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Effect of Rice Husk Ash and Corn Cob Ash in Concrete with Partial Replacement in Cement

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ABSTRACT: The objective of the study is to investigate the mechanical properties of high strength concrete with different replacement levels of ordinary Portland cement by Rice Husk Ash & Corn Cob Ash. The standard cubes (150mmX150mmX150mm) were casted. The cubes were casted by partial replacement of Rice husk ash and Corn cob powder in cement for M30 grade of concrete. The strength effect of concrete of various amounts of replacement in cement viz., 0%, 5%, 10%, 15%, 20%, 25%, 30% with Rice Husk Ash & Corn Cob Ash of M30 grade is compared with Normal concrete. The optimum replacement of rice husk ash and corn cob ash in cement is found to be 15% and obtain more strength when compared with the strength of normal concrete.

KEYWORDS: Rice Husk Ash(RHA), Corn Cob Ash(CCA), Compressive strength

I. INTRODUCTION

Concrete is the most versatile heterogeneous construction material and the most impetus of infrastructural development of any nation. Civil engineering practice and construction works around the world depend to a very large extent on concrete. Concrete is a synthetic construction material made by mixing cement, fine aggregates, coarse aggregates and water in the proper proportions. Each of these components contributes to the strength of concrete. The cost of concrete depends largely on the availability and cost of its constituent with the cost of cement in a cubic meter of concrete being higher than other constituent. In order to reduce the cost of concrete production there is a need to employ the use of agro waste scientifically known as pozzolons as a replacement of cement in concrete. Portland cement and similar materials are made by heating limestone (a source of calcium) with clay and grinding this product (called clinker) with a source of sulphate (most commonly gypsum). In modern cement kilns many advanced features are used to lower the fuel consumption per ton of clinker produced. Cement kilns are extremely large, complex, and inherently dirty industrial installations, and have many undesirable emissions. Of the various ingredients used in concrete, the cement is the most energetically expensive.

Rice husk Ash (RHA) is an agricultural product on which rice husk is burnt into ashes. RHA is found to be good material which fulfils the physical characteristics and chemical composition of mineral admixtures. A small amount addition of RHA (less than two to three by weight of the cement), to a given water cement ratio, is sufficient and helpful to improve the stability, durability as well as the workability tends to increase the compressive strength and durability of the concrete. Usage of the fine rice husk ask reduces the temperature as compared to the normal temperature. As per the researcher observation is was found that proper proportionate ratio RHA can reduce the initial setting time and also it obtains its maximum strength with a few days. RHA depends mainly on silica content, silica crystallization phase, and size and surface area of ash particles. Rice husk usage benefits are briefed in many literatures, very few of them deals in their real life.

Corn cob ash (CCA), the core of corn ears, are very absorbent. They have been used to make inexpensive smoking pipes, and to transport various materials. Ground corn cobs makes an effective blasting media, are friendly to the

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environment, and delicate while maintaining abrasive capacity. Corncobs are increasingly being used as a low-cost environmentally friendly insulation material for houses. In this study, corncob powder has been used as a filler material replaced partially with fine aggregate.

II. RELATED WORK

Concrete is a versatile Engineering composite material made with Cement, aggregate and Admixtures in some cases. Due to development in construction field, the consumption of natural aggregate is very high and at the same time the production of solid wastes from the demolitions and manufacturing units is also very high. Therefore extreme use of concrete, leads to scarcity of natural aggregates. Because of this reason the reuse of RHA & CCA came into picture.

Farah Alwani Wan Chik, BadorulHisham Abu Bakar, MegatAzmiMegatJohari and Ramadhansyah Putra Jaya [1] studied the influence of rice husk ash on concrete block. The compressive strength, water absorption, moisture movement and modulus of elasticity were investigated..Er.RaviBhushan, SopanGocche, Er.Harneet Singh and Bikram Prasad Bastola[2] studied the feasibility of using partial rice husk ash on the cement in order to mitigate the availability, quality and pollution issues. Solid masonry block size 150*150*150 Of M30 grade were casted by replacement of cement to RHA by weight at 0%,5%,10%,15%,20%,25% and 30%.OlafusiOladipupo S and Olutoge Festus A [3] to enhance the reduction of corn cob wastes and reduce the cost of concrete production by using locally available materials. Physical and mechanical properties of varying percentage of CCA cement concrete and 100% of cement concrete were examined and compared.

III. METHODOLOGY

The evaluation of waste by considering Rice husk ash and corn cob ash for the preparation of concrete contains cement, water, fine aggregate, coarse aggregate and grit. The basic properties like specific gravity, consistency and water absorption tests were conducted for the replacement materials ie., rice husk ash and corn cob ash. With the control concrete, i.e. 5% , 10%, 15%, 20%, 25% and 30% of the cement is replaced with Rice husk ash and Corn cob ash. The cube samples were casted on the mould of size (150*150*150) mm of concrete mix with partial replacement of cement. After about 24 hr the specimens were de-moulded and water curing was continued till the respective specimens were tested after 7, 14 and 28 days for compressive strength.

A.MATERIALS

Cement:

Cement is a fine powder, which when mixed with water and allowed to set and harden, is capable of uniting fragments or masses of solid matter together to produce a mechanically strong material. The most common cement used is ordinary Portland cement of 53grade confirming to IS: 12269. Out of the total production, ordinary Portland cement accounts for about 80-90 percent. It is a basic ingredient for concrete, mortar and plaster. It consists of a mixture of oxides of calcium silicon and aluminum. Cement kilns are extremely large, complex, and inherently dirty industrial installations, and have many undesirable emissions. Many tests were conducted to cement some of them are specific gravity tests, consistency tests, setting tests etc.

Fine Aggregate:

Locally available free of debris and nearly river bed sand is used as fine aggregate. The sand particles should also pack to give minimum void ratio, higher voids content leads to requirement of more mixing water. In the present study the sand confirms to zone 1 as per Indian Standards. The Specific gravity sand is 2.65. Those fractions from 4.75mm to 150 micron are termed as fine aggregate.

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Coarse Aggregates:

The crushed aggregates used were 20mm nominal maximum size and are tested as per Indian standard sand results are within the permissible limit. The specific gravity of coarse aggregate is 2.68.

Rice Husk Ash

Rice Husk is one of the waste materials in the rice growing regions. This not only makes the purposeful utilization of agricultural waste but it will also reduce the consumption of energy used in the production of cement. Therefore Rice Husk is an agro based product which can be used as a substitute of cement without sacrificing the strength and durability.

Corn Cob Ash:

Corn cobs, the core of corn ears, are very absorbent. They have been used to make inexpensive smoking pipes, and to transport various materials. Ground corn cobs makes an effective blasting media, are friendly to the environment, and delicate while maintaining abrasive capacity. Corncobs are increasingly being used as a low-cost environmentally friendly insulation material for houses. In this study, corncob powder has been used as a filler material replaced partially with fine aggregate.

Water:

Water available from the local sources conforming to the requirements of water for concreting and curing as per IS: 456-2000.



Fig1. Composition of Materials

Figure.1 shows the different materials that are used for the preparation of concrete.

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B. MATERIALS PROPERTY

Table -3.1: Physical properties of cement

SL.no	Particulars	Obtained values
01	Specific gravity	3
02	Setting time of cement	
	a. Initial setting time	90 min
	b. final setting time	211 min

The table 3.1 shows the physical properties such as specific gravity, Setting time of cement- initial and final setting time of Ordinary Portland Cement (OPC 53 grade).

Table -3.2: Physical properties of Fine aggregates

SL.no	Particulars	Obtained values
01	Fineness modulus	3.71
02	Maximum size	2.36mm
03	Specific gravity	2.65

Table 3.2 shows the physical properties such as specific gravity, fineness modulus and Maximum size of fine aggregates (sand).

Table -3.3: Physical properties of coarse aggregates

SL.no	Particulars	Obtained values
01	Fineness modulus	3.69
02	Maximum size	20mm
03	Specific gravity	2.66

Table 3.3 shows the physical properties such as specific gravity, fineness modulus and Maximum size of coarse aggregates.

Table -3.4: Physical properties of RHA

SL.no	Particulars	Obtained values
01	Specific gravity	3
02	Setting time of cement	
	a. Initial setting time	95 min
	b. final setting time	165 min

The table 3.4 shows the physical properties such as specific gravity, Setting time of cement- initial and final setting time of RHA

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Table -3.5: Physical properties of CCA

SL.no	Particulars	Obtained values
01	Specific gravity	2.75
02	Setting time of cement	
	a. Initial setting time	125 min
	b. final setting time	258 min

IV. SIMULATION AND RESULTS

MIX PROPORTION BY VOLUME = 1: 1.41:2.31

1= CEMENT

1.41= FINE AGGREGATE

2.31= COARSE AGGREGATE

0.4= WATER CEMENT

Table 4.1: Test results of M₃₀ grade concrete with 0%,10%, 20%,30%,40%and 50% replacement of brick powder with fine aggregate for 7, 14 and 28 days.

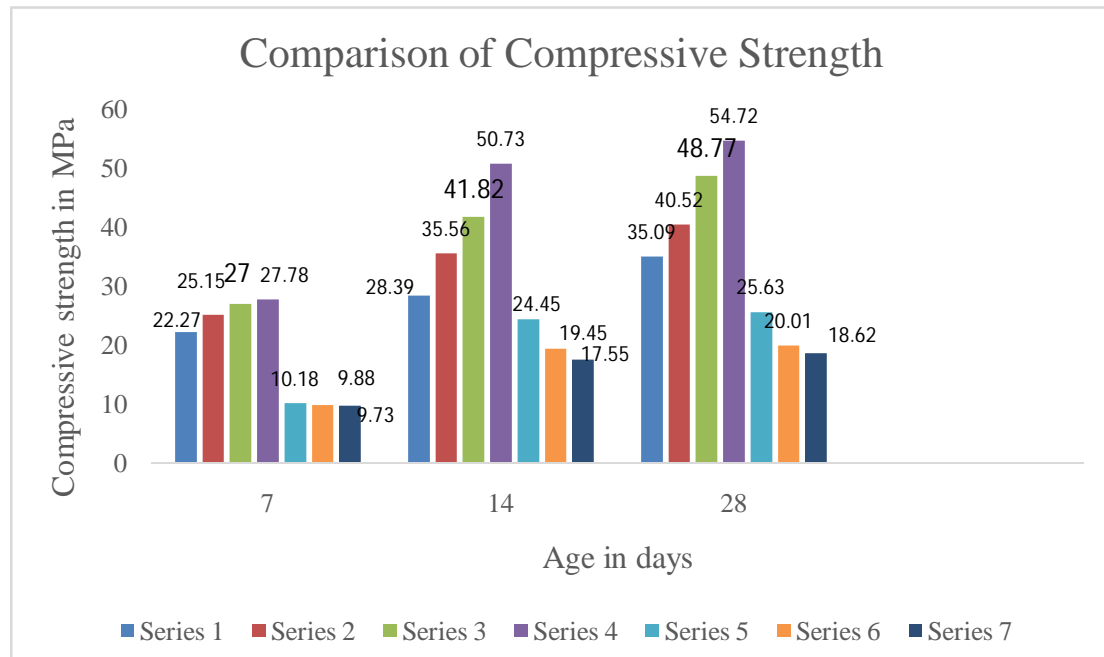
SL.NO	Grade	Percentage Replacement of RHA & CCA	Avg. compressive strength		
			Age in days		
			7	14	28
1	M ₃₀	0%	22.27	28.39	35.09
2	M ₃₀	5%	25.15	35.56	40.52
3	M ₃₀	10%	27	41.82	48.77
4.	M ₃₀	15%	27.78	50.73	54.72
5.	M ₃₀	20%	10.18	24.45	25.63
6.	M ₃₀	25%	9.88	19.45	20.01
7.	M ₃₀	30%	9.73	17.55	18.62

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V. CONCLUSION

Based on the compression strength test, the following are the conclusions obtained after performing the above experiment,

- The maximum compression strength is obtained when 15% of RHA & CCA was replaced in cement.
- The compressive strength for 20%, 25% and 30% replacement of RHA & CCA is not increased. The variation in strength is decreasing with increasing in CCA and RHA when compared with the normal concrete.
- The optimum result is obtained for 15% replacement of RHA & CCA with cement.
- By addition of RHA & CCA into cement, proper utilization of mill waste can be achieved.

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