ISSN: 2347-6540

International Journal of Latest Research In Engineering and Computing (IJLREC)
Volume 4, Issue 5 , Page No. 9-13 September-October 2016
www.ijlrec.com

EXPERIMENTAL STUDY ON THE BEHAVIOUR OF CEMENT CONCRETE WITH RICE HUSK ASH

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Abstract: -
Concrete is the most commonly used material for construction. The worldwide production of cement has greatly increased since 1990. Supplementary cementitious materials have been widely used all over the world in concrete due to their economic and environmentally benefits. By addition of some pozzolanic materials, the various properties of concrete workability, durability, strength and resistance to crack can be removed. Various types of pozzolanic materials that improve the cement properties have been used in industries. In the present investigation, a feasibility study is made to use Rice Husk Ash as an admixture to an already replaced Cement with fly ash (Portland Pozzolana Cement) in Concrete, and an attempt has been made to investigate the strength parameters of concrete (Compressive and Flexural). For control concrete, IS method of mix design is adopted and considering this a basis, mix design for replacement method has been made. Four different replacement levels namely 5%, 10%, 15% and 20 % are chosen for the study concern to replacement method. Large range of curing periods starting from 3days, 7days and 28days are considered in the present study.

Keywords: Rice Husk Ash, Pozzolan, Compressive Strength, Permeability, Durability

INTRODUCTION

Sustainable development of the cement and concrete industry requires the utilization of industrial and agricultural waste components. At present, for a variety of reasons, the concrete construction industry is not sustainable. Firstly, it consumes huge quantities of virgin materials which can remain for next generations. Secondly, the principal binder in concrete is Portland cement, the production of which is a major contributor to greenhouse gas emissions that are implicated in global warming and climate change. Thirdly, many concrete structures suffer from lack of durability which may waste the natural resources. So, finding a solution to substitute a practical recycled product for part of the cement seems to be desirable for sustainable development. In this century, the utilization of rice husk ash (RHA) as cement replacement is a new trend in concrete technology. Besides, as far as the sustainability is concerned, it will also help to solve problems otherwise encountered in disposing of the wastes. Disposal of the husks is a big problem and open heap burning is not acceptable on environmental grounds, and so the majority of husk is currently going into landfill. The disposal of rice husks create environmental problem that leads to the idea of substituting RHA for silica in cement manufactured. The content of silica in the ash is about 92-97%.

EXPERIMENTAL PROCEDURE

A. Materials Used

(i). Cement

Cement used in the experimental work is PORTLAND POZZOLONA CEMENT conforming to IS: 1489 (Part1)-1991.The physical and chemical properties of the cement obtained on conducting appropriate tests as per IS: 269/4831 and the requirements as per IS 1489-1991 are given in Table 1 & Table 2

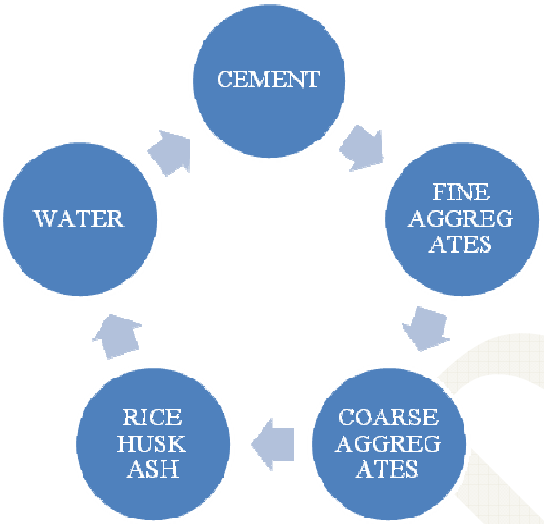

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Table 1: Physical properties of procured PPC

Particulars Test	Results	Requirements of IS: 1489-1991
Specific Gravity	3.15	
Fineness (m2/kg)	369	300 Min
Normal Consistency	32%	
Setting Time (Minutes): Initial Final	 175 265	 30 600
Soundness Le-Chatlier Expansion Autoclave Expansion	 1 mm 0.06 %	 10 mm Max 0.8% Min
Compressive Strength (Mpa) (3 days) (7 days) (28 days)	 26 37 46	 16 Min. 22 Min. 33 Min

Drying Shrinkage %	0.06 %	0.15 Max
% of Fly Ash addition	29	

Table 2: Chemical Properties of Procured PPC

Particulars Test	Results	Requirements of IS: 1489-1991
Loss on Ignition	1.79	5.0 Max
Magnesia (% by mass)	1.86	6.0 Max
Sulphuric anhydride (% by mass)	1.53	3.0 max
Insoluble Material (% by mass)	24.44	27.464 Max
Chloride (%)	0.011	0.1 Max

(ii). Rice Husk Ash

Rice Husk Ash used in the present experimental study was obtained from Bala ji Rice Mill, Ambala City. Specifications, Physical Properties of this RHA as given by the Supplier are given in Table 3.

Fig 1 Rice husk ash after drying and sieving

Table 3: Physical properties of procured Rice Husk Ash

Physical State	Solid – Non Hazardous
Appearance	Very fine powder
Particle Size	25 microns – mean
Color	Grey
Odour	Odourless
Specific Gravity	2.3

(iii) Fine Aggregates

The fine aggregate used in the investigation from khizrabad (Yamunanagar, Haryana), Yamuna River. The properties of fine aggregate as per IS-383 are shown in Table 4.

Table 4: Properties of Fine Aggregates

Properties	Results	Permissible Values
Fineness Modulus	2.54	2.55
Moisture Content	.57 %	Must be less than 2 %
Specific gravity	2.54	2.4-2.6

(iv) Coarse Aggregates

The coarse aggregate of size 12.5 mm and taken from khizrabad (Yamunanagar Haryana). The various properties of coarse aggregates are shown in Table 5.

Table 5: Properties of Coarse Aggregates

Properties	Results	Permissible Values
Fineness Modulus	6.26	6.3
Flakiness index	23 %	Must be less than 40%
Moisture Content	.76 %	Must be less than 2 %
Crushing value	21.3 %	Must be less than 30 %
Specific gravity	2.73	2.6-2.8

v) Water

Ordinary potable water free from organic content, turbidity and salts is used for mixing.

RESULTS AND DISCUSSION

The compressive strength of the cubes at different days and RHA combination are given in table 6

Table 6: Compressive strength of concrete

Mix	Compressive strength(MPa)		
	3 Days	7 Days	28 days
Normal Concrete	8.76	13.36	20.98
5 % RHA	7.76	15.46	21.92
10 % RHA	8.54	18.93	24.46
15 % RHA	7.68	17.66	23.38
20 % RHA	7.34	14.96	20.56

The slump and the compaction factor are given in table 7

Table 7: Slump and compaction factor test

Mix	Slump (mm)	Compaction Factor
Normal Concrete	60	.92
5 % RHA	61	.92
10 % RHA	58	.92
15 % RHA	54	.91
20 % RHA	50	.90

CONCLUSION

From the experiments and test results on fresh and hardened concrete the following conclusion is drawn,

1. Due to addition of RHA, it will increase the workability as compared to normal concrete.
2. The weight also considerably reduced to extend.
3. The cost required is very less than the normal concrete work.
4. The pozzolanic activity of rice husk ash will improve the impermeability characteristics of concrete.
5. The addition of RHA to a 10 % in concrete produces maximum compressive strength.
6. The use of rice husk ash will increase the corrosion resistance and durability of concrete.
7. RHA greatly reduces the environmental pollution due to construction.
8. The addition of RHA to an 20% in concrete as the compressive as far as same of normal concrete.

ACKNOWLEDGEMENT

We would like to express our sincere thanks towards researchers who give us valuable information which is useful in proposed project.

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