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The Effect Of Rice Husk Ash Used As Supplementary Cementing Material On Strength Of Mortar

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ABSTRACT

This paper summarizes the experimental studies on strength characteristics of cement mortar in which rice husk ash (RHA) is used as partial replacement of ordinary Portland cement (OPC). Cement mortar paste were proportioned with varying dosages of RHA as partial replacement of OPC in the range of 5%to 30% by weight of cement. The compressive strength test was carried out as per relevant Indian standard code of practice. It has been observed that replacement of cement to the extent of approximately 10% by weight of cement was found to give the optimum results for the 28 days strength.

KEY- WORD

Rice husk ash, mortar, pozzolanic material, strength.

INTRODUCTION

Cement mortar and concrete are the most widely used construction materials. According to the present state-of-the art concrete is not merely the four component system that is cement, water, fine aggregate and coarse aggregates. Now it is believed that it has many ingredients like fly ash, ground granulated blast furnace slag, silica fumes, rice husk ash, metakaoline and super plasticizers. One or more of these ingredients can be used in concrete and mortar as the situation demands.

The use of pozzolanic material is as old as the art of concrete construction. The use of various pozzolans mixed with OPC in optimum proportions improve many qualities of mortar and concrete in fresh and hardened state.

Rice husk ash is an agro waste material. Rice husk ash (RHA) is obtained by burning of rice husk in a controlled manner. When properly burnt, it has high silica content and can be used as an admixture in mortar and concrete.

India produces about 122 million tons of paddy every year. About 20-22% rice husk is generated from paddy and 20- 25% of the total husk becomes as "RICE HUSK ASH" after burning. Each ton of paddy produces about 40 Kg of rice husk ash. Therefore it is a good potential to make the use of rice husk ash as pozzolanic material for making mortar and concrete.

This paper represents the effect of rice husk ash on compressive strength of mortar when mixed in certain proportions in the ordinary Portland cement (OPC) as partial replacement of cement.

LITERATURE REVIEW

Some of the early researches have examined the use of rice husk ash (RHA) in concrete. RHA is highly pozzolanic material. The non crystalline silica and large specific surface area of the RHA is responsible for its high pozzolanic activity.

Al Khalaf and A.Yousif (1984) have investigated the effect of rice husk on pozzolanic behavior of rice husk ash. They studied the actual range of temperature required to burn rice husk to get the desired pozzolanic product. They investigated that up to 40% replacement of cement with RHA can be made with no significant change in the compressive strength as compared to the controlled mix, if the rice husk is burnt under optimum temperature condition.

Ismail and Waliuddin (1996) had worked on effect of rise husk ash on high strength concrete. They studied the effect the rise husk ash (RHA) passing 200 and 325 micron sieves with 10- 30 % replacement of cement on strength of HSC. Test result indicated that strength of HSC decreased when cement was partially replaced by RHA for maintaining same value of workability. They observed that optimum replacement of cement by RHA was 10 – 20 %. Ramezanianpour et al. 2009, 2010 concluded that burning rice husks at temperature below 700°C produces rice husk ashes with high pozzolanic activity.

EXPERIMENTAL PROGRAMME

Materials

RICE HUSK ASH The rice husk ash obtained from FAIR FOOD OVERSEAS RICE MILL KATNI has been used in the analysis. The physical and chemical properties are listed in table 1 and table 2 respectively.

Table 1 Physical properties of RHA.

S. No.	Parameter (Physical Properties)	Test Value	Method of Test
1	Particles retained on 45 micron IS sieves (Wet Sieving) in % Max.	27.13	IS:1727:1967

Table 2 chemical properties of RHA.

S. No.	Parameters (Chemical Properties)	Test Value	Method of Test
1	Silica as SiO_2 % w/w	83.6	IS:1727:1967
2	Calcium Oxide as CaO % w/w	0.84	IS:1727:1967
3	Magnesium Oxide MgO % w/w,	0.40	IS:1727:1967
4	Alumina as Al_2O_3 % w/w	0.76	IS:1727:1967
5	Ferric Oxide as Fe_2O_3 % w/w	0.64	IS:12423:1988
6	Loss on Ignition % w/w.	14.2	IS:1727:1967
7	Sulphuric Anhydride as SO_3 % w/w	0.69	IS:1727:1967

CEMENT Ordinary Portland cement (OPC) conforming to IS 8112-1989 was used for this study. The OPC "jaypee" of 43 grade has been used, the physical properties are listed in table- 3

Table 3 Physical Property of procured OPC

Particulars	Test Results	Requirements of IS: 8112-1989
Normal Consistency	29%	30%
Setting Time (Minutes):		
•Initial	75	30 (minimum)
•Final	450	600(maximum)

WATER ordinary tap water has been used.
FINE AGGREGATS standard sand is used for making cement mortar as per IS code 650- 1966.
MIX- PROPORTION

The test specimen were prepared as per IS 650-1966, and IS 4031- 1988.
The cement mortar pastes were prepared using rice husk ash (RHA). The modified pastes incorporating the RHA from 5% to 30% by weight cement were prepared and strength results were compared with the strength of plain mix cubes. The mix proportions are summarized in table 4.

Table 4 mix proportions

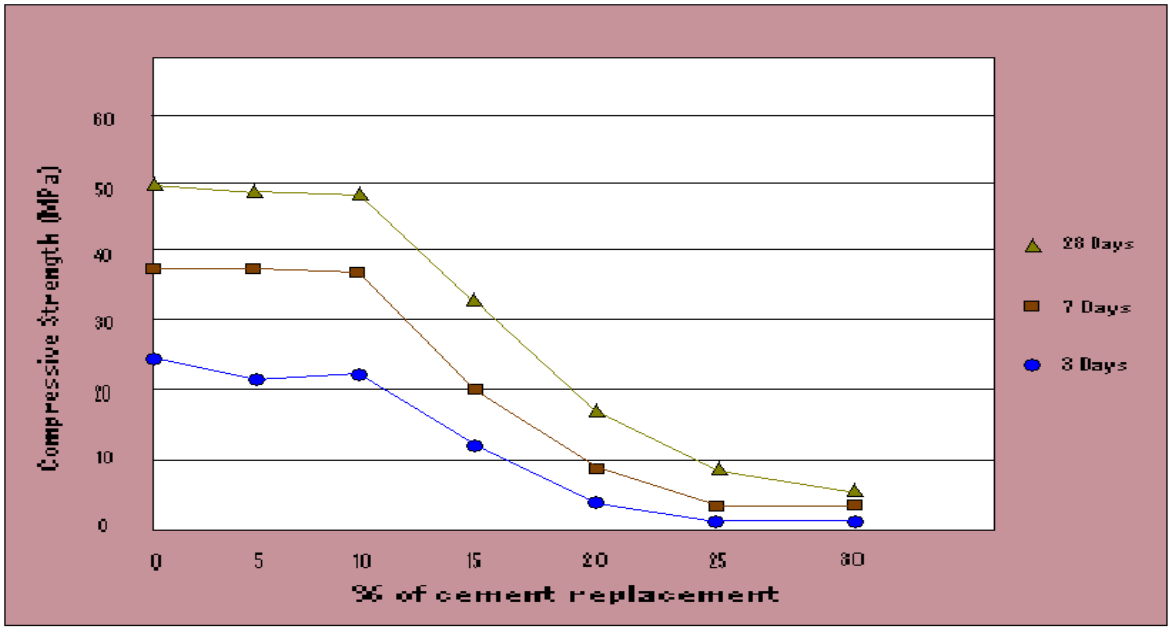
Replacement of cement	Quantity of RHA (gm)	Quantity of cement (gm)	Quantity of sand (gm)	Quantity of water(gm)
0%	0	600	1800	246
5%	30	570	1800	246
10%	60	540	1800	246
15%	90	510	1800	246
20%	120	480	1800	246
25%	150	450	1800	246
30%	180	420	1800	246

TEST RESULTS

Compressive strength test were conducted to evaluate the strength development of cement mortar paste containing various percentage tests of RHA. The strength result are summarized in table- 5

Table 5 Compressive strength of mortar

S.NO	Replacement of cement	COMPRESSIVE STRENGTH(N/mm2)		
		3Days	7Days	28Days
1	0%	24	37	50
2	5%	21	37	49
3	10%	22	36	48
4	15%	12	20	33
5	20%	4	9	17
6	25%	1	4	9
7	30%	1	4	6



CONCLUSIONS

The results of the study show that the RHA produced from agro waste can be used as partial replacement of ordinary Portland cement in cement mortar pastes.

From the test results it can be concluded that if approximately 10% of cement is replaced by equal amount of RHA, there is not any significant depreciation in the compressive strength. Thus the RHA can be used as partial replacement of cement in the regions where the material is locally available.

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