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Experimental Investication of Concrete on Partial Replacement of Cement by Cockle Shell

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ABSTRACT

In developing countries where concrete is widely used, the high and steadily increasing cost of concrete has made construction very expensive. The concepts of eco-friendly building are getting more attention today. The use of materials from natural sources is an alternative to the realization of the green building concept. The cement is partially replacement with 10 %, 20%, and 30% by cockle shell powder by using M20 grade concrete. The water cement ratio is maintained for this mix design is 0.5. The workability, compressive strength & tensile strength test of concrete with various percentage of cockle shell, as fine aggregate replacement are done workability, compressive and tensile strength test were conducted in accordance to IS 456.

Keywords: Cockle Shell Powder, Water Cement Ratio, Workability, Compressive Strength, Tensile Strength Test

1. INTRODUCTION

The waste shells are thrown away, which causes environmental pollution. marine pollution by waste oyster shells has become one of the most serious problems of the aquaculture industry causing nasty odors as a consequence of the decomposition of fresh remnants attached to the oysters. Fish and their products account for a large proportion of the people's diet and the intensification of fishing activities have led to the production of large quantities of these waste shells. As a way of waste management, a number of useful materials have been produced from sea shell wastes. To overcome this issue, waste materials have been analyzed and investigated their capability and potential to be used as partial cement replacement material in concrete production.

1. OBJECTIVE

To investigate the effect of concrete containing various percentage of cockle shells as partial replacement of cement towards workability, compressive strength and tensile strength of concrete.

2. EXPERIMENTAL INVESTIGATION

3.1Materials used:

Cement: Portland Pozzolana Cement (PPC-53 grade) conforming to IS: 8112-1989. The specific gravity of cement is 3.15.

Fine aggregate: Locally available river sand conforming to Zone II of IS: 383- 19707 was used as fine aggregate with specific gravity 2.89

Coarse aggregate: 20mm size crushed granite stone obtained from the local quarry with specific gravity 2.72

Water: Potable tap water is used to mix the concrete.

Cockle Shell: Cockle Shell consists of three layers outer, intermediate and inner layer. Outer layer is made up of calcite material whereas inner layer is otherwise known as nacre which is made up of calcium carbonate. Since 95% of calcium carbonate present in cockleshell, it has the strength nearly equal to coarse aggregate. The cockleshells of 20 mm size were sieved and used

3. RESULT AND DISCUSSION

Mechanical properties studies were conducted at 28 days for M20 and M30 grade various mix to find the compressive strength, split tensile strength and flexural strength.

Compressive strength Test:

The test is carried out on 150x150x150 mm size cubes, as per IS: 516-1959. The test specimens are marked and removed from the moulds and unless required for test within 24 hrs, immediately submerged in clean fresh water and kept there until taken out just prior to test. A 2000 KN capacity Compression Testing Machine (CTM) is used to conduct the test. The specimen is placed between the steel plates of the CTM and load is applied at the rate of 140 Kg/Cm2/min and the failure load in kN is observed from the load indicator of the CTM.

Table No.1 Compressive Strength Test Results

S.No	Percentage of Replacement	f_t at 7 days	f_t at 28 days
1	0	18.29	30.36
2	5	24.12	35.17
3	10	25.43	38.22
4	15	27.75	42.29
5	20	28.48	43.01
6	25	29.29	45.36
7	30	28.12	42.17

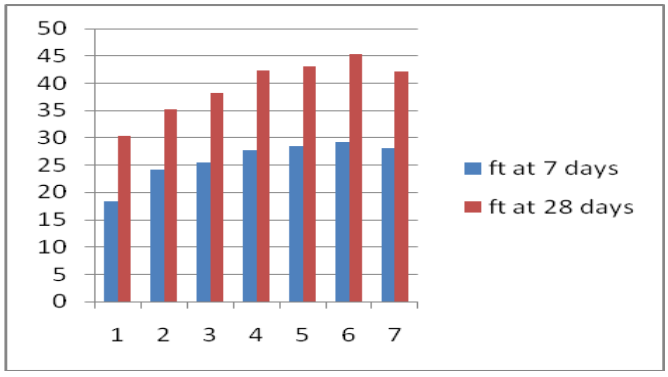

Fig. 1 Compressive Strength for various % replacements

Split tensile strength Test:

The cylinder specimens were tested on compression testing machine of capacity 3000KN.The bearing surface of machine was wiped off clean and looses other sand or other

material removed from the surface of the specimen. The load applied was increased continuously at a constant rate until the resistance of the specimen to the increasing load breaks down and no longer can be sustained.

Table No: 2 Split tensile strength Test Results

S.No	Percentage of Replacement	f_t at 7 days	f_t at 28 days
1	0	2.01	2.61
2	5	2.31	2.73
3	10	2.33	2.75
4	15	2.40	2.89
5	20	2.50	3.16
6	25	2.56	3.18
7	30	2.50	2.69

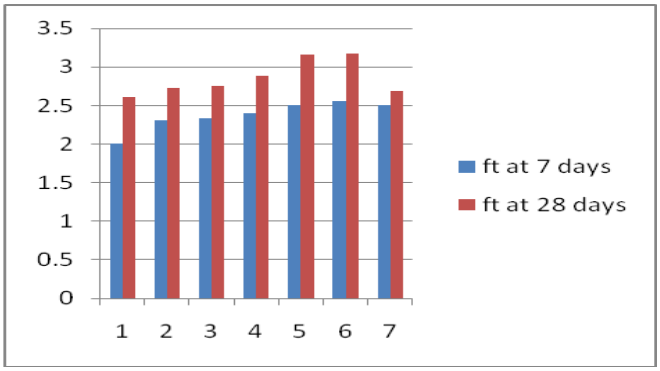

Fig. 2 Split Tensile Strength for various % replacements

Flexural Strength Test:

The flexural strength of concrete prism was determined based on IS: 516 –1959. The specimen was placed in the machine in such a manner that the load is applied to the upper most surface as cast in the mould along two lines spaced 13.3cm a part at a rate of 180 kg/min and is increased until the sample fails.

Table No: 3 Flexural Strength Test Results

S.No	Percentage of Replacement	f_t at 7 days	f_t at 28 days
1	0	3.17	3.49
2	5	3.51	3.60
3	10	3.89	3.61
4	15	3.59	3.63
5	20	3.98	3.77
6	25	4.01	4.29
7	30	3.23	3.53

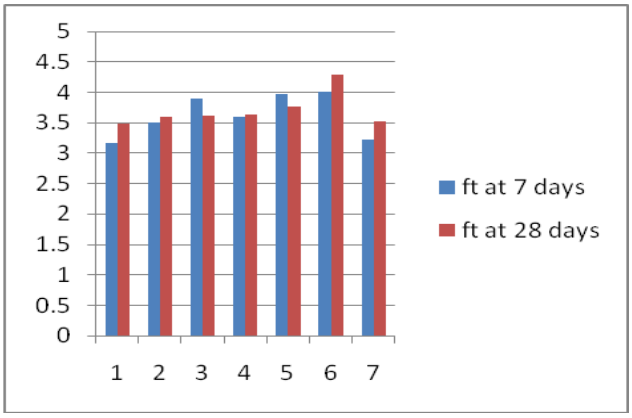

Fig 3 Flexural Strength for various % replacements

4. CONCLUSION

This early study found that addition of cockle shell as cement replacement reduces the concrete workability owing to its shape and rougher texture. However, it is replacement of cement by cockle shell at a level of 25% resulted in increase of compressive strength and also to the compared to control specimen

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