 20% rice husk ash	1767.668
6	75% clay + 25% rice husk ash	1729.405

Fig 3 Bulk density of Rice husk ash bricks[5]



6. CONCLUSION: These conclusions were derived from the experimental results that we got are as follows:

- 1) The clay burnt bricks were made of rice husk ash and these bricks showed similar appearance in comparison to ordinary bricks made of clay.
- 2) Bricks using rice husk ash as admixture experiences higher percentage of water absorption in comparison to ordinary bricks made of clay.
- 3) Bricks where rice husk ash is used experienced a slight growth in compressive strength by varying percentages of rice husk ash.
- 4) The bricks where rice husk ash is used as admixture can be constructed in various shapes or sizes so that they are useful in building construction.
- 5) The RHA bricks are prepared easily because the manufacturing process is simple and also the machinery needed here is easily available.
- 6) The RHA bricks are also considered economical for building construction.
- 7) The density of the rice husk ash(RHA) bricks decreases with higher percentages of rice husk ash(RHA).

REFERENCES:

- [1] Mohan NV, Satyanarayana PVV, Rao KS. "Performance of rice husk ash bricks." Int J Eng Res Appl 2012;2(5):1906–10.
- [2] Akshay Satish More*, Ahad Tarade*, Ashwani Anant* "Assessment of suitability of Rice husk ash burnt clay bricks", International Journal of Scientific and Research Publications, Volume 4, Issue 7, July 2014.
- [3] Rafid Shams Huq1, Farhana Chowdhury2 "Use of Rice husk ash as substitute to make clay bricks", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 7, Issue 10, October 2018.
- [4] J. Sutas*, A. Mana, L. Pitak "Effect of Rice husk ash to properties of bricks", Procedia Engineering 32 (2012) 1061 – 1067.
- [5] S.Raut, R.Ralegaonkar, S.Mandavgane "Utilization of rice husk ash in production of light weight bricks", journal of civil and mechanical engineering (2013) 269-275.
- [6] Chao-Lung Hwang, Trong-Phuoc Huynh "Investigation into the use of rice husk ash to produce eco-friendly construction bricks", Construction and Building Materials 93 (2015) 335–341.
- [7] G. W. Carter, A. M. Cannon† and D. S. Mansell. "Properties of bricks incorporating rice husk ash", J Building and Environment, 1982;17: 285-291.

[8] Kartini K., "Rice Husk Ash - Pozzolanic Material for Sustainability", International Journal of Applied Science and Technology, 2011, 1(6), p. 169-178.

[9] Tonnayopas D., Tekasakul P., Jaritgnam S., "Effect of rice husk ash on characteristics of brick", Technology and Innovation for Sustainable Development Conference, KhonKaen Univ. 28-29 Jan. 2008, Thailand, p. 36-39.

[10] Ashish Kumar Parashar and Rinku Parashar (2012), "Comparative Study of Compressive Strength of Bricks Made With Rice husk ash to clay Bricks", International Journal of Scientific and Research Publications, Volume 2, Issue 7.

