

Comparative Study on Conventional Concrete and Replacement of Coconut Shell Powder and Egg Shell Powder

K Thangamani¹, G. Mounika Naidu²

CIVIL ENGINEERING^{1,2}, KG REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY¹,

² Email: ktm@kgr.ac.in¹ naidumounika50@gmail.com²

Abstract- All over the world the concrete is being broadly used for the construction of most of the buildings, bridges and mass concrete works etc. a waste material which is having binding properties and can be used in concrete is appropriate in a worldwide. Waste materials appropriate and gradually more important because need of more sustainable binding products is require. Waste material such as egg shell and coconut shell are having siliceous properties which can partially replace the cement. Egg shell powder as potential additive to concrete. In this study egg shell powder and coconut shell powder is used for partially replacing the cement. M-20 grade of concrete designed specimen is tested for compressive strength and split tensile strength. Egg shell powder 5% in cement and coconut shell powder 10% used in weight of fine aggregate in concrete. Compressive strength and split tensile strength is evaluated after 7, 28 days of curing.

Index Terms- *Egg shell powder, coconut shell powder, Compressive strength and split tensile strength,*

1. INTRODUCTION

Concrete is a composite material made of fine and coarse aggregate and bonded together with the cement, water (cement paste) that hardens over time. The ecological impact of concrete mainly occurs in its manufacturing and application process. The cement industry is one of the main producers of carbon dioxide (CO₂), and greenhouse gases. It can cause harm to the most fertile layer of the earth, the top soil. Due to this backdrop, the search for substitute to cement is a needed. Many materials are tested but can only partially replace the cement. Egg shells and coconut waste are some of those which generate from domestic units as well as small scale industries. Most of the eggshell waste is commonly disposed in the campus areas without pretreatment because it was conventionally useless. eggshell is known as natural solid waste which is non unsafe, it may attract rats due to the organic protein atmosphere that may pose health problem to the public The chicken eggshell is having 95-97% calcium carbonate particles, which are stabilized by a protein matrix. About 1.61 million tones of egg shells are generated annually, which makes India a fifth largest country in the world. India is the third largest producer of coconut in world. From the

reports, India produced 11.1 millions of tones coconut in year 2014. Coconut shells have better durability characteristics, high toughness and abrasion resistant property. In Coconut shell lignin content is more and the cellulose content is less, coconut shells are having similar chemical composition to hard wood.

2. LITERATURE REVIEW

Doh Shu Ing et al studied the Eggshell Powder as Potential Filler in Concrete. In this investigation, five different percentages of eggshell powder with respect to cement were added into the concrete mix of Grade 25. The materials used were mainly Portland cement, crushed sandstone, river sand, plasticizing accelerator and eggshell powder. From the investigation, all the slump results of eggshell concrete were at medium degree of workability ranging from 65-75 mm. Eggshell concrete of 10% achieved the highest compressive strength at 42.82 N/mm² which is 57% higher than the control specimen. There is an increasing trend of flexural strength from 2.36 to 3.50 N/mm² with the increase of eggshell powder from 0 to 20%. Besides that, the eggshell concrete has shown significant reduction in water absorption and water penetration.

K. UMA SHANKAR J et al studied the use of experimental analysis on effective utilization of industrial waste materials of egg shell, GGBS and saw dust ash. The aim of the work is to study the suitability of egg-shell powder, Ground Granulated Blast Furnace slag and saw dust ash as a partial replacement of cement. The chemical compositions of these Industrial wastes taken under study are almost similar to that of Ordinary Portland cement. In this experimental work, egg shell plays a major role, as it is used in all the combination of the concrete cubes. The industrial wastes are grounded to the fineness of cement, and the properties of cement such as initial setting time, final setting time, fineness test, soundness of cement, water absorption, etc. are conducted on the replaced sample. The tests revealed encouraging

The aim of the work is to study the suitability of egg-shell powder results for the study. The sample of blended cement consists of 20% of egg shell powder, 50% of GGBS and 10% of Sawdust ash.

Mohamed Ansari M et al studied the Replacement of Cement using Eggshell Powder. The paper describes the effect and experimental result of replacement of

eggshell powder in cement. The compressive test was carried out for concrete replaced with 10%, 15% and 20% of eggshell powder in Portland Pozzolona cement. The compressive strength were tested for concrete cubes of dimension 150 x 150 x 150 mm. The test was carried in compressive test machine of capacity 100KN. In compressive strength test the loading rate was 50KN/s. The compressive test was conducted on 150mm cube specimens at 7th day and also to be done on 28th day. The results which came after carrying out all tests found successful which indicates that eggshell powder can be used as a replacement material for cement. From the results it is proved that replacement of eggshell powder if about 10 % to 15 % is effective and when we increasing further the percentage of eggshell powder decrease the compressive strength.

3. MATERIALS

Different materials used in the work and their test results are presented below.

3.1 Materials Used

- Cement (53 Grade OPC)
- Fine aggregate (F.A)
- Coarse aggregate (C.A)
- Coconut shell powder
- Egg shell powder

Cement used is OPC ordinary Portland cement of grade 43 is taken for testing in work.

For testing in this project egg shell is required. It is from local sources is collected from the college canteen for use. Egg shells require proper processing before using as cement. The process to follow is washing, air drying, grinding and sieving. Sieving is done through 90 micron sieve. Coconuts shell powder is obtained from the chilkur temple area. These shells should be removed prior to use as we only require shell powder. Proper procedure should be followed before using it involves removal of shells, sun drying, powdering and sieving.

4. MIX PROPORTION

IS method is used for mix design and M-15 grade of concrete with mix of 1:2:4 is made with water/cement ratio of 0.6.

5. TEST RESULTS

We have done two tests for finding the mechanical properties of concrete with replacement material. So the two tests are;

- 1) Compressive strength test
- 2) Split tensile strength test

Compressive strength test results:

Concrete cubes of 150 mm has been casted according to the IS specification. These specimens were tested in compression testing machine to determine the average compressive strength.

Splitting tensile strength test results:

Concrete cubes of 150 mm diameter and 300mm height has been casted according to the IS specification. These specimens were tested in splitting tensile testing machine as to determine the average splitting tensile strength.

5. DIFFERENT MIXES:

Following are different mixes used for the project where the control mix is used for comparing the strength with different mixes

S. No.	Concrete mix		Compressive strength	
	In mix	In percent age	7 Days	28 day S
1	E0 C0	0%	9.11	12.33
2	E2.5 C2.5	5%	7.65	9.54
3	E5 C5	10%	8.23	10.56

Table-1: Overall compressive strength of the specimen

S.No	Concrete mix		Split tensile strength	
	In mix	In percent age	7 days	28 days
1	E0 C0	0%	5.23	8.92
2	E2.5 C2.5	5%	3.25	5.64
3	E5 C5	10%	4.53	7.95

Table-2: Overall split tensile strength of the specimen

6. CONCLUSION

- Egg shell powder and coconut shell powder are founded as of useful binding materials. Properties of ESP the materials are very similar to cement and CSP in coarse aggregate which we are using in concrete.
- ESP and CSP of 10% replacement give the minimum compressive strength.
- If we want more compressive strength, we can go for 50% replacement as it gives more strength than conventional.
- If we want more split tensile strength, we can go for 50% replacement as it gives more strength than conventional.

7. REFERENCES

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