Experimental Investigation On Concrete With Partial Replacement Of Cement By Egg Shell Powder

N.Manodeepan[1], T.Dinesh[2], K.Mahenthiran[3], M.N.Mohamad Nazim Fazil[4], T.Vijayaraja[5]
[1]Assistant Professor Dept of Civil Engineering
[2, 3, 4, 5]Dept of Civil Engineering
[1, 2, 3, 4, 5] The Kavery Engineering College

Abstract- *Currently India has taken a major initiative on developing the infrastructure such as express highway, power project and industrial structure etc., to meet the requirement of globalization, in the construction of building and other structure. Concrete is being utilized in every construction practices. India ranks second in the world with annual egg production. The egg shall usually which are disposed, is used as an alternate for the cement since the shell is made up of calcium. An egg shall are used in different combination to find the feasibility of using the egg shall as an alternate to cement. Egg shell powder replaces 0%,10%and 20%weight of cement. Concrete is cast and compressive test and tensile tests were carried out to find the best combination which results in optimum percentage of strength.*

Keywords- Egg shell, Compressive Strength, Tensile Strength, Egg Shell Powder.

I. INTRODUCTION

Concrete is being widely used for the construction of most of the buildings, bridges and it is also known as backbone to the infrastructure development of a nation. At present, for a variety of reasons, the concrete industry is not sustainable. Firstly, it consumes huge amount of natural resource due to which no virgin material will be left for future generation. Secondly, the major component of concrete is cement. Lot amount of green house gas will be emitted in the manufacturing processes of cement. Thirdly, concrete structure suffers from durability problem due to which natural resources are wasted. Therefore, there is a need to find an alternative method so that concrete industry becomes sustainable. The cement produces about 5% of CO2 emissions of the world. 900kg of CO2 for every 1000kg of cement produced. Hence, currently, the entire construction industry is in search of a suitable and effective the waste product that would considerably minimize the use of cements and ultimately reduces the construction cost. And also waste by products from agriculture and industry like fly ash, rice husk ash, egg shells, copper slag, quarry dusts. The materials are proportioned by their weights.

II. METHODOLOGY

This project follows the steps given below:

- Collection and study the material properties required for making a concrete.
- Mix proportioning of concrete (M30). Investigation of strength parameter like Compressive, Tensile, and Flexural strength of conventional concrete Vs egg shell powder.

III. MATERIAL PROPERTIES

A. Cement Tests

Cement is binder, that can sets and hardens independently and is used to bind some other materials together. the volcanic ash and crushed pulverized brick additives are altogether added to burn lime to obtain a hydraulic binder were later called as, and cement. cement which is used in construction is characterized as hydraulic. Cement is obtained by pulversing clinker formed by calcining raw materials primarily comprising of lime (CaO), silica (SiO2), Alumina (Al2O3), and ferric Oxide (Fe2O3) along with some minor oxides the aggregate together to produce a continuous compact mass. concrete mass in a given condition depends on the type, quality, and quantity of cement.

Table 1

S No	Description	Value
1	Fineness of cement	5%
2	Standard consistency	4%
3	Soundness of cement	7mm
4	Initial setting time	27 min
5	Final setting time	6hours 20 min
6	Specific gravity	3.14

B. Fine Aggregate Tests

The fine aggregate confirms to Zone II and is designated as fine sand. All tests are carried out as per IS: 383-2000.

Table 2

S.No	Name of the Test	Test Value
1	Specific gravity of fine aggregate	2.74
2	Sieve Analysis	3.11

C. Coarse Aggregate Tests

Aggregate are obtained by crushing various types of granites, schist, crystalline and lime stone and good quality sand stones.

Table 3

S. No	Description	Value
1	Crushing value	22.65%
2	Flakiness Index	27.53%
3	Elongation Index	43.86%
4	Impact value	24.52%
5	Sieve Analysis of coarse aggregate	3.8

D. Fresh Concrete Tests

S. No	Title	Result
1	Slump cone test	130mm
2	Compaction factor	0.94

E. Mix Proportions

Table 5

Grade of Concrete	Cement (Kg/m^3)	Fine aggregate(Kg/m^3)	Coarse aggregate (Kg/m^3)	Water (liter)
M_{30}	492.9	447.9	887.22	0.45
	1	0.91	1.8	185

IV. EXPERIMENTAL INVESTIGATIONS

A. Compressive strength

The compressive strength of concrete is one of the most important properties of concrete. Comparative strength if M30 grade of concrete for the fully replacement of sand by crushed was found. In this test 150x150x150mm concrete cubes were cast, by using 30 Mpa concrete. The mixing was done by cubes were remolded and placed under water and cured for 28 days. Then the cubes were tested for their crushing strength at 7, 14 and 28 days.

Compressive strength (Mpa)= ____

B. Split tensile strength

The test is carried out in a cylindrical specimen of 150mm diameter and 300mm height. The cylindrical specimen is placed horizontally between the loading surface of a compression testing machine and the load is applied until failure of cylinder, along the vertical diameter. The split tensile strength is given by the formula,

Split tensile strength (Mpa) = $\frac{\square\square}{\square\square\square}$

Where,

D= diameter of the cylinder = 150mm
L= length of the cylinder = 300mm
P = Compressive load on cylinder

C. Flexural Strength

To determine the flexural strength of concrete of beam of size 500 x 100 x 100mm were cast with steel reinforcement concrete. After 24hours the specimen were remoulded and subjected to water curing. After 7, 14 and 28days of curing, the curing three beams were taken and allowed to dry and tested in UTM.

Flexural strength(Fct)= $\frac{\square\square\square}{\square\square\square}2$ (N/mm^2)

Where,

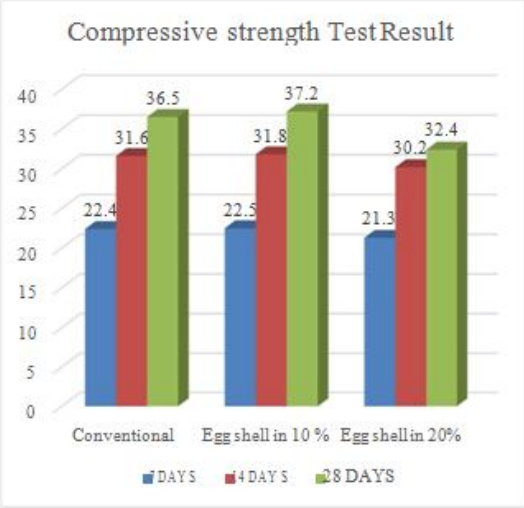
P – Ultimate load (N)
l - Length of specimen (mm) b – Width of specimen (mm) d – Depth of specimen (mm)

V. RESULTS AND DISCUSSIONS

A. Compressive strength

Table 6

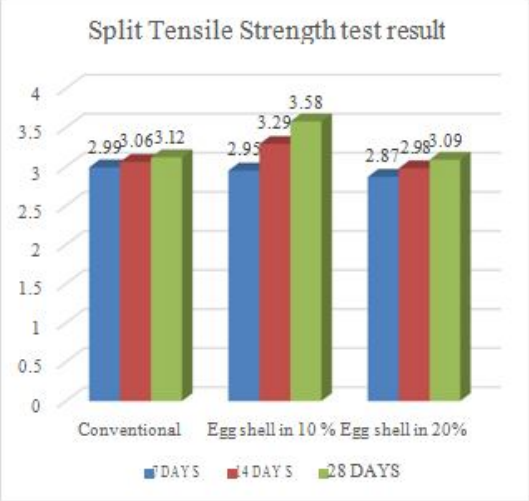
S no	Mix (%)	Average Compressive strength (N/mm^2)		
		7days	14days	28days
1	Conventional	22.4	31.6	36.5
2	Egg Shell in 10%	22.5	31.8	37.2
3	Egg Shell in 20%	21.3	30.2	32.4



B. Split tensile strength

Table 7

S no	Mix (%)	Average Tensile strength (N/mm^2)		
		7days	14days	28days
1	Conventional	2.99	3.06	3.12
2	Egg Shell in 10%	2.95	3.29	3.58
3	Egg Shell in 20%	2.87	2.98	3.09



V. CONCLUSION

- Compressive strength was higher than conventional concrete for 10% ESP replacement at 7, 14 and 28 days of curing ages. ESP replacements greater than 20 %had lower strength than conventional concrete.
- The strength results are compared at an age of 7, 14 and 28 days.
- Split tensile strengths of ESP concretes were comparable with conventional concrete up to 10 % ESP replacement. However, concrete with 20% ESP had lower split tensile strength than conventional concrete.
- The results demonstrated that, irrespective of ESP percentage replacement there was good relationship between compressive strength and split tensile strength.
- Hence, the Overall Strength Results of Egg Shell powder Concrete is more than the Concrete.
- On the Side of Cost; the egg shell powder is waste material.So, less than the cement.

REFERENCES

[1] Bandhavya G.B,Sandeep K,Bindhushree G.B " An Experimental Study on Partial Replacement of Cement with Egg Shall Powder in Concrete"IRJET e-ISSN:2395-0056 Volume:04 Issue:06 June-2017.

[2] Mohamed Ansari M, Dinesh Kumar M,Milan Charles J,Dr.Vani G "Replacement of Cement using Eggshell Powder " SSRG-IJCE ISSN:2348-8352 Volume-3,Issue 3-March 2016.

[3] Raji S.A,Samuel A.T " Egg shell as a fine Aggregate In Concrete For Sustainable Construction" IJSTR ISSN:2277- 8616,Volume:4,Issu:09,September 2015.

[4] Gowsika D,Sarankokila S,Sargunan K "Experimental Investigation of Egg Shell Powder as Partial Replacement with Cement in Concrete"IJETT,ISSN:2231-5381,Volume:14,Number:2-Aug 2014.

[5] Nivedhitha M,Dr.Sivaraja M, "Experimental Study on Partial Replacement of Cement with Coconut shell Powder and Egg Shall Powder" IJRSET, ISSN(Online):2319- 8753,Volume:6,Issue:5,May 2017.

[6] Amarnath Yerrmalla andRamachandrudu. (2014), Properties of Concrete with eggshell powder as cement Replacement, International Journal of Engineering Investigation Volume 1.

[7] Praveen Kumar R, Vijaya Sarathy.R and Jose Ravindraraj.B (2015), Experimental Study on Partial Replacement of Cement with Egg Shell Powder, International Journal on Innovations in Engineering and technology (IJIET)Volume 5.

[8] M.S. Shetty, Concrete Technology and Practice, 7th edition, S.Chand and company limited.IS: 10262-2009 --- Recommended guide lines for concrete mix design.
[9] Karthick J, Jeyanthi R, and Petchiyammal M. (2014).Experimental Study On Usage Of Egg Shell As Partial Replacement For Sand In Concrete International Journal Of Advanced Research In Education Technology (IJARET) Vol. 1, Issue 1 (July - Sept. 2014). PP 7-10.