Effect of Rice Husk Ash in Concrete

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ABSTRACT

Cement is widely noted to be most expensive constituents of concrete. The entire construction industry is in search of a suitable and effective waste product that would considerably minimize the use of cements and ultimately reduces the construction cost. RHA is a great environment threat causing damage to the land and the surrounding area in which it is dumped. The possibility of using RHA as a construction material needs to be investigated. Present study concentrates to produce an economic concrete by replacing the percentage of OPC with RHA at 0, 10, 15 and 20% respectively. The test results show that the 10% replacement of RHA concrete shows the strength gain was around 12%. The behaviour of RHA replacement upto 20 % was be studied. The optimum utilization of RHA in concrete is expected as 10%. This leads to saving in construction cost up to 10 to 20%.

Keywords: Rice husk ash, Ordinary Portland Cement, Concrete, Compressive strength

1. INTRODUCTION

Rice husk is an agro-waste material which is produced in about 100 million of tons. Approximately, 20 Kg of rice husk are obtained for 100 Kg of rice[1].Rice husk ash is produced by burning the outer shell of the paddy that comes out as a waste product during milling of rice.Rice husk is extremely prevalent in East and South-East Asia because of the rice production in this area.RHA is a highly pozzolanic material[2].The non-crystalline silica and high specific surface area of the RHA are responsible for its high pozzolanic reactivity[3].

Indian Standard code of practice for plain and reinforced concrete, IS 456- 2000, recommends use of RHA in concrete but does not specify quantities. Chemical compositions of RHA are affected due to burning process and temperature. Silica content in the ash increases with higher the burning temperature Under controlled burning condition in industrial furnace, conducted by Mehta, P. K. (1992), RHA contains silica in amorphous and highly cellular form, with 50-1000 m^2/g surface area[1].So use of RHA with cement improves workability and stability, reduces heat evolution, thermal cracking and plastic shrinkage. This increases strength development, impermeability and durability by strengthening transition zone, modifying the pore-structure, blocking the large voids in the hydrated cement paste through pozzolanic reaction [4] .RHA minimizes alkali-aggregate reaction, reduces expansion, refines pore structure and hinders diffusion of alkali ions to the surface of aggregate by micro porous structure.

2. EXPERIMENTAL WORK

2.1 MATERIALS USED

2.1.1 Cement

Ordinary Portland cement of 53 grade with a specific gravity of 3.15 was used.

2.1.2 Fine Aggregate

Natural river sand conforming to Zone II with a specific gravity of 2.64 and fineness modulus of 3.03 was used.

2.1.3 Coarse Aggregate

Coarse aggregate of size 20 mm having the specific gravity of 3.02 and fineness modulus of 6.8 was used.

2.1.4 Rice Husk Ash

Rice husk ash which was commercially available was used in the experimental work. The properties of rice husk ash that was procured commercially are given in Table 1.

Table 1 Properties of RHA

Sl.No	Parameters	Values
1	Fineness passing 45 micron	96%
2	Specific gravity	2.06
3	Specific surface (nitrogen absorption) m2/ kg	27400
4	Silicon dioxide (SiO2)	87.20%
5	Aluminium oxide (Al2O3)	0.15%
6	Ferric oxide (Fe2O d3)	0.16%
7	Calcium oxide (CaO)	0.55%
8	Magnesium oxide (MgO)	0.35%
9	Sulphur trioxide (SO3)	0.24%
10	Carbon (C)	5.91%
11	Loss on ignition	5.44%
12	Pozzolanic activity	84%
13	Particle size (µm)	7

3. RESULTS AND DISCUSSION

TESTING OF CONCRETE SPECIMENS

Concrete cubes of size 150 mm× 150mm × 150 mm for M60 grade of concrete were cast and tested under compressive load at different curing ages. All the cube specimens were completely wiped out of moisture and tested in saturated surface dry condition. The relation between the percentage of RHA replaced and the strength at various ages is shown in Figure 1. The strength increased with RHA for up to 10% which resulted in achieving the maximum value. The increase in compressivestrength for 10% and 15% of cement replacement by RHA are 13% and 1.5%at 28 days, respectively. For 20% replacement of cement, the strength was similar to that of control concrete specimen.The decrease in the strength by increasing the RHA replacement level is due to the reduction in the cement amount.The compressive strength of the blended concrete with 10% RHA has been increased significantly.

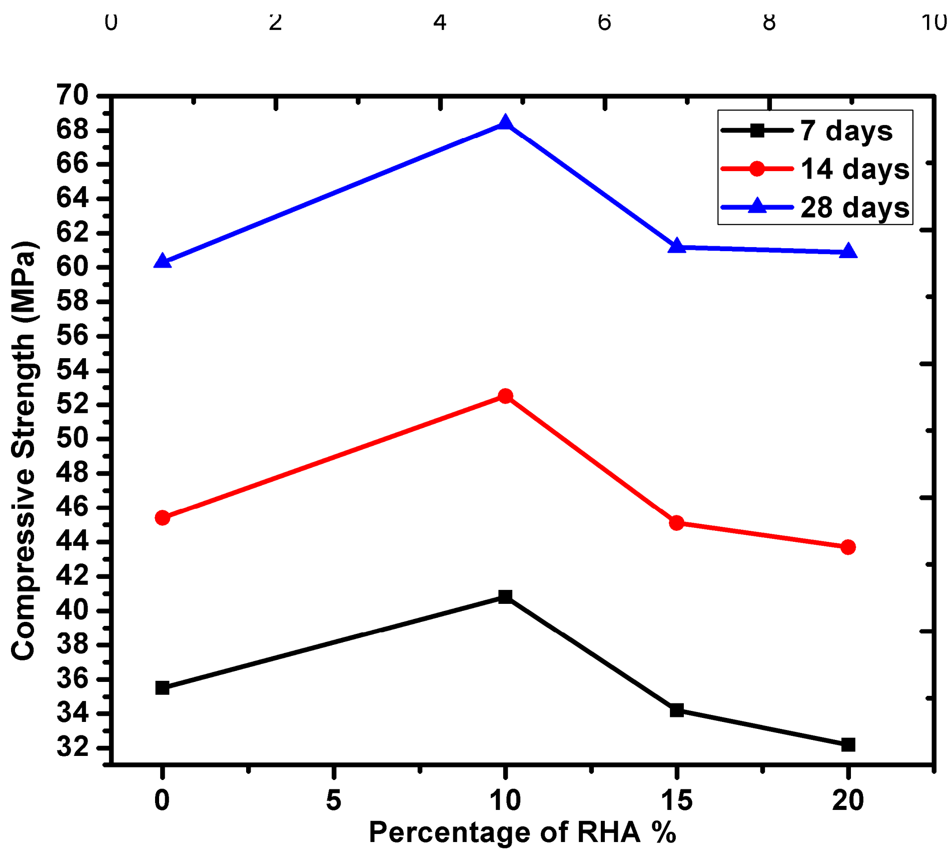

Figure 1: Compressive Strength Test Results

4. CONCLUSION

The employment of RHA in cement and concrete has gained considerable importance because of the requirements of environmental safety and more durable construction in the future. The use of RHA as partial replacement of cement in mortar and concrete has been extensively investigated in recent years. With the addition of RHA weight density of concrete reduces by 72-75%. Thus, RHA concrete can be effectively used as light weight concrete for the construction of structures where the weight of structure is of supreme importance. Rice husk ash therefore can be effectively used as a sustainable concrete option.

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