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Assessment of the Strength of Concrete by Employing Eggshell Powder and Rice Husk Ash for Partial Replacement of Cement

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Abstract - *Nowadays the conventionally established concrete construction industry is not capable of being sustained due to huge intake of natural materials and environmental defilement created during its yield. The usage of waste matter as a cementitious material in concrete will cut down the use of cement and finally the cost of construction. In the present probe, Rice Hush Ash and Egg Shell Powder are applied as a replacement of cement. In this research work, the properties of the compressive strength, spit tensile strength and flexural strength of these mixings are being examinedand equated with the normal concrete by using the mix 1:1.5:3 at the end of 7 and 28 day times. From the results it is witnessed that, substitution of cement with Rice Hush Ash and Egg Shell Powder in concrete up to an optimal quantity gives more beneficial strength than formally established concrete.*

Key Words: Cementitious material, Concrete, Egg Shell Powder, Rice Hush Ash, spit tensile strength.

1. INTRODUCTION

It is well known that, Concrete has become essential material which is being extensively practiced for the construction of structures due to the existence of features like structural stability and its property of strength. It is the anchor of infrastructural evolution of a nation. Now recently, for various kinds of reasons, concrete industriousness is not looking to be sustainable. Foremost, it uses up vast amount of natural resources due to which no virgin stuff will be remained for further future contemporaries. Secondly, the major constituent of concrete is cement and large amount of greenhouse gas is being expelled out in the manufacturing process of cement. It can be said that 7% of world's carbon dioxide emanation is attributable to Portland cement industry.

Almost 900Kg of CO_2 is raised during 1000Kg of cement production. Furthermore, the concrete body structure endures from durability issues due to which natural resources are diminished.

In this experimentation, Rice husk ash and Egg shell powder are expended as a supplementary cementitious material in concrete. Rice husk ash consists of non- crystalline silicon dioxide with high specific surface area and high pozzolanic responsiveness. Besides, calcium rich egg shell is a poultry waste with chemical mixture nearly similar as that of lime stone. Hence, the use of these materials in concrete can have gains like derogating the use of cement, conserving natural lime and utilization of waste materials. Rice husk ash is one of the most widely usable agricultural wastes in many rice producing countries around the world. Rice husk ash is unusually high-pitched in ash. The ash is 87- 97% silica, highly porous and light weight, with a very high extraneous surface area.

This research was accomplished in order to ascertain the optimum percentage of eggshell ash and rice husk ash (RHA) as partial cement replacement. The samples were tested for its mechanical samplings by using concrete grade G30 with cube. The samples were commixed with eggshell ash and RHA admixture with dissimilar proportions (2%:8%:4%:6%, 6%:4%).

Several eccentrics of test were acquitted towards the samples, which are the slump test, compressive and flexural test. Based upon the former explores, the strength of concrete reduced as replaced with eggshells. Most of the researches demonstrate the similar kind of trend when partial cement is substituted using eggshell ash. Thus, to increment of the strength, an commixture which has pozzolanic reactivity called rice husk ash (RHA) is brought in into mix design which has been proved can help to improve the strength of concrete.

Okonkwo *et al*., depicted that, eggshell is primarily framed of calcium compounds that is very equivalent to that of cement and presented as being composed of 93.70% calcium carbonate. Thus, it is an alternative that alters the cement to be interchanged with eggshell [1].

Dr. N Mahedran *et.al.*, concentrated on the emergence of strength and permeability assigns of concrete by optimal substitution of cement with united ratio of fly ash and RHA with synthesis egg shell powder. Fly ash and RHA

along with four distinct contents of 5%, 20% & 30% in terms of weight were executed for transposition of cement and addition of a persistent 5% egg shell powder in every substitution. The restraints conceived for analysis admitted compressive strength, split tensile strength, water permeability and absorptivity. The compressive and tensile strength of concrete altered with increased percentage of fly ash and RHA upto substitution with addition of egg shell powder of 7,14,28 and 56 days of curing . Their study has disclosed the fact that, 15% RHA+ 5% ESP may be covered as a finest creation in view of developed value of compressive strength, water permeability, reduced chlorine penetration and desirable practicality [4].

Ramli. M *et.al* used a compounding of egg shell with silica fumes to find out the feasibleness of egg shell as an option to cement. Egg shell powder supercedes 10%, 20% & 30% in addition with the silica fume by 5%, 10% & 15% of weight of cement. M30 concrete was casted and the compressive strength, split tensile strength and flexural strength test as 7 & 28 days were exercised. Based on the experimental outcomes, they discovered that the compressive strength with egg shell powder as cement replacement material enhances upto 15 % without silica fume. Addition of silica fume also enriches the strength but in economical view point, only the egg shell powder replacement is ample enough for acquring higher strength [5].

H.C. Lung *et al*., followed up the probe on attributes of ESP as a admixture in concrete. They imparted consistency test on ESP. It was noticed that higher the contents of ESP in the cement, the speedier the setting of cement. The decreased setting time of OPC was due to addition of ESP as an accelerator [6].

2. METHODOLOGY

Laboratory experiments were conducted by using main ingredients of concrete mix design, cement, fine aggregate, coarse aggregate and water.

Meanwhile, eggshell ash and RHA were used as partial substitutes for cement in the mix design. After that, tests were conducted such as slump and compressive strength tests which are shown in this paper. The other tests like spit tensile strength and flexural strength tests were also been conducted. Then the data for all experiments were recorded for the analysis.

The test specimens were mixed with eggshell ash and RHA admixture added. Partial cement will be replaced using eggshell ash with RHA during mixing the concrete design according to determined proportions. Table 1 shows the proportions of cement that is partially mixed with eggshell ash and RHA for each test.

Fig -1: Various Materials used for construction

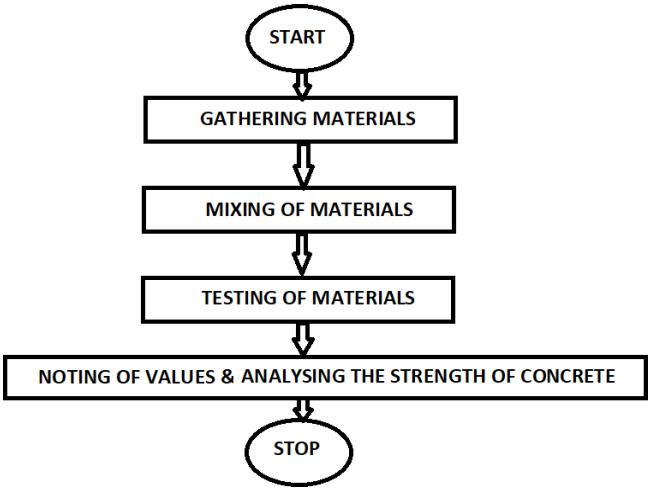

Fig -2: Action plan of preparation

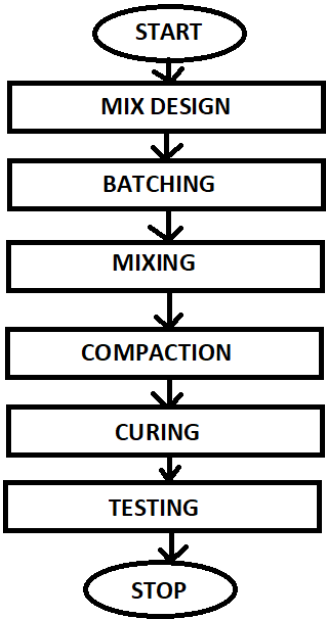

Fig -3: Flow chart of Methodology

ILLUSTRATION OF FLOWCHART:

Mix Design: The purpose of mix design is to attain the designed/ desired workability in the plastic.

Batching: It is the process in which the quantity or proportion of materials like cement aggregates; water, etc. are measured on the basis of either weight or volume to prepare the concrete mix. A High and uniform quality of concrete can be achieved by measuring concrete ingredients accurately for each **batch.**

Mixing concrete: It is simply outlined as the "complete fusing of the materials which are required for the production of a homogeneous concrete". This can vary from hand to machine **mixing**, with machine **mixing** being the most common.

Compaction: It is the process which expels entrapped air from freshly placed **concrete** and packs the aggregate particles together so as to increase the density of concrete. It increases importantly the ultimate strength of concrete and enhances the bond with reinforcement.

Curing: It is nothing but providing tolerable moisture, temperature, and time to allow the concrete to achieve the desired properties for its intended use.

Testing: It is evaluation of the outcome. In testing, the aim is to determine the quality**.**

Table -1: Proportions of Materials used

Proportions of cement, egg shell ash and RHA			
Type of Material	Cement	Egg shell Ash	RHA
Normal concrete	100%	-	-
Concrete A	90%	3%	7%
Concrete B	90%	5%	5%
Concrete C	90%	6%	4%

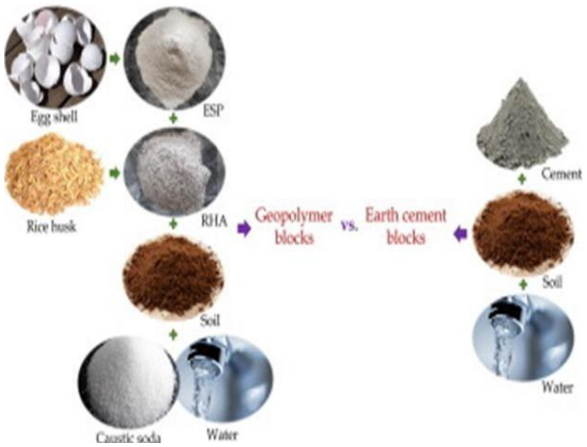

Fig -4: Schematic representation of preparation

3. RESULTS:

SLUMP TEST RESULT:

According to the test results, the concretes with replacement eggshell and RHA is more workable compared to normal concrete.
The test values are depicted below:

Table -2: Slump test values

Type of Material	Slump Value
Normal concrete	3.5
concrete with 3% egg shell ash and 7 % RHA	6.6
concrete with 5% egg shell ash and 5 % RHA	25.5
concrete with 6% egg shell ash and 4 % RHA	45.7

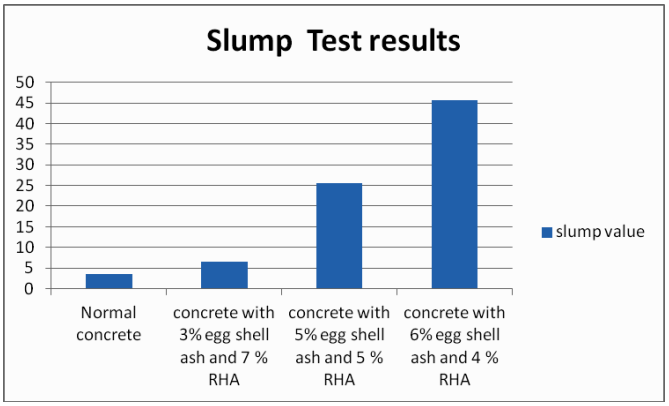

Chart -1: Slump Test result

COMPRESSIVE STRENGTH:

For compressive strength, replacement of eggshell ash and RHA reduced the strength. The strength of concrete is developed at 28 days of curing. Also, the percentage of replacement eggshell ash enhanced along with reduction in percentage of RHA.

3. CONCLUSION

In this study, an effort has been taken to enlighten the use of rice husk ash and egg shell powder in concrete in accordance to their proficiency. This research results shows workability in slump test can be achieved with the mixing of 6% eggshell ash and 4% RHA. Meanwhile, for the normal concrete and concrete with 3% eggshell ash and 7% RHA are less workable.

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BIOGRAPHIES

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