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Examining the Potential of Egg Shell Powder as a Cement Replacement in Concrete Experiments

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ABSTRACT: This study reports the results of experiments evaluating the use of egg shell powder from egg production industry as partial replacement for ordinary Portland cement in cement mortar. The chemical composition of the egg shell powder and compressive strength of the cement mortar was determined. The cement mortar of mix proportion 1:3 in which cement is partially replaced with egg shell powder as 5%, 10%, 15%, 20%, by weight of cement. The compressive strength was determined at curing ages 28 days. There was a sharp decrease in compressive strength beyond 5% egg shell powder substitution. The admixtures used are Saw Dust ash, Fly Ash and Micro silica to enhance the strength of the concrete mix with 5% egg shell powder as partial replacement for cement. In this direction, an experimental investigation of compressive strength, split tensile strength, and Flexural strength was undertaken to use egg shell powder and admixtures as partial replacement for cement in concrete.

KEYWORDS: Egg shell powder, cement mortar, compressive strength, split tensile strength,

I.INTRODUCTION

During the world, concrete is presence broadly used for the structure of greatest of the buildings, bridges etc. Presently, the complete construction industry is in exploration of an appropriate and operative the unused product that would greatly minimize the use of cement and eventually decrease the creation cost. Such a substitute material are egg shell powder and silica fume. Greatest of egg shell waste is willing in landfills short of any pre-treatment since it is conventionally unusable and eventually makes thoughtful eco glitches. Therefore, proper alternate is required to manage the wastes in eco-friendly way. The goal of this investigation work is to use the egg shell powder, as a limited additional of cement. Egg shell powder is replaced by 5%, 10%, 15% and 20% in addition with cement. An experimental research demonstrates the strength features such as split tensile strength, compressive strength, and flexural strength test of egg shell based concrete were investigated. It is found the strength of the concrete rises with the adding of egg shell powder and finally the comparison is made for the egg shell and added strength of concrete. Energy plays a crucial role in growth of developing countries like India. In the context of low availability of non-renewable energy resources coupled with the requirements of large quantities of energy for Building materials like cement, the importance of using industrial waste cannot be under estimated. During manufacturing of one tonnes of Ordinary Portland Cement we need about 1.1 tonnes of earth resources like limestone, etc. Further during manufacturing of 1 tonnes of Ordinary Portland Cement an equal amount of carbon-di-oxide are released into the atmosphere. The carbon-di-oxide emissions act as a silent killer in the environment as various forms. In this Backdrop, the search for cheaper substitute to OPC is a needful one.

1.1. Materials used

1.2. Cement Cement is the important required material for the construction of concrete. Cement is a well-known construction material and has engaged a vital place in construction work. There is a change of cement obtainable in market and each type is used under convinced illness due to its singular properties such as Color and arrangement of cement. Although cement creates only about ten percentage of the volume of the various concrete mix, it is the active portion of the compulsory medium and the only systematically controlled component of concrete. The physical properties of cement, chemical composition of cement are Course Aggregate Without aggregate, large castings of neat cement paste would essentially self-destruct upon drying. Coarse aggregates are particles greater than 4.75 mm, but generally range between 9.5 mm to 37.5 mm in diameter. They can either be from primary, secondary or recycled.

II. LITERATURE SURVEY

Manzoor Ahmad Allie' A Review Study of Egg Shell Powder as A Cement Replacing Material in Concrete 'May 2018 Ijsdr | Volume 3, Issue 5

As the quality of construction material is an important factor which enhances the stability of the structure, an attempt has been made to study the possibilities of using Eggshell powder in paver block. Cement was partially replaced by Eggshell Powder at 5% intervals from 0% to 25% by the method of replacement by weight. The function of this admixture is to reduce the water cement ratio and enhance workability. The paver block Curing process is done for 7 days and 28 days, after curing it is checked for its Compressive Strength and flexural strength. It was noted that 13.4% increase of compressive strength at 10% replacement of Eggshell Powder. Flexural strength was also 19.5% increased at the same 10% replacement of Eggshell Powder. The result showed the Eggshell Powder can be advantageous if it was replaced as 10% of cement

Pradeep Sharma an experimental investigation on partial replacement of cement with egg shell powder in concrete 'Volume 5, Issue 10, June-2018

This research was carried out to determine the optimum percentage of eggshell powder as partial cement Replacement. The construction industries are searching for 'alternative products that can reduce the Construction cost. Over 5% of global CO₂ emissions can be attributed to Portland cement production. Demand for cement continues to grow. Different ESP concretes were developed by replacing 4-16% of ESP for cement. Concrete plays the key role and a large quantity of concrete is being utilized in every construction practices. The egg shell usually which are disposed, is used as an alternate for the cement since the shell is made up of calcium. An egg shell is used in different combinations to find the feasibility of using the egg shells as an alternate to cement. aim of this project is to prevent the pollution of environment by the improper disposal of the Egg shell waste, a remain from eggshells domestic waste such as schools, restaurant, bakeries, homes and fastfood hotels, by using it as an additive material in form of ash & powder in conventional concrete with grade M35 since it is normally used in construction sites.

N. Parthasarathi Experimental Study on Partial Replacement of Cement with Egg Shell Powder and Silica Fume Vol. 10 | No. 2 | 442 - 449 | April - June | 2017

In the world, concrete is presence broadly used for the structure of greatest of the buildings, bridges etc. Presently, the complete construction industry is in exploration of an appropriate and operative the unused product that would greatly minimize the use of cement and eventually decrease the creation cost. Such a substitute material is eggshell powder and silica fume. Greatest of egg shell waste is willing in landfills short of any pre-treatment since it is conventionally unusable and eventually makes thoughtful eco glitches. Therefore, proper alternate is required to manage the wastes in eco-friendly way. The goal of this investigation work is to use the egg shell powder, silica fume as a limited additional of cement. Egg shell powder is replaced by 5%, 10% and 15% in addition with the silica fume by 2.5%, 5%, and 7.5% of weight of cement. An experimental research demonstrates the strength features such as split tensile strength, compressive strength, and flexural strength test of egg shell based concrete were investigated. It is found the strength of the concrete rises with the adding of egg shell powder and silica fume and finally the comparison is made for the egg shell and silica fume added strength of concrete.

III. ACTUAL METHODOLOGY

To explore the use of business squanders as a swap for bond in cement and impact of this on the Strength of cements made with completely totally unique concrete supplanting levels with admixtures. Common concrete of 53 grade affirming to IS 12269- 1987 was utilized amid this investigation. Stream sand affirming to reviewing zone III of Is 383-1970 was utilized as a fine blend. Well hierarchic coarse blend going through 20mm sifter for every IS 383-1970 was utilized. Well hierarchic coarse blend going through 20mm strainer for each IS 383-1970 was utilized. Eggshell acquired from local exchange. It grained and sieved to the required size before utilized as a part of solid blend. Saw earth was acquired from sawmill and saw soil slag was gotten by burning strategy and sieved before utilized. Fiery debris was gathered from Salem process, Salem, Tamilnadu and sieved before utilized affirming to IS 3812 (section I). Little oxide was a side- effect of the part and Ferro-silicon creation. Transferrable water was utilized inside the examinations for each blend and cementing capacities. Potential use of waste eggshells in cement-based materials.

Water cement ratio:

The water content of concrete is influenced by a number of factors such as aggregate size, shape, texture, workability,

cement and other supplementary cementations material type and content and chemical admixture. The quantity of maximum mixing water per unit volume of concrete is given in table 11.23 in IS 10262 -1982[21]. The quantity of water given in table is for angular coarse aggregate and for 25 to 50 mm slump range.

Course aggregate proportions

Aggregates of the same nominal maximum, size type and grading will produce concrete of satisfactory workability, when a given volume of coarse aggregate is used. Approximate aggregate volume in given table 11.24 (IS 456:2000) for a w/c ratio of 0.5. This aggregate volume may be adjusted for other w/c ratio in the following way. For every decrease of w/c ratio by 0.05, the coarse aggregate volume may be increased by 1.0 per cent to reduce the sand content for every increase of w/c ratio by 0.05 the coarse aggregate volume may be decreased by 1.0 per cent to increase the sand content.

Fine aggregate proportion:

From all the above steps, we have estimated the proportions of all the ingredients except coarse and fine aggregates. As a next step, find out the absolute volume of all the so far known ingredients. Deduct the sum of all the known absolute volume from unit volume (1 m³), the result will be the absolute volume of coarse and fine aggregates put together. We know the volume of coarse aggregate and hence volume of fine aggregate can be calculated.

Concrete Mixer

A concrete mixer is a device that homogeneously combines cement, aggregates, such as a sand or gravel and water to form concrete. Characteristic concrete mixer uses are developing drum.



Casting Moulds

Cubic size: 15*15*15cm. (Fig). Cube specimens are crushed after rotating those 90. To decrease the amount of friction caused by the rough finishing.



Damping Rod

As per IS: 10086 -1982 the damping rod shall be 16±0.5mm dia and 600±2mm long with a rounded working end and shall be made of HYSD.

Grade Designation: M30

Characteristic Comp. Strength required in the field at 28 days = 30 Mpa

Max. Size of aggregate = 20 mm

Type of exposure = Severe

Degree of quality of control = Good Test data for materials

Cement Used = OPC 53Grade

Specific Gravity of

Fine Aggregate = 2.696

Coarse Aggregate – 20mm = 2.63

Specific Gravity of Cement = 3.15

Sand corresponds of Zone = Zone III

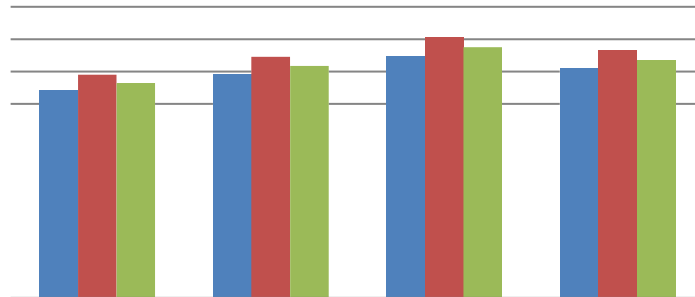


IV. DISCUSSION AND RESULT

COMPRESSIVE STRENGTH OF SAMPLE 28 DAYS FOR M30			
% REPLACEMENT OF CEMENT	I	II	III
5A	32	34.5	33.2
10A	34.56	37.26	35.85
15A	37.32	40.24	38.72
20A	35.45	38.2	36.78



COMPRESSIVE STRENGTH OF SAMPLE 28 DAYS FOR M20



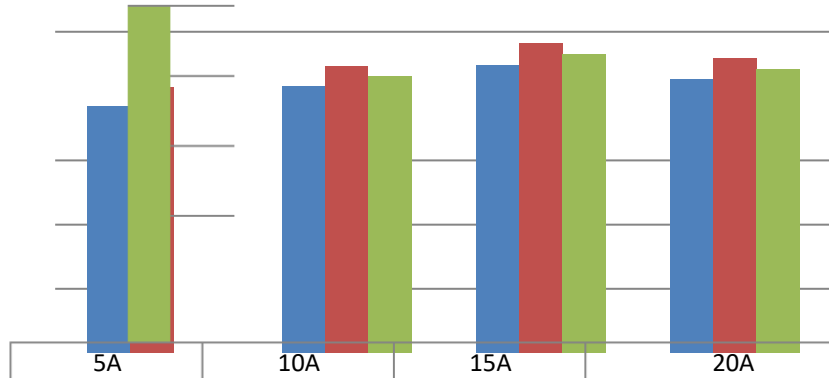
COMPRESSIVE STRENGTH OF SAMPLE 28 DAYS FOR M30 I	32	34.56	37.3248	35.45856
COMPRESSIVE STRENGTH OF SAMPLE 28 DAYS FOR M30 II	34.5	37.26	40.2408	38.22876
COMPRESSIVE STRENGTH OF	33.2	35.856	38.72448	36.788256

COMPRESSIVE STRENGTH OF SAMPLE 14 DAYS FOR M30

% REPLACEMENT OF CEMENT	I	II	III
5A	19.2	20.7	19.92
10A	20.73	22.35	21.51
15A	22.39	24.14	23.23
20A	21.27	22.93	22.07



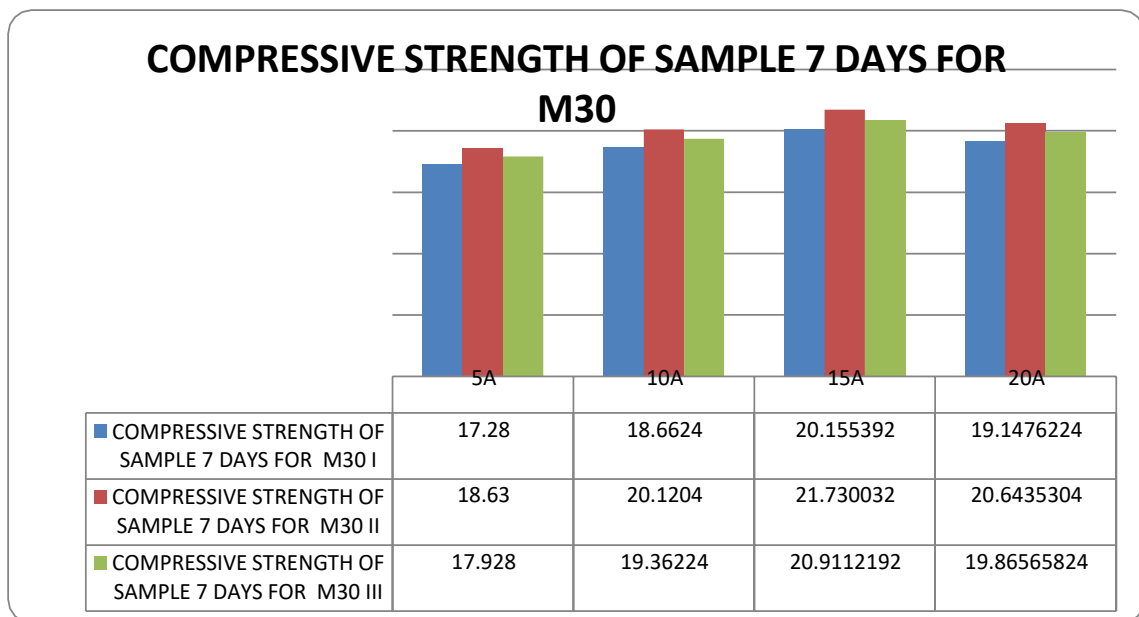
COMPRESSIVE STRENGTH OF SAMPLE 14 DAYS



	5A	10A	15A	20A
COMPRESSIVE STRENGTH OF SAMPLE 14 DAYS FOR M30 I	19.2	20.736	22.39488	21.275136
COMPRESSIVE STRENGTH OF SAMPLE 14 DAYS FOR M30 II	20.7	22.356	24.14448	22.937256
COMPRESSIVE STRENGTH OF SAMPLE 14 DAYS FOR M30 III	19.92	21.5136	23.234688	22.0729536

COMPRESSIVE STRENGTH OF SAMPLE 7 DAYS FOR M30

% REPLACEMENT OF CEMENT	I	II	III
5A	17.28	18.63	17.928
10A	18.66	20.12	19.36
15A	20.155	21.73	20.91
20A	19.147	20.64	19.81



VI.CONCLUSION

We conclude that with this experiment the 5% and 15% of egg shell powder with cement is attained Max., compressive strength. So, the egg shell powder is used as a partial replacement with cement in concrete. Replacement of Egg shell powder and small silicon dioxide as an admixture replacement in cement yields similar flexural strength as in common place concrete. Replacement of Egg shell powder and small silicon dioxide as an admixture replacement in cement yields higher Split enduringness as compared to completely different compositions. The initial and final setting time of cement is 93 and 210 minutes. The egg shells as a useful material instead of a waste material (harm to the environment) that they were hurled in many hundred tons annually had been use in an engineering applications. The hardness and specific gravity were increased with increasing ESP. Compressive strength increases with increase of percentage of Egg shell powder up to certain limit. Better mechanical and physical properties of concrete can be obtained with the replacement of cement with Egg shell powder in mix. The workability of concrete is decreased by increasing the amount of Egg shell powder The results demonstrated that, irrespective of ESP percentage replacement there was good relationship Between compressive strength and split tensile strength.

REFERENCES

1. Manzoor Ahmad Allie' A Review Study of Egg Shell Powder as A Cement Replacing Material in Concrete 'May 2018 Ijsdr | Volume 3, Issue 5
2. Pradeep Sharma' an experimental investigation on partial replacement of cement with eggshell powder and fine aggregate with copper slag in concrete 'Volume 5, Issue 10, June-2018
3. N. Parthasarathi' Experimental Study on Partial Replacement of Cement with Egg Shell Powder and Silica Fume Vol. 10 | No. 2 | 442 - 449 | April - June | 2017
4. Amarnath Yerramala,, Properties of concrete with eggshell powder as cement replacement. The Indian Concrete

Journal October 2014.

5. D.Gowsika,. Experimental Investigation of Egg Shell Powder as Partial Replacement with Cement in Concrete, International Journal of Engineering Trends and Technology (IJETT). Volume 14 Number 2. Aug 2014.
6. J. Karthick, R.Jeyanthi, M.Petchiyammal (2012), Experimental Study on Usage of Egg Shellas Partial Replacement for Sand in Concrete. International Journal of Advanced Research inEducation Technology, Vol.1, Issue 1, pp. 7-11.
7. Isaac O. Igwe, Genevive C. Onuegbu, Studies on Properties of Egg Shell and Fish Bone Powder Filled Polypropylene. American Journal of Polymer Science 2012, 2(4): 56-61.
8. M.O.A. Mtallib and A. Rabiou, Effects Of Eggshells Ash on the Setting Time of Cement. Vol3, 12 January 2011.
9. Jayasankar.R, Mahindran.N, Ilangovan.R (2010), .Studies on Concrete Using Fly Ash, Rice Husk Ash and Egg Shell Powder.,International Journal of Civil and Structural Engineering,Vol. 1, Issue No 3, pp. 362-373.
10. L.Sathish' Experimental Investigation Of Eco-Friendly Concrete Using Rice Husk Ash & Egg Shell Partially Replacement With Cement & Fine Aggregate'2008.
11. Praveen Kumar R,(2006) .Experimental Study on Partial Replacement of Cement with Egg Shell Powder., International journal of innovations in engineering and technology, Volume 5, ISSN: 2319-1058.
12. Dinesh.N, Ramesh Kumar.R, Arunachalam, Chandrasekhar, Gautam.P (2001), .Partial Replacement of Fine Aggregate by Rice husk as hand Eggshell Powder., International Journal of Innovative Science and research, Vol.3, Issue 1, pp.1-17.



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