Effect of Egg Shell Powder on Strength Behaviour of Concrete

R.Venkata Krishnaiah, P. Dayakar, S.J. Mohan

***Abstract*: The study of strength behaviour of M20 grade concrete, by exchanging the cement partly by powder of egg shell, for which an experimental tests were carried out and the effect of egg shell powder (0%,5%.10%,15%) on compressive strength characteristics were studied. The result of this present investigation shows that the replacement of 5% of cement with egg shell powder attains the maximum compressive strength. The best and economical percentage exchange of replacement of powder of egg shell (ESP) with cement is about 5% and also reduces the cost of concrete with the use of powder of egg shell, which is available freely as raw material and then it is grinded well to make powder.**

The egg shell is available from municipal solid waste and is mixed in powder form in concrete by exchanging the cement and is found that 5% replacement is very effective in the improvement of strength properties when compared to the conventional concrete. Also the exchangement of 5% ESP in cement gives higher split tensile strength as compared to other cement ingredient mixtures.

In this study, it is fixed that 0.45 is the w/c ratio and it produces medium degree of workability which is suitable for most of the concrete mixtures on site. The addition of eggshell powder as filler in concrete has improved the strength of concrete and also improved and better split tensile strength.

***Key words*: Egg Shell Powder, Comprssive Strength, Split Tensile Strength**

I. INTRODUCTION

To meet the fast growing industrial and construction development in the country, there is a huge consumption of cement and its various ingredients of mixtures[1],[3],[5]. Concrete is a construction material which has relatively high strength in compression, but lower strength in tension.

For more varieties of reasons, there is no stability in infrastructural construction industry. Firstly, because of utilization of very high volumes of natural resources which are sustaining for next generations. Secondly, the binder material called cement in concrete, the production of which leads to greenhouse gas emissions and that are causing global warming and climate change[2],[4],[6]. Thirdly, there is a lack of durability in many concrete structures, which are wasting the natural resources and the major component of concrete is cement and it produces carbon dioxide about 1000kg of CO_2 emitted for every 1000kg production cement. As of 2001, the world wise cement production is contributed about 7.5% CO_2 emission[7],[9] ,[11] , it is mainly due to the burning of limestone and clay at 1600°C. There fore the production of cement is directly related to CO_2 emission.

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II. EXPERIMENTAL STUDY

Fundamental tests are done according to IS Standard to decide the physical properties of fine and coarse totals. For fine total, trial of explicit gravity and fineness modulus are discovered and for coarse total, trial of explicit gravity, sway esteem, squashing worth and Los Angeles are led. Testing of hardned cement is done according to IS benchmarks to decide the compressive quality of cement at 7 days and 28 days directed.

Table 1.Physical properties of cement

Sl.no	Properties	Test results
1.	Specific gravity	3.15
2.	Fineness	7.33%
3.	Normal consistency	37%
4.	Initial setting time	48min

Table 2. Tests of fine aggregate

Sl.no	Test	Result
1.	Specific gravity	2.55
2.	Fineness Modulus	3.25

III. RESULTS

A. Compression test for cubes

The concrete is filled in the mould and compacted properly to remove the voids. After 24 hours, specimens are removed from the moulds and the specimens are immersed in water for curing. Then, after 7 days curing, the specimens are tested by compression testing machine. [19],[21],[23]

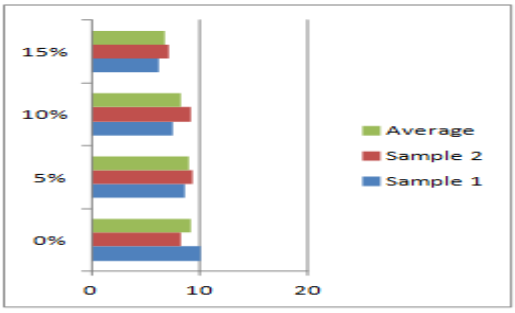
Compressive strength of concrete cube is the maximum

Compressive strength= Maximum load/area

Table – 3 Compressive strength of cubes for 7 days

Grade	% of replacement	Sample 1	Sample 2	Avg.compressive strength for 7 days (N/mm^2)
	0%	10.10	8.35	9.225
M2O	5%	8.65	9.35	9.00
	10%	7.55	9.16	8.35
	15%	6.35	7.25	6.9

Figure – 1 Graphical Representation of Compressive Strength of Cubes-7 days

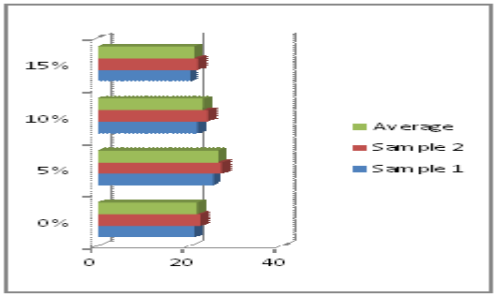


x-axis: Compressive strength, y-axis: % of replacement of egg shell powder.

Table – 4 Compressive strength on cubes for 28 days

Grade	% of replacement	Sample 1	Sample 2	Avg.compressive strength for 7 days (N/mm^2)
	0%	21.30	22.63	21.96
M2O	5%	25.26	27.34	26.30
	10%	22.10	24.15	23.12
	15%	20.20	22.17	21.18

Figure – 2 Graphical Representation of Compressive Strength of Cubes-28 days



x-axis: Compressive strength, y-axis: % of replacement of egg shell powder.

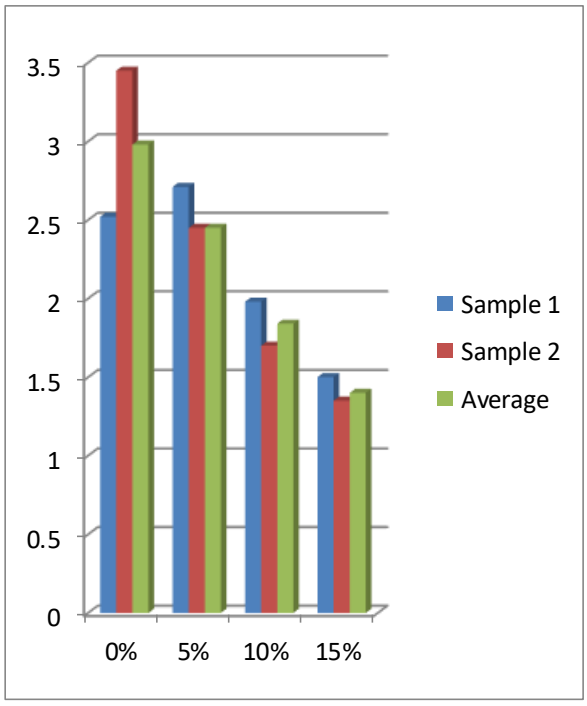
B. Split Tensile Strength Test on Concrete Cylinders

It is very important to determine the tensile strength of concrete as to determine the load at which the concrete members may crack.

Table 5 - Split Tensile strength on cubes for 7 days

Grade	% of replacement	Sample 1	Sample 2	Avg.compressive strength for 7 days (N/mm^2)
	0%	2.52	3.45	2.45
M2O	5%	2.71	2.45	2.98
	10%	1.98	1.7	1.84
	15%	1.5	1.35	1.4

Figure – 2 Graphical Representation of Split Tensile Strength of Cylinders-7 days



x-axis: % of replacement of egg shell powder, y-axis: Tensile strength value.

V CONCLUSION

Egg shell acquired from civil strong squanders is by making powder and included different rates for bond substitution and it is resolved that the substitution of bond by 5% egg shell powder is expanded by 19.76% in 28 days compressive quality when contrasted with the customary concrete [31],[33]. Likewise it is resolved that the substitution of bond by 5% egg shell powder is expanded by 21% in 7 days split rigidity when contrasted with the ordinary concretet.

The water bond proportion of 0.45 produces medium level of usefulness which is reasonable for the vast majority of the solid throwing nearby. It is seen that there is an improvement of compressive quality of cement by the expansion of eggshell powder which is going about as a filler in the solid. Concrete with the expansion of 5% eggshell powder demonstrated the most noteworthy compressive quality[32],[34]. At 28 days relieving. So also, concrete with expansion of 5% eggshell powder demonstrated the most noteworthy split rigidity.

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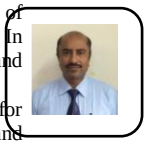

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