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Experimental Study on Partial Replacement of Cement with Coconut Shell Powder and Egg Shell Powder

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ABSTRACT: The use of waste materials with pozzolanic properties in concrete production is a becoming a worldwide practice. The assessment of the pozzolanic activity of cement replacement materials is becoming increasingly important because of the need for more sustainable cementing products. In this paper, coconut shell powder and egg shell powder is used as partial replacement for cement in ranges of 0%, 2.5%, 5%, and 15% in M₃₀ grade. Strength tests were carried out to assess the feasibility of using coconut shell powder and egg shell powder as partial replacement of cement in concrete. These methods of concrete are cured at 7th and 28th days. Then comparing the results of conventional & mechanical properties.

KEYWORDS: coconut shell powder , egg shell powder, Cement,

I. INTRODUCTION

The aim of this study is to study the naturally grown coconut shell powder & chemical composition of the egg shell powder to find its suitability of replacement in the concrete. To study the strength parameters of the coconut shell powder & egg shell powder mixed specimens and to compare it with conventional specimens. This paper analyzes the Comparison of Coconut shell powder & Egg shell powder in concrete by partial replacement of cement at the ratio of 0%, 2.5%, 5%, and 15%. The experimental study examines the mechanical properties such as compressive strength, split tensile strength and flexural strength. The main ingredients consist of Ordinary Portland cement, coconut shell powder, Egg shell powder, sand, coarse aggregate, & water. After mixing, concrete specimens were casted and subsequently all test specimens were cured in water at 7 and 28 Days & with the specified combinations of coconut shell powder & egg shell powder and compare it with the controlled concrete specimens. In this project M₃₀ Concrete is designed for various combinations.

II. REVIEW OF LITERATURE

Praveen Kumar.R, et.al., (2015) Shows that the Experiment is explained that the egg shell powder is replaced 10%, 20% and 30% by cement in concrete in addition with 5%, 10%, 15% of weight of cement. The egg shell powder replacement is sufficient enough for getting higher strength. The flexural strength of the egg shell concrete increases with the addition of egg shell powder. The Split tensile strength of the egg shell powder concrete decrease with the addition of egg shell powder. This can be increase s used with reinforcement.

Shaik Akhil Masten et.al., (2015) Explained that the experimental study is an attempt to find the optimum usage of fly ash and egg shell powder in normal concrete by replacing the river sand 7%, 14%, 21%, 28%, & 35 % by weight at various proportions. Fly ash & egg shell powder could be very conveniently used in structural concrete. **Olanitori LM et.al., (2015)** Shows that the experiment is explained that using a mix design ratio of 1:2:4 and water binder ratio of 0.63 concrete cubes were casted using varying Ordinary Portland Cement: Palm Kernel shell ash & Ordinary Portland cement: coconut shell ash ratios of 100:0, 90:10, 80:20, 70:30, 60:40, & 50:50 respectively. Reducing the production

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cost and the environmental pollution caused by the dumping of the agricultural waste. **Niya Eldhose et.al., (2015)** Explained that the experiment is explained that the replacing the cement by egg shell powder (ESP) 5%, 10%, 15% and Fine aggregate by Crumb Rubber (CR) 2.5%, 5%, 7.5% & 10%. The compressive strength of concrete decreased with increase in varying percentage of Crumb rubber Result of Replacing cement by 5% ESP in 10% Crumb Rubber replaced concrete shows increase in both flexural and split tensile strength. **Sargunan K, et.al., (2014)** Explained that the experiment is explained that the cement is partially replaced with egg shell powder as 5%, 10%, 15%, 20%, 25%, 30% by weight of cement. & the replacement of 5% Egg shell powder + 10% Microsilca replacement in cement yields similar flexural strength as in conventional concrete. Micro silica replacement in cement yields higher Split Tensile strength as compared to other compositions.

III. MATERIAL AND METHODOLOGY

Locally available OPC cement of grade 43 was used in this work, table 1 shows composition of cement. Coarse aggregate and fine aggregate and water were used from local source the specific gravity of fine aggregate and coarse aggregate was found to be 2.65 and 2.7 respectively.

Egg shells from local hotels were collected, the weight of each egg shell produces 1 teaspoon of Egg Shell Powder approximately and normally it weighs 5 grams. Table 2 shows composition of egg shell and table 3 shows chemical composition of Coconut shell powder

The grinded egg shells were sieved through the 90 micron sieve size and then packed to use it in the cement replacement.

MIX PROPORTION

IS Method was used for mix design and finally for M30 Grade of concrete the mix was 1: 1.87:3.37

TABLE 1
Composition of OPC43

S. No	Oxide Contents	Percentage (%)
1	CaO	50.7
2	SiO ₂	0.09
3	Al ₂ O ₃	0.03
4	MgO	0.01
5	Fe ₂ O ₃	0.02
6	Na ₂ O	0.19
7	P ₂ O ₅	0.24
8	SrO	0.13
9	NiO	0.001
10	SO ₃	0.57
11	Cl	0.219

TABLE 2
Composition of Egg Shell

S. No	Oxide Contents	Percentage (%)
1	CaO	60-67
2	SiO ₂	17-25
3	Al ₂ O ₃	3-8
4	Fe ₂ O ₃	0.5-6.0
5	MgO	0.1-4.0
6	K ₂ O, Na ₂ O	0.4-1.3
7	SO ₃	1.3-3.0

TABLE 3 Composition of Coconut Shell

Element	Al ₂ O ₃	CaO	Fe ₂ O ₃	K ₂ O	MgO	Na ₂ O	SiO ₂	MnO	ZnO
%	15.6	0.57	12.4	0.52	16.2	0.45	45.05	0.22	0.3

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IV. EXPERIMENTAL RESULTS

COMPARISON OF COMPRESSIVE STRENGTH TEST RESULT

Concrete cubes of 150mm X 150mm X 150mm has been cast according to the specifications mentioned in the IS codes : 516 :1959. The Concrete specimens were cast based on the specifications and tested to determine the feasibility of egg shell powder and Coconut shell powder in concrete.



Figure 1- Testing of Cube

Figure 2 - Comparison of Conventional concrete, Coconut Shell Powder & Egg shell powder Replacement of cement in Strength at 7day's concrete

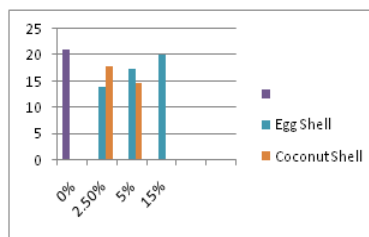


Fig:2 Strength at 7day's concrete

Figure 3 - Comparison of Conventional concrete, Coconut Shell Powder & Egg shell powder Replacement of cement in Strength at 28day's concrete

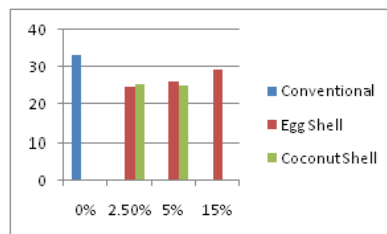


Fig:3 Strength at 28day's concrete

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COMPARISON OF TENSILE STRENGTH TEST RESULT

Cylinder moulds of size 150 mm diameter and 300 mm length for concrete has been cast according to the specifications mentioned in the IS codes : 516 :1959. The Concrete specimens were cast based on the specifications and tested to determine the feasibility of egg shell powder and Coconut shell powder in concrete.



Figure 4 -Testing of Cylinder

Figure 5 - Comparison of Conventional concrete, Coconut Shell Powder & Egg shell powder Replacement of cement in Strength at 7day's concrete

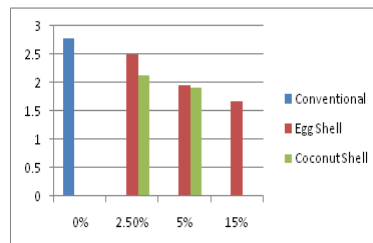


Fig:5 Strength at 7day's concrete

Figure 6- Comparison of Conventional concrete, Coconut Shell Powder & Egg shell powder Replacement of cement in Strength at 28day's concrete

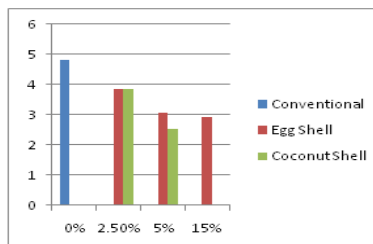


Fig:6 Strength at 28day's concrete

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COMPARISON OF FLEXURAL STRENGTH TEST RESULT

The prisms of size 150 mm in cross section length and 300mm in longitudinal length are cast are used for to test the Flexure Strength of the Concrete as per the specifications of IS 516:1959



Figure 7-Testing of Prism

Figure 8 - Comparison of Conventional concrete, Coconut Shell Powder & Egg shell powder Replacement of cement in Strength at 7day's concrete

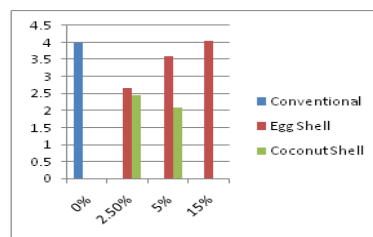


Fig:8 Strength at 7day's concrete

Figure 9 - Comparison of Conventional concrete, Coconut Shell Powder & Egg shell powder Replacement of cement in Strength at 28day's concrete

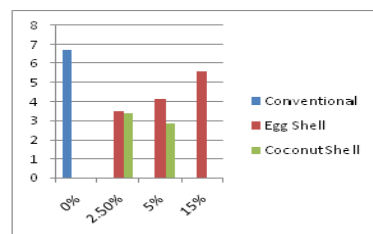


Fig:9 Strength at 28day's concrete

V. CONCLUSION

Concrete is used for many structures basically for its compressive strength to support any type of load. This work has shown that partial replacement of cement with 2.5% ,5%,15% of Coconut Shell Powder (CSP) and Egg Shell Powder (ESP) in concrete gives an average optimum compressive strength in concrete. The use of Coconut Shell Powder (CSP) and Egg Shell Powder (ESP) as a partial replacement of cement produced a cheaper structural light weight concrete using the optimum compressive strength value and lower volume of replacement, will enhance the reduction of cement usage in concretes, thereby reducing the production cost and the environmental pollution caused

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by the dumping of the agricultural waste. The flexural strength of the egg shell concrete increases with the addition of egg shell powder upto 15 percent.

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