

# Experimental Study On Low Cost Bricks Using Copper Slag And Rice Husk Ash

K.Mahendran  
Assistant Professor  
Department of Civil Engineering  
P.S.R Engineering college,  
Sivakasi , India.

M.Bala Nivetha & P.Kaleeswari  
Under Graduate Student ,  
Department of Civil Engineering  
P.S.R Engineering college,  
Sivakasi , India.

*Abstract - Since the large demand has been placed on building material industry especially in the last decade owing to the increasing population which causes a chronic shortage of building materials, the civil engineers have been challenged to convert waste to useful building and construction material like brick. Recycling of such waste as raw material alternatives may contribute in the exhaustion of the natural resources; the conservation of non renewable resources; improvement of the population health and security preoccupation with environmental matters and reduction in waste disposal costs. In the review of utilization of those waste, this paper reviewed recycling various waste like copper slag and rice husk ash(RHA) in bricks production. In this study, primary RHA and copper slag , RHA heat-treated at 500°C and medium grained copper slag were used to substitute red soil as partial replacement in raw material mixtures. The experiments are conducted for variation in properties i.e, compressive strength, water absorption, hardness and soundness. The effects of those wastes (copper slag and RHA) on the bricks properties as physical, mechanical properties will be reviewed and recommendations for future research as out comings of this review will be given. This reviewed approach on bricks making from waste is useful to provide potential and sustainable solution.*

**Key words :recycling, copper slag , Rice Husk Ash , compressive strength.**

## 1.Introduction :

Clay bricks were used by humans from very early dates. First it was used without burning as sundried bricks. Burnt brick was a common building material among the Egyptians. Nowadays, they are made from specially selected and matured brick earth consisting chiefly of silica (35-70 percentage) and alumina (10-20 percentage). Too much silica tends to make the brick brittle and too much alumina makes the brick warp and crack on drying and burning. It is also desirable to have other agents like lime, magnesia, oxide of iron which act as coloring agent and flux to assist fusion during burning of the brick earth. If they are not naturally present, they should be added to the clay during mixing. Clay when heated to lower temperatures loses its moisture, and only physical change occurs, such half-burnt clay crumbles when placed in water. However, when clay is heated to high temperatures, its constituents fuse, and chemical change takes place. Such well burnt bricks do not breakdown when immersed in water. The temperatures in these kilns go 700 – 1100 degree Celsius. In this chapter we will deal with the manufacturing of clay bricks and methods of testing them for use in building construction.

Copper slag is a by-product obtained during the copper smelting and refining process. Produced from a copper concentrate containing around 30 – 35% of copper, iron and sulphur each along with around 12% of silica and 5% of calcium. While producing copper the anode, a slag with rich iron and moderate silica content also generated or copper slag is a byproduct created during the copper smelting and refining process. Rice husk ash is mostly used as a fuel in the boilers for processing of paddy . Rice husk is also used as a fuel for power generation.

Rice husk ash (RHA) is about 25% by weight of rice husk when burnt in boilers .It is a carbon neutral green product. Lots of ways are being thought of for disposing them by making commercial use of this RHA . It is a good super-pozzolan.RHA acts as a very good insulator . It is also used for insulation of molten metal in tundish and ladle in slab caster. It is also used in specially paints , ceramic glasses, refractory , carrier for

pesticides etc.

**2.Object and Scope:**

The object of the present paper is to study the effect of copper slag and RHA bricks on the performance and the properties of bricks with the view to study the comparison between clay brick and a RHA & copper slag because both is enriched by silica , is the main constituents for conventional building material. From the experiment , it is further desired to compare the strength of copper slag and RHA brick by that of conventional clay brick .the salient properties of bricks like crushing strength , water absorption ,bulk density are to be determined.

Bricks will always be the necessity of building material and in future soil for the making of bricks would not be available in plenty as the use of land is rapidly increasing , at the time RHA and copper slag will fulfil the necessity of clay bricks as these bricks are made by the industrial waste . Moreover the building structures are getting heavier with time ,the use of these combination of bricks would be more efficient as it strength is more than that of clay bricks.

**3.Experimental Test:**

In the present study of combination of RHA and copper slag bricks are subjected to the following tests to find out its suitability for the construction work:

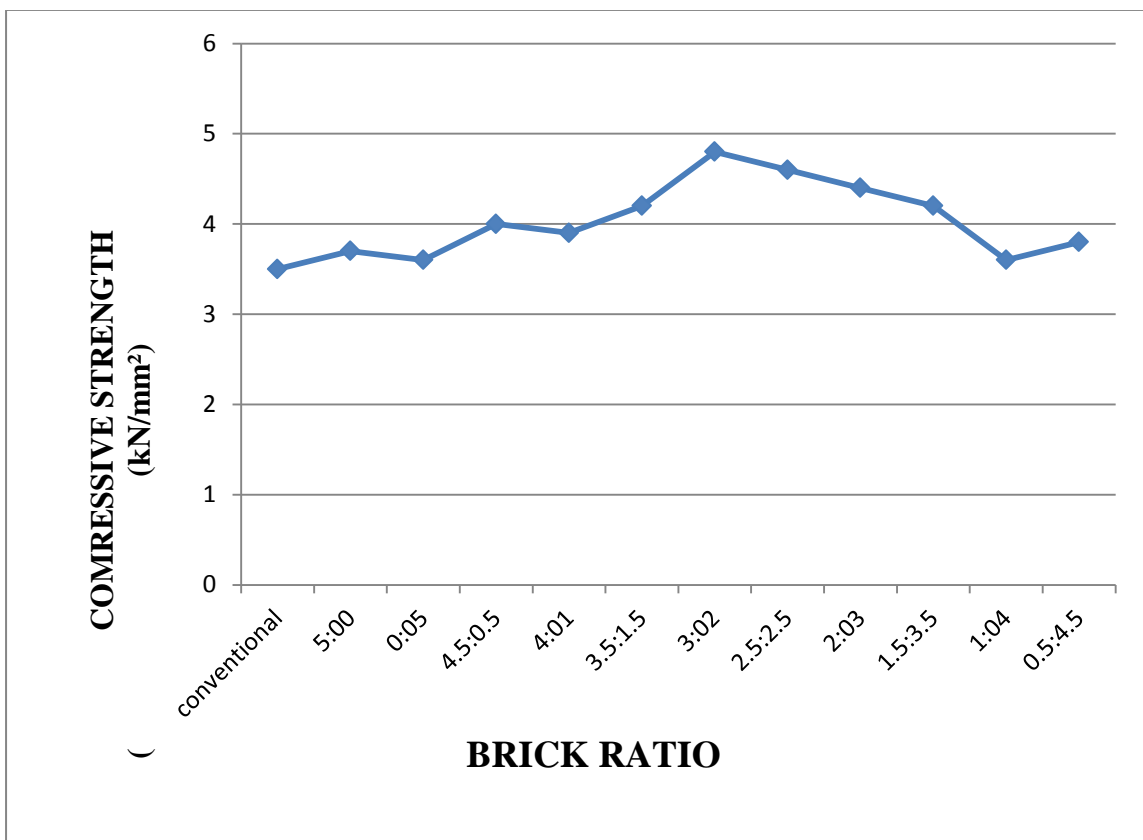
**3.1. crushing strength:**

This test is done to know the compressive strength of brick. It is also called crushing strength of brick. Generally 5 specimen of brick are taken to laboratory for testing and tested one by one. In this test a specimen is put on crushing machine and applied pressure till it breaks. The ultimate pressure at which brick is crushed is taken into account. All five brick specimen are tested one by one and average result is taken as bricks compressive/crushing strength.



BRICK RATIO (RHA:COPPER SLAG)	LOADS	LOADS
	( KN)	( N/mm2)
conventional	75	3.5
5:0	76	3.6
0:5	79	3.7
4.5:0.5	85	4

4:1	81	3.9
3.5:1.5	88	4.2
3:2	101	4.8
2.5:2.5	98	4.6
2:3	92	4.4
1.5:3.5	89	4.2
1:4	77	3.6
0.5:4.5	80	3.8

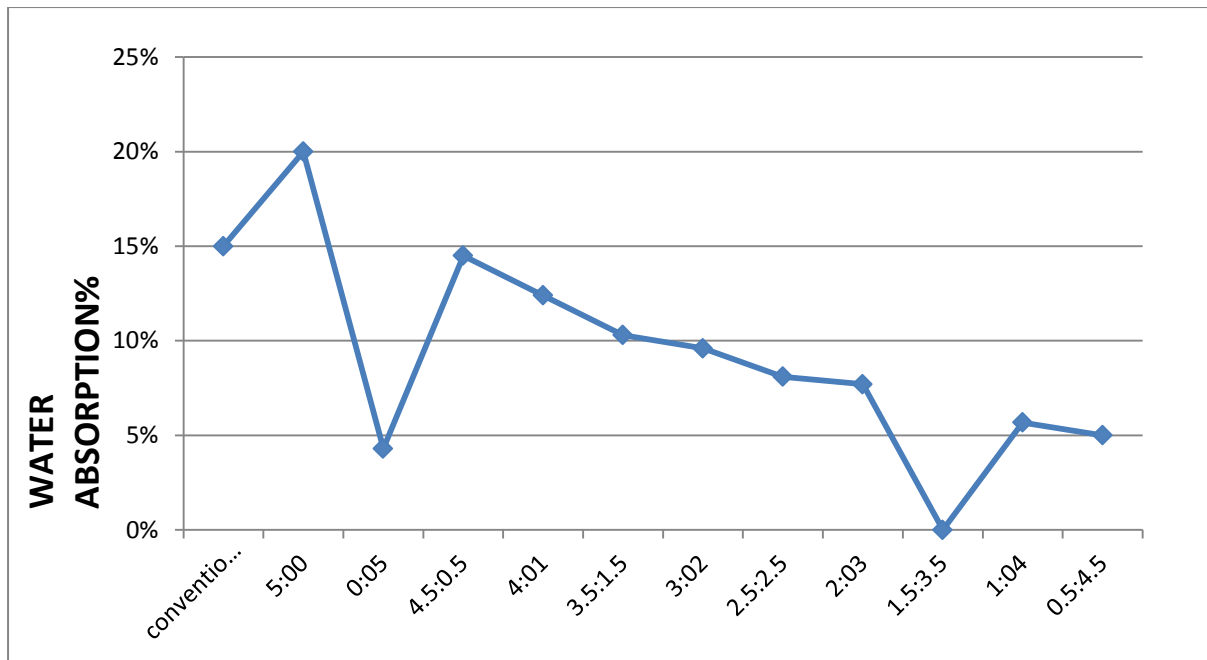


**3.2: Water Absorption :**

In this bricks are weighed in dry condition and led them immersed in fresh water for 24 hours. After 24 hours of immersion those are taken out from water and wipe out with cloth. Then brick is weighed in wed condition. The difference between weights is the water absorbed by brick. The percentage of water absorption is then calculated. The less water absorbed by brick the greater its quality. Good quality brick doesn't absorp more than 20% water of its own weight.



BRICK RATIO (RHA:COPPERSLAG)	TRIAL (%)			AVERAGE
	I	II	III	%
conventional	1.556	1.906	0.776	15%
5:0	1.891	2.990	2.030	20%
0:5	0.065	0.195	1.036	4.3%
4.5:0.5	1.556	0.905	3.162	14.5%
4:1	1.925	1.996	0.776	12.4%
3.5:1.5	0.662	0.871	0.771	10.3%
3:2	0.741	1.606	1.058	9.6%
2.5:2.5	1.006	1.818	1.742	8.1%
2:3	0.158	0.880	2.094	7.7%
1.5:3.5	2.159	2.078	2.239	6.4%
1:4	0.171	0.199	0.198	5.68%
0.5:4.5	0.191	0.293	0.102	5%



### 3.3 Bulk Density :

This is the test conducted to test the density of the bricks for construction work.

BRICK RATIO ( RHA : COPPER SLAG)	TRIAL (Kg/M3)			AVERAGE
	I	II	III	
5:0	3.485	3.497	3.473	3.485
0:5	3.508	3.485	3.485	3.493
4.5:0.5	3.625	3.508	3.497	3.543
4:1	3.485	3.508	3.473	3.489
3.5:1.5	3.508	3.508	3.508	3.508
3:2	3.625	3.485	3.497	3.536
2.5:2.5	3.500	3.498	3.400	3.466
2:3	3.624	3.597	3.508	3.577
1.5:3.5	3.500	3.489	3.508	3.499
1:4	3.485	3.625	3.497	3.536
0.5:4.5	3.638	3.524	3.625	3.596

#### 4. Conclusion

Based on limited experimental investigation concerning the compressive the following conclusions are drawn . Compressive strength reduces when red soil replaced RHA & copper slag. As RHA & copper slag percentage increases compressive strength decreases. The water absorption of brick become poor in large proportion of copper slag compared to RHA bricks. Use of copper slag & RHA in brick can save the coal & thermal industry disposal costs and produce a 'greener' brick for construction. If the brick contains low amount of copper slag the water absorption value will be reduced compare to conventional brick. For example above the table 17 the water absorption value of RHA & copper slag is reduced compared to other proportion of brick in the ratio of 0.5:4.5 . The compressive strength of rice husk ash and copper slag has increased in the ratio of 3:2 in the load range of 101 kN. The cost analysis indicates the percent brick reduction decreases cost of red soil , but at the same time strength also decreases.

#### 5. Reference

1. N.Vamsi Mohan, Prof.P.V.V. Satyanarayana and Dr.K.SrinivasaRao, "Performance of Rice Husk Ash Bricks " *International Journal of Engineering Research and Applications*, Vol. 2/ pp. 1906-1910/ September- October 2012.
2. Acosta, A., I. Iglesias, M. Aineto, M. Romero, J.MA. Rincon, 2002. Utilization of IGCC slag and clay sterile in soft mud brick (by pressing) for using in building bricks manufacturing. *Journal of Waste Management*, 22: 887-889.
3. Badr El-Din Ezzat Hegazy, Hanan Ahmed Fouad and Ahmed Mohammed Hassanain, 2012. Incorporation of water sludge, silica fume, and rice husk ash in brick making. *Journal of Advances in Environmental Research*, 1: 83-96.
4. British Standards BS3921: 1985. Specifications for clay brick. United kingdom.
5. Raut, S.P., R.V. Ralegaonkar, S.A. Mandavgane, 2011. Development of sustainable construction material using industrial and agricultural solid waste: A review of waste-create bricks. *Journal of Construction and Building Material*, 25: 4037-4043.
6. Aeslina Abdul Kadir, Abbas Mohajerani, " Bricks: an excellent building material for recycling wastes – a review"(2011).