Brick Masonary Mortar by using Cement, Sand & Rice Husk Ash

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Abstract— Due to pozzolanic reactivity, Rice Husk Ash is used as a supplementary cementing material in mortar and concrete. It has economical and technical advantages to be used in mortar and concrete. I am going to replace cement by the RHA by 5%, 10%, 15% & 20% by weight of cement in different experiments to find out the maximum strength and compare it to the normal mortar at 7,14 and 28 days. Therefore this research is an investigation of the performance of the mortar made of partially replacing the OPC with RHA on the structural integrity and properties of RHA mortar

Key words: OPC, Mortar, Rice Husk Ash, OMC, MDD and structural integrity.

1. INTRODUCTION

Rice Husk is generated from the rice processing industries as a major agricultural by product in developing countries. About 500 million tons of paddies is produced in the world annually after incineration only about 20% of the Rice husk is transformed in Rice HUSK Ash. Still now there is no useful application of RHA and is usually dumped into the water streams or as landfills causing environmental air pollution, water pollution, and soil pollution. RHA consist of non-crystalline silicon dioxide with high specific surface area and high pozzolanic reactivity, thus due to growing environmental concern and the need to conserve energy and resources, utilization of industrial and biogenic waste material has become an integral part of mortar construction. RHA is active pozzolana. Pozzolanas improve strength because they are smaller than the cement particles, and can pack in between the cement particles and provides a finer pore structure. RHA has two roles in mortar and concrete manufacturing as a substitute for Portland cement, reducing cost of mortar and concrete in production of low cost building blocks and as an admixture in the production of high strength mortar.

The presence of mineral and chemical admixtures in concrete is known to impart significant improvement in workability and durability. Among the different existing residues and by-products, the possibility of using rice husk ash in the production of structural concrete is very important for India. India is second largest rice paddy cultivating country in the world. Both the technical advantages offered by structural concrete containing rice husk ash and the social benefits' related to the decrease in number of problems of ash disposal in the environment have simulated the development of research into the potentialities of this material. Rice plant is one of the plants that absorbs silica from the soil and assimilates it into its structure during the growth (Smith et al., 1986). Rice husk is the outer covering of the grain of rice plant with a high concentration of silica, generally more than 80-85% (Siddique 2008). It is responsible for approximately 30% of the gross weight of a rice kernel and normally contains 80% of organic and 20% of inorganic substances. Rice husk is produced in millions of tons per year as a waste material in agricultural and industrial processes. It can contribute about 20% of its weight to Rice Husk Ash (RHA) after incineration (Anwar et al., 2001). RHA is a highly pozzolanic material (Tashima et al., 2004). The non-crystalline silica and high specific surface area of the RHA are responsible for its high pozzolanic reactivity. The utilization of RHA as a pozzolanic materials in cement and concrete provides several advantages such as improve strength and durability properties, reduce materials cost due to cement saving and environmental benefits related to disposal of waste materials.

2. PROPERTIES OF RICE HUSK ASH

Rice husk essentially consists of amorphous silica(90% SiO_2), carbon (5% C) and potassium-oxide(2% K_2O). Some of the useful properties are described below:

2.1. High silica content

Many of RHA's most practical applications stem from its high amorphous silica content. RHA contains around 85 to 90 percent silica. Applications which take advantage of RHA's high silica content include cement and concrete mixes, glaze and release agents for ceramics, specialty paints, and flame retardants. In the cement industry, RHA acts as a much more economical alternative to micro-silica and silica fume, which are imported from China, Norway and Burma. Also, exposing RHA to temperatures exceeding 1,500 degrees Fahrenheit transforms the silica to its crystalline form, which in itself has a number of practical applications, including microelectronics and solar cells.

2.2. Small particle size

RHA's particle size ranks second among its most useful properties. RHA powders normally measure about 25 microns, giving it a very high surface-area-to-volume ratio and making it an excellent absorbent for oil and chemical spills. It also plays an important role in concrete mixes. Cement, which has a particle size of 35 microns, leaves voids in the concrete after curing, reducing the latter's strength. RHA's small particle size allows it to fill the spaces between cement particles.

2.3. Moisture resistance

RHA's water resistance makes it a good additive for waterproofing materials, reducing water penetration by nearly 60 percent when incorporated in sealants and specialty paints. In concrete, a study conducted by the Civil Engineering Department of the Universidade Estadual Paulista Júlio de Mesquita Filho in Brazil, learned that substituting a portion of cement with 10 percent RHA lowers its water absorption by about 40 percent. Increasing the ratio of RHA to cement to an allowable extent increases concrete's water resistance without compromising its quality. Practical applications include concrete pilings for bridges and other marine environments.

2.4. Heat resistance

RHA's heat resistance allows it to be of important use as an insulation powder in steel mills, especially during casting, as reported by the Rice Husk Ash website. Without an RHA coating over the molten metal, transferring the latter from the ladle to a mold would cause an abrupt 300-degree Fahrenheit temperature drop, which damages the cast. RHA prevents the rapid cooling of the metal, preserving the cast's quality. Also, RHA's heat resistance is used in concrete mixes for high-temperature environments, such as nuclear power plant.

3. EXPERIMENTAL PROGRAMME

3.1 ***Materials***

1. Rice Husk Ash:

The rice husk ash was obtained from J.P. Enterprises, Kushinagar, U.P. The physical and chemical properties are shown in table 1 and table 2 respectively.

Table 1: Physical Properties Of RHA

Physical State	Solid Non-Hazardous
Appearance	Very Fine Powder
Color	Grey
Odor	Odorless
Specific Gravity	1.7

Table 2: Chemical Properties of RHA

SiO_2	93.80%
Al_2O_3	0.74%
Fe_2O_3	0.30%
TiO_3	0.10%
CaO	0.89%
MgO	0.32%
Na_2O	0.28%
K_2O	0.12%

2. Cement

The cement used was Ordinary Portland Cement. Cement is procured from local market.

***3.* Fine Aggregate**

In addition to cement, water and aggregates are the other primary constituents of concrete or mortar mixture. Sand is the largest compound of the mortar and the material that gives mortar it distinctive colour, texture and cohesiveness. Sand is procured from local market. Sand is generally from Wainganga River near Nagpur.

***4.* Coarse Aggregate.**

Aggregate is a rocklike material of various sizes and shapes, used in the manufacture of Portland cement concrete or mortar bituminous (asphalt), concrete, plaster grout, filter beds and so on**.** Aggregate is procured from local market. The aggregate which we used are brought from local market.

5. Water

The water used for the study was obtained as portable water.

4. METHODS ADOPTED

The Procedure adopted to make 54 cubes is as follows:

1. Consistency Test is performed to determine the amount of water required to prepare hydraulic cement pastes with normal consistency, as required for certain standard tests.

2. Initial Setting time and final Setting time is performed to find whether cement sets at a rate suitable for a particular work.

3. Specific gravity of cement and RHA is determined by a Pycnometer Method.

4. The concrete used in this Experimental work was made using Binder (Cement and RHA), Sand and Gravel. The concrete mix proportion was 1:1.5:3 by weight.

5. The Compressive Strength of Cubes were tested for the duration period of 3 days,7 days and 28 days after curing respectively.

5. RESULTS AND DISCUSSIONS

1. Consistency test for cement is 33% and for Consistency test for cement with RHA is 37%. The standard consistency results should always in between 25 to 33% and our result is 33% so it is satisfactory
2. The Initial setting time of cement is found out to be 176 minutes and Final setting time of cement is 270 minutes
    a. The Initial setting time of cement with RHA is found out to be 195 minutes and Final setting time of cement with RHA is 265 minutes.
    b. Standard value as recommended by I.S 12269-1987 is Initial setting time should not be less than 30 mins and final setting time should not exceed 600 minutes.
    c. Specific gravity of cement is found out to be 3.14 and Specific gravity of RHA is 2.22

6. CONCLUSIONS

1. Compressive strength of concrete is gradually decreasing when the cement is replaced by RHA.
2. With a percent increase in cement by RHA there is decrease in gain of early strength with time in concrete
3. Specific gravity for cement is 3.145 and RHA is 2.22 and thus it can be said that RHA is lighter than cement
4. Initial and Final setting time of Cement with RHA combination is found out to lie within appropriate range.
5. The workability of concrete had been found to be decreased with increase RHA in concrete
6. The percentage of water cement ratio is reliant on quantity of RHA used in concrete as RHA is a highly porous material.

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