ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 7, Issue 3, March 2018

Experimental Investigations of Partial Replacement of Cement with Egg Shell Ash in Concrete

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Abstract: Cement is one of the universal bonding materials for all construction materials it influenced by more over the constructional values our environmental design systems. It productions for heavy rocks mineral matters (plaster of paries) high lose of minerals and ball mills processing systems. It productions compulsory needs for the cement it high production values is induced global warmings and heavy losses of mineral matters. It will controlled to them partial mixed for the egg shell ash powder in cement content 20, 30, 40 percentage of replacing to mixings of concrete. It's more reliable to mixing ratios for M20 grade of concrete.

Keywords: OPC cement, Egg shell ash powder, Coarse aggregate, Fine aggregate

I. INTRODUCTION

This paper aims to focus on the possibilities of using waste materials from different manufacturing activities in the preparation of innovative mortar and concrete [1]. Marble stone industry generates both solid waste and stone slurry. Leaving the waste materials to the environment directly can cause environmental problems. Advance concrete technology can reduce the consumption of natural resources and energy sources, thereby less the burden of pollutants on the environment. We describe the feasibility of using the egg shell ash powder in concrete production as partial replacement of cement [2]. These materials, participate in the hydraulic reactions, contributing significantly to the composition and microstructure of hydrated product. Presently large amounts of egg shell ash power are generated in natural calcium content processing plants with an important impact on the environment and humans. This project describes the feasibility of using the egg shell waste product to make an ash in concrete production as partial replacement of cement. In INDIA, the marble and granite stone processing is one of the most thriving industry the effects if varying marble dust effect of problems in human hygienic and environmental problems. The contents of the physical and mechanical properties of fresh and hardened concrete have been investigated. The use of the replacement materials offer cost reduction, energy savings, arguably superior products, [3] and fewer hazards in the environment. In this project our main objective is to study the influence of partial replacement of cement with egg shell ash powder, and to compare it with the compressive and tensile strength of ordinary M20 concrete. We are also trying to find the percentage of egg shell ash powder replaced with concrete that makes the strength of the concrete maximum. The nowadays slate, marble, marbonate powder has become a pollutant. So, by partially replacing cement with egg shell ash powder, we are proposing a method that can be of great use in reducing pollution to a great extent.

II. EXPERIMENTAL MATERIALS

Cement

The cement used to be ordinary Portland cement 53 (OPC 53). All properties of cement were determined by referring IS 12269 - 1987. The specific gravity of cement is 3.15. The initial and final setting times were found as 55 minutes and 258 minutes respectively. Standard consistency of cement was 30%.

Fine Aggregate

M-sand was used as fine aggregate. The specific gravity and fineness modulus was 2.55 and 2.93 respectively.

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Coarse Aggregate
The 20 mm size aggregates-The coarse aggregates with size of 20 mm were tested and the specific gravity value of 2.78 and fineness modulus of 7 find and selected. The coarse aggregate fine angular sharpened edges aggregates were available from local sources.

Water
Potable water used for mixing and curing purposes. Preparing of concrete and for this purpose used in the Water cement ratio is W/C of 0.52 (52%) water range 6 to 7.5 PPM.

Egg Shell Powder
The egg shell ash powder is obtaining 95% of calcium, 5% magnesium carbonates. The specific gravity of egg shell ash powder is found to be 2.15, and the finess found to be 7%.

III. METHODOLOGY

The estimate of egg shell ash powder which is used as a partial mixed with of cement grain powder casted after curing with the concrete testing. With the conventional concrete 20%, 30%, 40% of the egg shell ash powder replaced with cement. Weight batching is done by volume, but most specifications required that batching be done by mass rather than volume. Cement: 53 grade (OPC), Content=330 kg/m^3 [4]. Combination material mix proportion: (M20 grade) 1:1.5:3 is 10262-2009.

Batching and mixing of materials
Batching of materials was done by weight. The percentage replacements of Ordinary Portland cement (OPC) by marble powder were, 20%, 30% and 40%.

Concrete Mix Design
The concrete used in this research work was made using Binder, Sand and Gravel. The concrete mix proportion was 1:1.5:4 by weight.

Test Specimens
Test specimens consisting of 150 × 150 × 150 mm cubes for Compressive strength, 150mmΦ, 300mmLength cylinders for split tensile strength and 150 × 150 × 700 mm [5] beam for flextural strength using different percentage glass fiber for M20 grade of concrete mix were cast and tested as per IS: 516 and 1199.

IV. RESULTS AND DISCUSSION

Compressive Strength Tests on Concrete Cubes
Table 1 shows compressive strength of concrete cubes with various percentages of egg shell ash powder:

Table 1. Compressive strength of concrete cubes with various percentages of egg shell ash powder.

Egg shell ash powder percentage of replacement	7-Days	14-Days	28-Days
20%	16 N/mm^2	22.54 N/mm^2	31 N/mm^2
30%	15.95 N/mm^2	22.30 N/mm^2	30 N/mm^2
40%	15 N/mm^2	21.50 N/mm^2	27 N/mm^2

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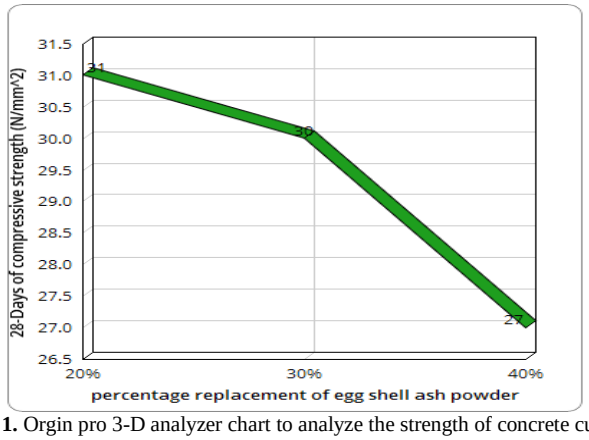

Fig. 1. Orgin pro 3-D analyzer chart to analyze the strength of concrete cubes.

Fig. 1 represented orgin pro 3-D analyzer chart to analyze the strength of concrete cubes. It takes the samples for the casting cubes after 7, 14, 28 days tested the CTM (Compressive testing machines) are used to compress the maximum load to yield point failure them. To take the maximum range of curing values is taking about to the mean values are calculated about the final strength compressive ability of cubes.

Split Tensile Strength Test on Concrete Cylinder

Table 2. The result of split tensile strength of concrete cylinder.

Egg shell ash powder percentage of replacement	7-Days	14-Days	28-Days
20%	3.9 N/mm^2	4.2 N/mm^2	4.3 N/mm^2
30%	3.5 N/mm^2	3.9 N/mm^2	4.2 N/mm^2
40%	3.3 N/mm^2	3.6 N/mm^2	4 N/mm^2

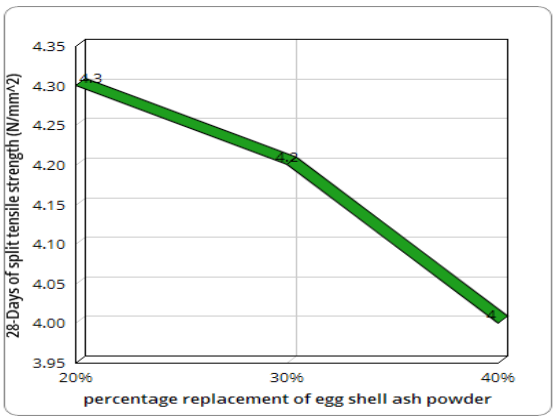

Fig. 2. Orgin pro 3-D analyzer chart to analyze the strength of concrete cylinders.

Fig. 2 represented orgin pro 3-D analyzer chart to analyze the strength of concrete cylinders (Table 2). It takes the samples for the casting cubes after 7, 14, 28 days tested the UTM (Universal testing machines) are used to compress the maximum load to yield point failure them. To take the maximum range of curing values is taking about to the mean values are calculated about the final strength compressive ability of cylinders. It takes the cylinder placed the UTM in horizontal positions.

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Flextural Strength Test on Concrete Beams

Table 3. The result of the flextural strength of concrete beams.

Egg shell ash powder percentage of replacement	7-Days	14-Days	28-Days
20%	6.2 N/mm^2	10.2 N/mm^2	10.6 N/mm^2
30%	5.8 N/mm^2	9.75 N/mm^2	10.3 N/mm^2
40%	5.3 N/mm^2	9.2 N/mm^2	10.2 N/mm^2

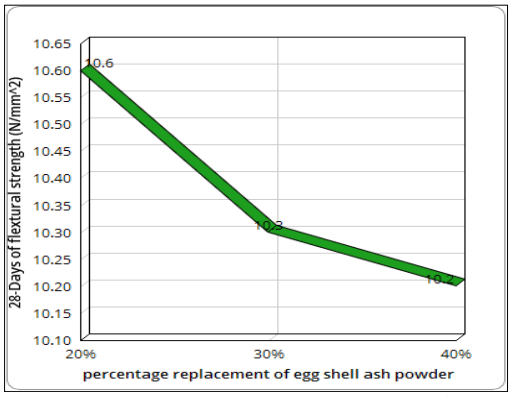

Fig. 3. Orgin pro 3-D analyzer chart to analyze the strength of concrete beams.

Fig. 3 represented orgin pro 3-D analyzer chart to analyse the strength of concrete beams (Table 3). It takes the samples for the casting cubes after 7, 14, 28 days tested the flextural strength machines are used to compress the maximum load to bend yield point failure them. To take the maximum range of curing beams bending values is taking about to the mean values are calculated about the final strength bending ability of beams.

V. RECOMMENDATION

The result of the test, it is recommended that optimum values of 30%, 40% egg shell ash powder. The use of local materials like ESH as pozzolans should be encouraged in concrete production. Similar studies are recommended for concrete beams and slab sections to ascertain the flextural behavior of better bonding strength made with this material. Durability studies of concrete cubes made by ESH as partial replacement for cement should be carried out.

VI. CONCLUSION

Outstanding performance of egg shell ash powder, it's beginning learn , it is completed that the egg shell ash powder can be used as a replacement material for cement 30 to 40% partially mixed with the egg shell ash gives a first-rate consequence in strength feature. The consequences values of the project of the cement content through egg shell ash powder improved the higher compressive, flextural, split tensile strength and durability of concrete. The experimental result values higher beneficial of features hardened concrete performance, ductility resistant of the seismic building design is used. If 30, 40% of partially mixing ratios of concrete are plain concrete are provided by foundations.

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