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ANALYSIS OF COMPRESSIVE STRENGTH OF CONCRETE BY PARTIAL REPLACEMENT OF CEMENT WITH RICE HUSK ASH

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ABSTRACT- *The aim of the project is to find the influence on compressive strength of concrete prepared using Rice husk ash (RHA). The Rice husk ash has been optimised by controlled burning or grinding process and it has been used as a pozzolanic material in cement and concrete. Using RHA enables several benefits, such as improved compressive strength and durability properties, and environmental benefits regarding disposal of waste materials and to reduce carbon dioxide emissions. Till today, many research works has been done to investigate the use of RHA as contributory material in cement and concrete production. The main intention of this work is to find out the suitability of the RHA as a pozzolanic material for cement replacement in concrete. Though, it is expected that the use of RHA in concrete improves the compressive strength of concrete. Also, it is an effort made to create the concrete using rice husk as a source material for a partial replacement of cement.*

KEYWORDS: *Rice husk ash, Special concrete, cement replacement, environment friendly concrete, Strength of concrete.*

I. INTRODUCTION

Throughout the world, concrete is being widely used in the construction. Hence, it has been properly labelled as Backbone to the infrastructure development of a nation [1]. Currently our country is taking major initiative to improve and develop its infrastructure by constructing power projects and industrial and industrial structures to emerge as a major economic power, to meet this development huge quantity of concrete is required [2]. Rapid increase in the infrastructure and real-estate development leads towards shortage of construction material like cement, sand etc. And makes the construction costlier. Hence, it is necessary to think of alternative construction material [3]. Nowadays, Different waste products such as Fly-ash, Sugar cane waste, Egg shell, coconut shells, Rice husk ash etc. are used as such alternative material in different developed countries [4]. It is proposed to study the possibilities of replacing cement with locally available material Rice husk ash (RHA) without sacrificing the strength and workability of concrete [5].In rice mill during the milling of paddy near about 78% of weight is received as rice, broken rice and bran. The rest 22% of weight of paddy is received as husk [6]. This husk is also used in the rice mills for the boilers for processing paddy andit also used in small power plants for generating energy [7]. Rice husk contains about 75% organic volatile matter which burns up and the balance 25% of the weight of this husk is converted in to ash during the firing process, which is known as Rice husk ash (RHA) [8]. India is a major Rice producing country, about 20 million tons of RHA produce annually [9]. This RHA causes the great environmental damage to the land and surrounding area in which it is dumped. Lots of ways are being thought of for disposing it by making commercial use of this RHA [10]. In the present investigation, Portland cement was replaced by at various percentages to study compressive and flexural strength [11].

II. OBJECTIVES

The main objective of this research work is to find out the suitability of the RHA as a perfect pozzolanic material for cement replacement in concrete and find the effect on the various strength properties of M25 grade of concrete when cement is replaced by RHA [1].Generally, 5%, 10%, 20%, 25% and 40% of Rice husk ash are adopted as replacement by weight of cement [2].We have adopted 25% replacement of RHA by weight [3]. However, it is expected that the use of Rice husk ash in concrete improves the compressive strength of concrete [4]. It is an effort made to create the concrete using RHA as a source material for partial replacement of cement [5].

III. EXPERIMENTAL PROGRAMME

3.1 Properties of Material

3.1.1 Cement

In the current research, Ordinary Portland Cement (OPC) of 53 Grade confirming to IS specification was used.

Table 1. Properties Of Cement

Sr. No.	Properties	Obtained values
1.	Fineness (%)	2.25
2.	Initial setting time (min.)	30
3.	Final setting time (min.)	600
4.	Specific gravity	3.15

3.1.2 Fine Aggregate

Locally available Orsang River(Bodeli) sand confirming to IS specification was used as fine aggregate in concrete preparation. The Properties of Fine aggregate are shown in Table 2.

Table 2. Properties Of Fine Aggregate

Sr. No.	Properties	Obtained values
1.	Specific Gravity	2.65
2.	Fineness Modulus	3.30
3.	Zone	Zone-I

3.1.3 Coarse Aggregate

The Coarse aggregate used in our experiment work was of nominal size 20mm & 10mm, obtained from local quarry near Sevaliya confirming to IS specification was used. The properties of coarse aggregate are shown in Table 3.

Table 3. Properties Of Coarse Aggregate

20mm C.A.		
Sr. No.	Property	Obtained value
1.	Aggregate impact value	10.6%
2.	Flakiness index	13.7%
3.	Water absorption	0.92%
4.	Specific Gravity	2.87

10mm C.A.		
Sr. No.	Property	Obtained value
1.	Aggregate impact value	12.6%
2.	Flakiness index	15.2%
3.	Water absorption	1.01%
4.	Specific Gravity	2.84

3.1.4 Rice Husk Ash

For making the Rice Husk Ash, Rice husk is burnt approximately 48 Hours under Uncontrolled Combustion Process. The Burning Temperature is within the Range of 600^0c to 850^0c. The Ash obtained is ground in a ball mill near about for 30 minutes and colour of Rice Husk Ash is seen as Grey.

The Particle size of the cement is about 35-45 microns. There may be formation of void in the concrete mixes, if curing is not done properly. This reduces the strength and quality of the concrete. Our Product Silpozz which is made of this RHA is finer than cement having very small particle size of 25 microns, so that it fills the interstices in between the cement in the aggregate and gains more strength.

Figure 1. Rice Husk Ash

3.1.5 Water

Water used for curing and casting of concrete test specimens is procured from geo test laboratory and is free from impurities which when present can adversely affect the strength of concrete.

3.1.6 Admixture

Recently it has been defined that lower W/C ratio which has been always associated with lower permeability is not enough to make impermeable concrete contributing to high durability. Use of supplementary cementitious material such as fly-ash, silica fume etc. or supplementary pozzolanic material such as Rice husk ash, Egg shells, coconut shell etc. are required to be used admixture for better workability and durability. In our present investigation, EPCO-KP-200 confirming to RDSO specification was used as admixture which is non-toxic and eco-friendly material hence, it is safe to concrete as well as safe to environment.

Table 4. Properties of Admixture used

Name of Admixture	EPCO-KP-200
Colour	Colourless Hazy Liquid
Specific Gravity	1.01 to 1.02 at 25^0c

3.2 Mix Proportion

M25 grade of concrete were designed as per Indian Standards codes for practice. The various ingredients for 1 cum of concrete for different mixes used in the present research are shown in Table 4.

Table 4. Quantities of Ingredients Per cum Of M25 Grade Concrete

Water	Cement	RHA	Fine Aggregate	Coarse Aggregate	W/C Ratio
140 lit.	308 kg	77 kg	751 kg	1127 kg	0.45

3.3 Test Specimens

Cubes moulds were well-greased before casting, to prevent sticking of concrete inside the specimen. Total 6 nos. cubes of size 150mm x 150mm x 150mm were casted and were tested at different curing period (3, 7, 21, 28 days) to get the compressive strength of M25 Grade concrete with 25% replacement of cement. Quantity of material required for 1 cube mould, with and without RHA replacement are described in the table 5. given below:

Table 5. Quantity of Material Required for 1 Cube Mould with & without RHA Replacement

Without RHA Replacement		
Cement	Sand	Coarse Aggregate
1.00 kg	2.50 kg	3.70 kg

With 25% RHA Replacement			
Rice Husk Ash	Cement	Sand	Coarse Aggregate
0.251 kg	0.779 kg	2.51 kg	3.79 kg

IV. RESULTS AND DISCUSSION

4.1 Compressive Strength

The Graph below depicts the variation of compressive strength of M25 Grade concrete for 25% replacement of cement with RHA for different curing periods as shown in Figure 2.

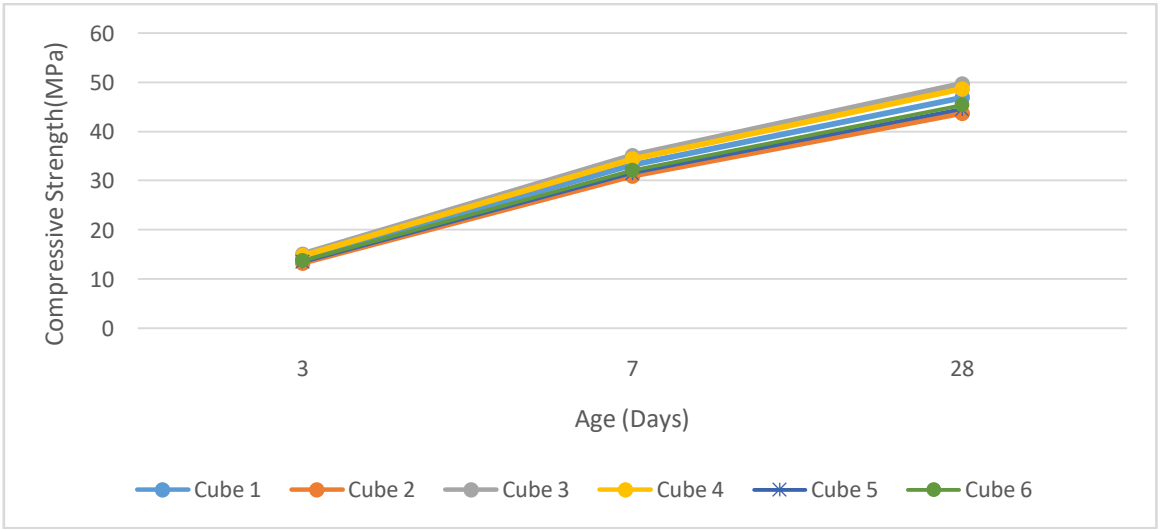

Table 6. Compressive Strength Test Results

Sr No.	Load at failure (KN)	Strength at 28 days (N/mm^2)	Average Strength at 28 days (N/mm^2)
1	1055.7	46.92	46.52
2	983.7	43.72	
3	1119.3	49.75	
4	1096.2	48.72	
5	1004.6	44.60	
6	1022.4	45.44	

V. CONCLUSION

Using the test result, it can be observed that the average compressive strength of M25 grade concrete is 46.52 N/mm^2 which is approximately 1.5 times higher than actual strength of ordinary concrete. The reason behind this extra ordinary strength are proper gradation of the material, proper curing condition and particle size of silpozz which is made up of RHA that we had used in our experimental work. At the end of the experiment, it is observed that compression strength can be obtained by adding RHA up to 25% and this is the optimum percentage of RHA for maximum compressive strength of the concrete.

The results of the experimental investigation indicate that Rice Husk Ash (RHA) can be adopted as partial replacement material for the preparation of the concrete used in the structural application.

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