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Study on Structural Behavior of Egg Shell Powder in Concrete

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Abstract: The egg shell usually which are disposed off is used as an alternate for the cement, since, the shell is made up of calcium. In this study the results of specimens calculating the performance of egg shell powder as the partial replacement of cement in concrete. Partially, the cement is replaced with egg shell powder as 5, 10 and 15% by weight. The compressive, split tensile and flexural strength was determined at curing ages 7, 14 and 28 days. Concrete is cast and compressive test, tensile and flexural tests were carried out to find results in the optimum percentage of strength.

Key words: Egg shell powder, structural behavior of concrete, compressive test, flexural strength, partial, cement

INTRODUCTION

The objective of this study is estimating the recyclability of egg shell powder as pozzolanic ash and as a partial replacement in the concrete and to carry out the comparative study of egg shell powder practical and conventional concrete strength. The scope of the survey is to cast the real specimens and conduct the compressive. The strength test and permeability properties of concrete using fly ash are explained by Sivakumar and Mahendran (2014), split tensile strength test and flexural strength test at 7, 14 and 28th days with the specified percentage of egg shell powder and compare it with the plain concrete specimens. In this project, M 25 concrete is designed for various combinations.

The scope of this study is to examine the chemical composition of the egg shell to find its suitability of replacement in the concrete. Evaluate the partial replacement of cement with egg shell powder is illustrated by Yerramala (2014). Examine the feasibility of utilizing the egg shell in concrete. To study the strength parameters of the egg shell powder mixed specimens and to compare it with conventional examples.

This study review, analysis on the structural, spectroscopic and dielectric properties of borate glass (Shajan *et al*., 2016), smart memory alloys as structural composites illustrated by Raman *et al*. (2014) and experimental study on core analysis for determination of sandstone resistivity is determined by Prince and Jefferson (2014).

MATERIALS AND METHODS

Egg shell powder is a powder prepared from the chicken egg's shell. The physical properties like density and porosity of the egg shell powder is discussed in Table 1. The 100 g of the egg shell powder contains 50 g of calcium oxide and another 50 g contains some chemical components, the exact composition is given in Table 2.

Table 1: Physical properties of the eggshell powder

Names	Physical properties
Specific gravity	0.850
Moisture content	1.180
Bulk density (g/m^3)	0.800
Particle density (g/m^3)	1.012
Porosity (%)	22.400 BET

Table 2: Chemical properties of the eggshell powder

Contents	Percentage
CaO	50.700
SiO_2	0.090
$Al2O_3$	0.030
MgO	0.010
$Fe2O_3$	0.020
Na2O	0.190
$P2O_5$	0.240
SrO	0.130
NiO	0.001
SO_3	0.570
Cl	0.219

The cement in M 25 grade concrete mixture were replaced with egg shell powder in different quantities and few sample cubes and beams are made off with each concrete mixture. The concrete mixture is made by replacing 5, 10 and 15% of cement with egg shell powder. The cubes and beams are included for the compressive and flexural strength test after 7, 14 and 28 days. The test results are logged and used for analysis.

RESULTS AND DISCUSSION

Table 3 and 4 show the test results of compressive strength of cube and flexural strength of beam

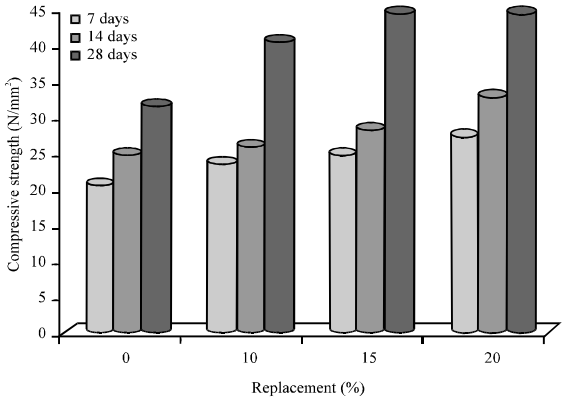

Fig. 1: Comparison chart of compressive strength of cubes for different sample

Table 3: Test results for compressive strength of cubes

	Average compressive strength (N/mm²)			
		Egg shell powder concrete (%)		
Number of curing days	Plain concrete	5	10	15
7	20.44	23.72	24.86	27.30
14	24.77	25.90	28.32	32.97
28	31.61	40.67	44.47	44.59

Table 4: Test results of flexural strength of beam

	Average compressive strength (N/mm²)			
		Egg shell powder concrete (%)		
Number of curing days	Plain concrete	5	10	15
7	3.46	2.78	2.85	3.05
14	4.28	3.29	4.32	4.52
28	5.86	5.61	6.53	6.81

correspondingly. Figure 1 shows the comparison chart of compressive strength of cubes for different sample. Similarly, Fig. 2 shows the comparison chart of flexural strength of beam for different sample.

From table results, we can observe that both compressive and flexural strengths are increased in each sample. Out of this 15% achieves the maximum flexural strength for partial replacement of cement with egg shell powder. It is found to be greater than the conventional concrete.

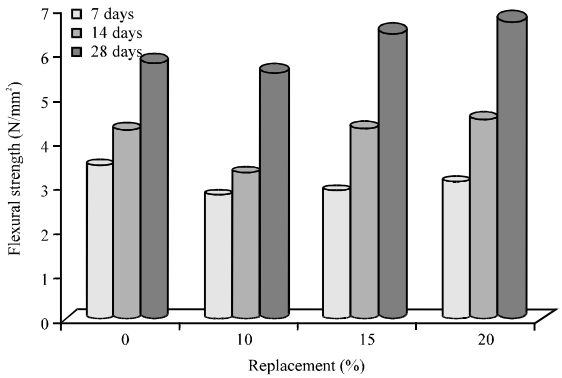

Fig. 2: Comparison chart of flexural strength of beam for different sample

CONCLUSION

Compressive and flexural strength of different specimens were conducted with increment in replacement of cement by egg shell powder. The maximum flexural strength for partial replacement of cement using egg shell powder be achieved by 15% is invented to be greater than the conventional concrete. So, the optimum percentage of replacement of egg shell powder is 5%.

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