

Mechanical Properties of concrete by using Egg shells with Partial Replacement of Fine Aggregate

M.Bhuvaneshwari

Department of Civil Engineering
Roever College of Engineering and Technology
Perambalur.Pune,India
Email ID:rmba88@gmail.com

Abstract – The present research design to check the workability and strength of egg shells by using with partial replacement of egg shells fine aggregate. This work has investigated the potential use of used egg shells as a concrete material. The egg shells mixed with 0%,5%,10%,15%,20%,25% replacement level. It is addition of egg shells in mix design to find the workability like slump cone and hardened concrete to like Compressive Strength ,Split Tensile Strength and Flexural Strength of the concrete .To compare the strength between the partial replacement of egg shells aggregate concrete and conventional concrete. The results shows that 20% of egg shells aggregate add gives efficient results when compared to other percentage and conventional concrete .

Keywords: Compressive Strength, Egg Shells Aggregate, , Flexural Strength, Split Tensile Strength.

I. INTRODUCTION

One common material that can be recycled and have the possibility of use in concrete applications is used egg shell. Egg shell waste falls within the category of food waste. As a part of this technique the usage of Egg shells aggregate as the replacement material of fine aggregate along with the in order to show considerable increase in strength has been developed.

The Egg shells primarily contains calcium, magnesium carbonate (lime) and protein.To find the physical properties like Specific Gravity, Water Absorption , Grain size of Distribution. The size of aggregate in approximately pass in 4.75mm and retain in 2.36 mm sieve.

To investigate the performance of Egg shells aggregate at different percentage 5%, 10%, 15%, 20%, 25%, by weight of cement. To find the mechanical properties of Compressive ,Spilt Tensile, Flexural strength to be find out in various percentage. To prepare the concrete for M_{25} grade mix design by using IS10262:2009.

II. LITERATURE REVIEW

Egg shells aggregate concrete shows increased strength when compared to conventional concrete literature that details with various replacement of aggregate are given below.

Praveen Kumar, 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.

Olanitori LMet.al., (2015) Shows 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. The Compressive strength of the concrete is to meet required strength with 20% of the egg shell at the same time weight of the cubes are reduced upto 2kg to 2.8kg.

Jayasankar et al (2010)Has investigated theexperiment by partially replacing cement with flash and egg shell powder. They had conducted experiment byvarying percentage of RHA, ESP, Fly ash in M20, M25 and M30 concrete. Egg shell up to 10%, 20%, 30%, 40% & 50%.

Arash Barazesh et al., (2012) carried out the experiment Eggshell powder of various amounts,

namely 5%, 10%, 15% and 20% by volume, was added as a replacement for ordinary Portland cement.

III. METHODOLOGY AND MIX DESIGN

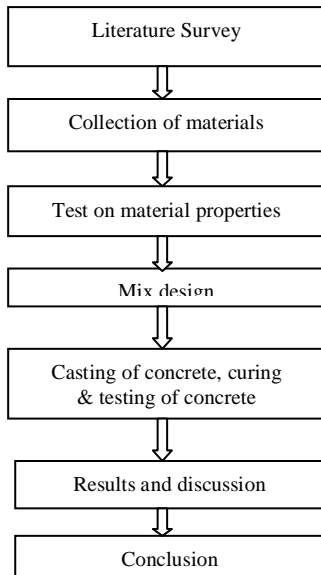


Fig.1 Block diagram of Methodology

1. Constituent Materials

Table 1 Material Test Results

Properties	Results
Fineness Test on Cement	4%
Specific Gravity of Cement	3.11
Specific Gravity of Coarse Aggregate	2.857
Specific Gravity of Fine Aggregate	2.52
Zone	II
Water Absorption test on coarse aggregate	0.399%
Standard Consistency test	32%
Initial Setting time	40minutes
Final Setting Time	10 hours
Compaction Factor Test	0.94

2. Mix design

Water cement ratio 0.45, weight of cement is 425.77kg/m³, weight of Fine aggregate is 525.40 kg/m³ and weight of coarse aggregate is 1265.042kg/m³. A mix ratio is 1:1.23:2.97:0.45

IV. RESULT AND DISCUSSION

1. Fresh Concrete Test (Workability Test)

Table 2 slump value.

percentage	slump value
0%	25mm
5%	25mm
10%	24mm
15%	21mm
20%	19mm
25%	18mm

2. Hardened Concrete Test

4.2.1. Compressive strength in 7, 14 & 28 days

The cube compressive strength of concrete is determined by conducting tests on 150mm x 150mm x 150mm cube in specimen at 7, 14 and 28 days test shown in figure 2. The cubes are placed in the Universal Testing Machine.

The specimen will be cylindrical in shape in 150mm diameter and 300mm long. The prism size is 100mmx100mmx500mm.

The Compressive Strength of Concrete in 7, 14 and 28 days for with 0%, 5%, 10%, 15%, 20%, 25% egg shells with partial replacement of fine aggregate.

Table 3 Compression test in 7, 14 & 28 days

percentage of egg shell aggregate	7 days n/mm ²	14 days n/mm ²	28 days n/mm ²
0%	8.81	12.76	26.74
5%	8.92	13.01	28.14
10%	8.83	12.78	27.01
15%	9.06	13.93	27.96
20%	9.14	15.72	29.71
25%	8.83	14.43	26.92

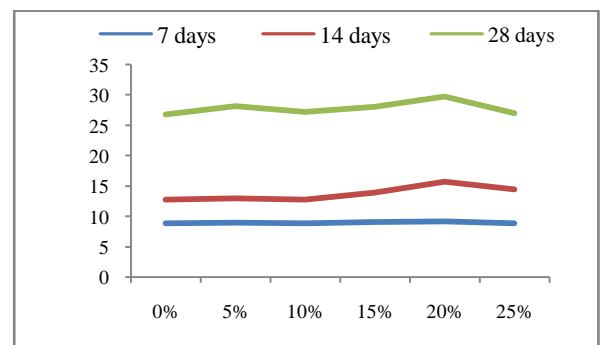
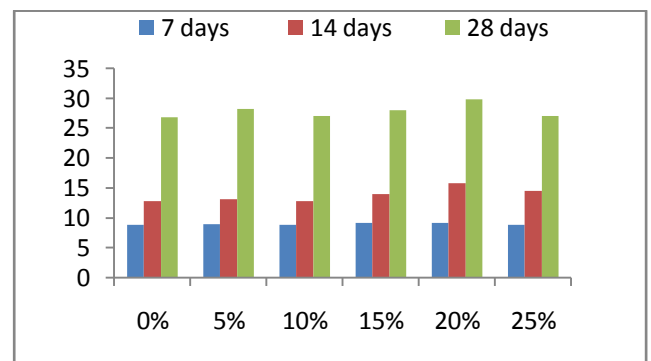


Fig.2. Compressive Strength in 7, 14 & 28 days

The Compressive Strength of Concrete by using partial replacement of 5% shows 7.32% increase when compared to Conventional Concrete. The Compressive Strength of Concrete by using partial replacement of 10% shows 1% increase when compared to Conventional Concrete .

The Compressive Strength of Concrete by using partial replacement of 15% shows 4.33% increase when compared to Conventional Concrete. The Compressive Strength of Concrete by using partial replacement of 20% shows 11.10% increase when compared to Conventional Concrete The Compressive Strength of Concrete by using partial replacement of 25% shows 0.67% increase when compared to Conventional Concrete

4.2.2. Split Tensile Strength

The split tensile strength of concrete in 28 days for 0%, 5%, 10%, 15%, 20%, 25% of partial replacement of egg shell aggregate.

Table 4 Split Tensile strength in 28 days.

Percentage of egg shells aggregate	Flexural Strength in 28Days N/mm ²
0%	13.01
5%	12.47
10%	13.31
15%	13.96
20%	14.48
25%	13.71

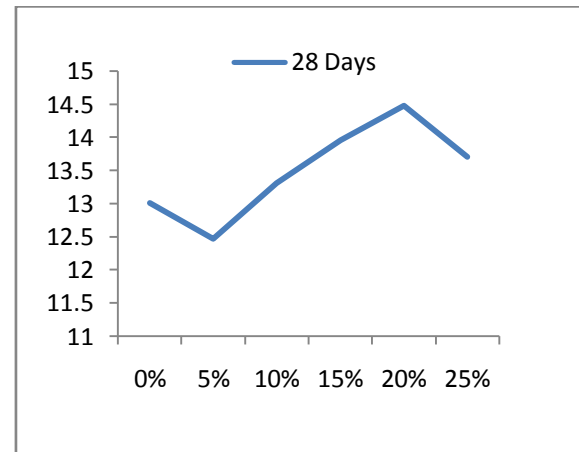
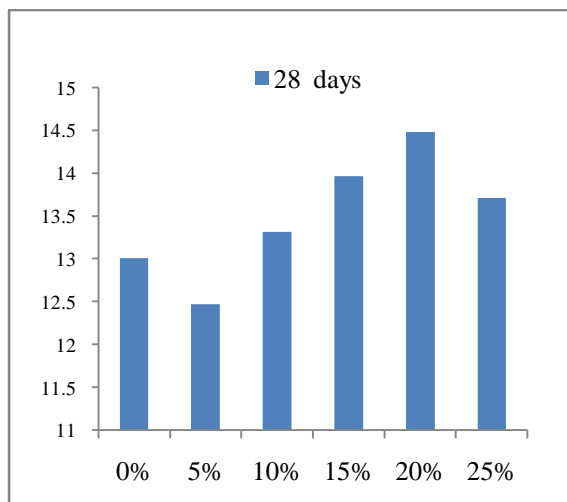


Fig. 3. Split Tensile Strength in 28 days.

The Split Tensile Strength of Concrete by using partial replacement of 5% shows 4.33% decrease when compared to Conventional Concrete. The Split Tensile Strength of Concrete by using partial replacement of 10% shows 2.31% increase when compared to Conventional Concrete.

The Split Tensile Strength of Concrete by using partial replacement of 15% shows 7.30% increase when compared to Conventional Concrete. The Split Tensile Strength of Concrete by using partial replacement of 20% shows 11.30% increase when compared to Conventional Concrete.

The Split Tensile Strength of Concrete by using particle replacement of 25% shows 5.38% increase when compared to Conventional Concrete.

4.2.3. Flexural Strength

The Flexural strength of concrete in 28 days for 0%, 5%, 10%, 15%, 20%, 25% of partial replacement of egg shell aggregate.

Table 5 Flexural strength in 28 days.

Percentage of egg shells aggregate	Flexural Strength in 28Days N/mm ²
0%	3.12
5%	3.45
10%	3.62
15%	3.47
20%	3.89
25%	3.11

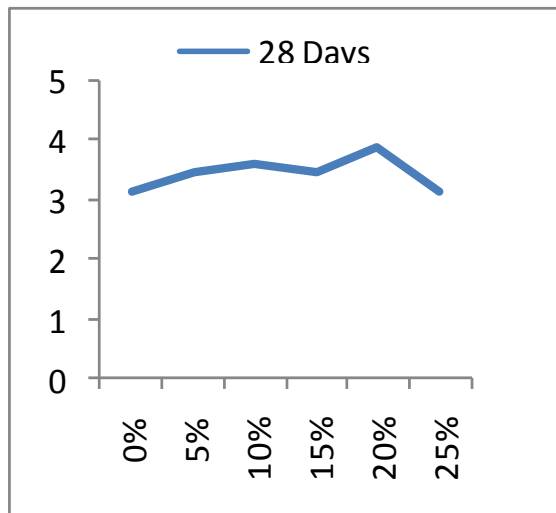


Fig. 4. Flexural Strength in 28 days.

V. CONCLUSION

An experimental study was conducted for egg shell aggregates in various weight of cement in the percentage of the concrete. We had used the egg shell aggregate in different percentages 0%, 5%, 10%, 15%, 20%, 25%. To find out workability test like Slump cone and compaction factor test carried out. Mechanical properties of Conventional concrete in compressive Strength, Split Tensile Strength and flexural Strength Carried out. We confirm, the Strength was increasing 20% of egg shell aggregate add in conventional concrete and other percentage of egg shell added. To reduce Environment effect from wastes and maximum amount of hazardous waste in egg shell aggregate is reduced throughout this project.

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