Research article Available online www.ijsrr.org ISSN: 2279–0543

International Journal of Scientific Research and Reviews

Experimental Study on Partial Replacement of Cement with Coconut Shell Ash and Egg Shell Powder

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ABSTRACT

The wish and rising cost of building construction in developing countries have been a source of concern to government and private developers. The use of waste materials with pozzolanic properties in concrete production is a becoming a worldwide practice. The assessment of the pozzolanic activity of cement replacement materials is becoming increasingly important because of the need for more sustainable cementing products. In this project, coconut shell ash and egg shell powder is used as partial replacement for cement in ranges of 0%, 5%, 10%, 15%, 20% and 25% in M_{40} grade. The both materials used to partially replace the cement from 0% - 25%. Strength tests like Compressive and tensile strength is carried out to assess the feasibility of using coconut shell ash and egg shell powder as partial replacement of cement in concrete. These methods of concrete are cured at 7 and 28days.Then comparing the results of conventional & mechanical properties. The reduction in cost up to 15% can be achieved for every cubic meter of concrete production with use of materials. In the last decades, the use of residue in civil construction, especially in addition to concrete, has been subject of many researches due to besides to reduce the environmental polluter's factors, it may lead several improvements of the concrete properties.

This project evaluates how different contents of Egg Shell Powder (ESP) and Coconut Shell Ash (CSA) added to concrete may influence its strength and durability of concrete. This may increase the strength of concrete against cracking. A total of 24 cubes were produced and cured by immersing them in water for 7 and 28 days respectively. Properties such as compressive strength, flexural strength density and setting times were determined.

KEY WORDS; Coconut Shell Ash, Egg Shell Powder, Compressive Strength, Tensile Strength, Concrete

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INTRODUCTION

Concrete is by far the most widely used construction material today. The versatility and flexibility in concrete, its high compressive strength and the discovery of the reinforcing and pre stressing techniques which help to make up for its strength have contributed largely to its widespread use. We can rightly say we are in age of concrete. But nowadays due to rapid growth in construction cement is very costly. Also due to large growth in industrialization there is a large amount of wastes generated, which is hazardous to environment and living beings. To overcome above problems wastes generated can be used as alternative materials. Coconut shell ash and egg shell powder can be used as replacement for cement. So, disposal of agricultural waste materials such as rice husk, groundnut husk, corn cob and coconut shell and egg shell have constituted an environmental challenge, hence the need to convert them into useful materials to minimize their negative effect on the environment. The aim of this project is to study the naturally grown coconut shell ash & egg shell powder to find its suitability of replacement in the concrete. To study the strength parameters of the coconut shell ash & egg shell powder mixed specimens and to compare it with conventional specimens. This project analyses the Comparison of Coconut shell ash & Egg shell powder in concrete by partial replacement of cement at the ratio of 0%, 5%, 10%, 15%, 20% and 25%.The experimental study examines the mechanical properties of flexural strength compressive strength. The main ingredients consist of Ordinary Portland cement, coconut shell ash, Egg shell powder, fine aggregate, coarse aggregate, &water. After mixing, concrete specimens were casted and subsequently all test specimens were cured in water at 7 and 28 Days & with the specified combinations of coconut shell ash & egg shell powder and compare it with the controlled concrete specimens. In this project M_{40} Concrete is designed for various combinations. In construction sector there is always a demand to find a suitable material for effective replacement of Cement since manufacturing of cement causes environmental pollution and lack of natural resources to a greater extent. Nowadays, all over the world aimed at increasing the reuse and recycling products, where it is technically, economically or environmentally acceptable. The aim of this study is to determine the suitability of coconut shell ash (CSA) and egg shell powder for use in partial replacement of cement in concrete production. The objectives include ascertaining the optimum replacement level of Portland cement with Coconut shell ash and egg shell powder that will still give required compressive strength as well as compare the setting times of OPC paste with OPC- Coconut shell ash and egg shell powder pastes at various replacement levels

Scope of the project:

The experimental investigation is planned as under:

1) To obtain mix proportions of control concrete by IS method
2) To conduct compression test on cube and control concrete on standard IS specimen , size150*150*150mm.(cube)
3) To conduct Flexural test on egg shell powder and coconut shell ash on standard IS specimen size, Height 300 mm, diameter 150mm(cylinder)

Objective of the project:

The objectives of this experimental project study are

1. Developing mix design for concrete relevant to IS: 10262-2009.

2. To study the strength properties of concrete of grade M40.

3. To study the influence of partial replacement of cement with coconut shell ash and egg shell powder to compare it with the compressive strength of M40 concrete.

4. We are also trying to find the percentage coconut shell ash and egg shell powder replaced in concrete that makes the strength of the concrete maximum

MIX DESIGN

Design of Concrete Mix:

Introduction:

Design of concrete mixes involves determination of the proportions of the given constituents namely, cement, water, coarse aggregate and fine aggregate. Workability is specified as the important property of concrete in the fresh state. For hardened state compressive strength and durability will be considered. In this chapter the details of concrete mixes are discussed. In the present work M_{40} grade of concrete were carried out

Factors to Be Considered In Mix Design: (As per SP23-1982)

The design of concrete mix will be based on the following factors.
(a) Grade of concrete (b) Type of cement c) Maximum nominal size of aggregate
d) Minimum water cement ratio e) Workability

EXPERIMENTAL WORK

Casting of Specimens:

The cement and sand were first added and mixed thoroughly in the dry state until homogeneity was achieved. The dry coarse aggregate were added to the mixture and again mixed thoroughly. Water was slowly added and mixed thoroughly for 3 min. After mixing all the ingredients, concrete specimens were cast using steel moulds and compacted with a table vibrator in three layers. For each mix, six 150*150*150 mm cubes and cylinders of 150mm diameter and 300mm length were produced for measurement of the compressive strength and split tensile strength respectively.

Figure.1 – Casting of Specimens

Table: 1 - Coconut shell ash and egg shell powder concrete mix

Mix	Material by Weight		
	% of coconut shell ash and egg shell powder	**Cement (Kg)**	**Waste coconut shell ash and egg shell powder (Kg)**
M40	0%	477	0
	5%	453.15	20.65
	10%	429.30	47.7
	15%	405.55	71.55
	20%	381.6	95.4
	25%	357.75	119.25

Coconut shell ash and egg shell powder Concrete mix:

Based on the Indian Standard (IS: 10262 - 1982), design mix for M_{40} grade of concrete was prepared by partially replacing cement with five different percentages by weight of coconut shell ash and egg shell powder (0%, 5%, 10%, 15%, 20% and 25%). The mix proportion for M_{40} Grades of concrete with varying percentage of coconut shell ash and egg shell powder is presented

Concrete mix with both coconut shell ash and egg shell powder:

Coconut shell ash and egg shell powder is mixed in concrete as a partial replacement of cement (0%, 5%, 10%, 15%, and 20%, 25%). For each percent of coconut shell ash and egg shell powder replacing Cement, 2 cubes were casted for 7 days and 28 days.

RESULT AND DISCUSSION

This project deals with the observation of the results from the various tests conducted on concrete for use as reducing the quantities concrete. The results are compared with the control of different Concrete mixes for the various percentage replacement levels of cement with coconut shell ash and egg shell powder. The strength characteristics of concrete containing coconut shell ash and egg shell powder are discussed in this project. Tests were performed on high strength concrete cured under Standard laboratory conditions, and compressive strengths were observed at Curing ages of 7 and 28 days.

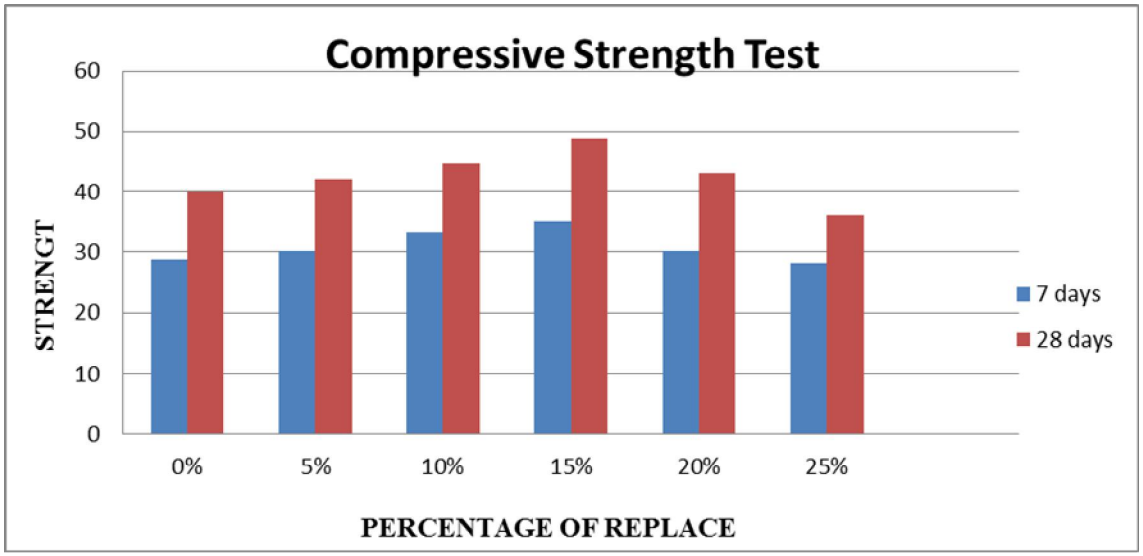
Table: 2 compressive strength test result

Mix Designation	Concrete mix for both coconut shell ash and egg shell powder	7 days(N/mm^2)	28day(N/mm^2)
M_1	0%	30.02	40.54
M_2	5%	30.23	42.10
M_3	10%	33.36	44.75
M_4	15%	35.19	48.93
M_5	20%	30.12	43.16
M_6	25%	31.12	36.10

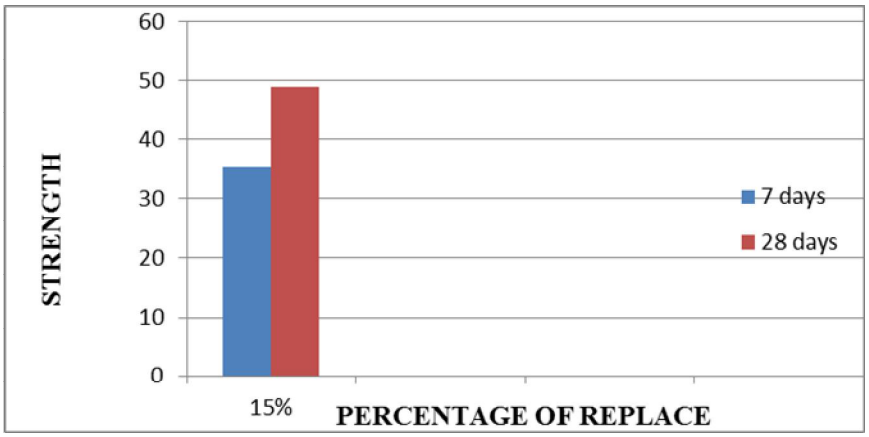
Test procedure and results for compressive strength

Test specimens of size 150×150×150 mm were prepared for testing the compressive Strength of both controlled as well as coconut shell ash and egg shell powder based concretes. The Modified mixture with varying percentage of coconut shell ash and egg shell powder as a partial Replacement of cement were prepared and cast into cubes. Compressive strength test results at curing ages of 7 and 28 days for control mix as well as for the Modified mix. For testing in compression, no cushioning Material was placed between the specimen and the plates of the machine.

The load was applied axially without shock till the specimen was crushed. The test setup for the compressive strength. Two specimens for each mix were tested and the corresponding values were observed and average values were taken for discussion. The variation of compressive strength with varying percentage replacement of Cement with coconut shell ash and egg shell powder. Variations with both materials being used as replacements of cement in the concrete



Graph.1: Compressive Strength of Various Percentage of Replacement



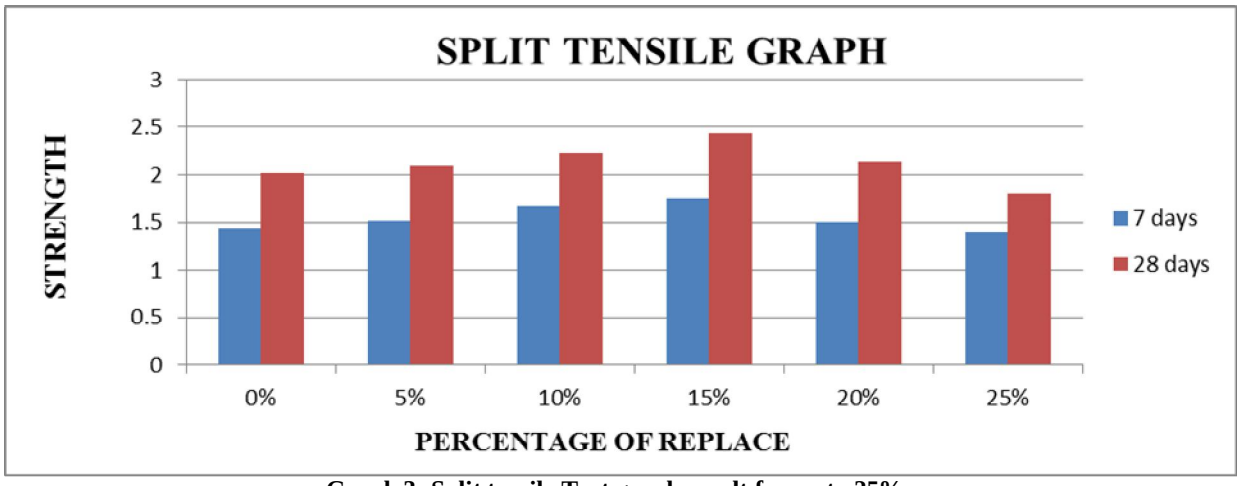
Graph.2: Compressive strength of 15% of Replacement

Split Tensile Test

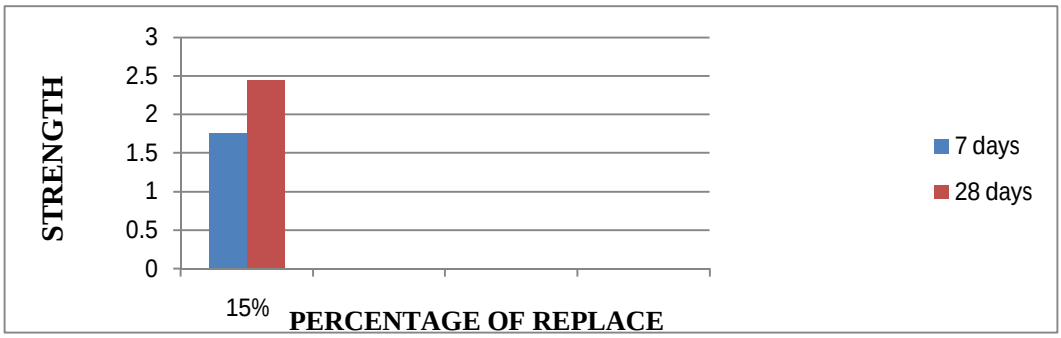
The concrete mix is prepared for M_{40} grade and cement is replaced by Egg shell powder & Coconut shell ash as certain percentage. The Split Tensile Test is done graphs which shows the 7 days and 28days strength of the concrete mix, graph also says, there is increase in strength as compared to conventional concrete

Table.3 Split Tensile Test results

Mix Designation	Concrete mix for both coconut shell ash and egg shell powder	7 days(N/mm^2)	28day(N/mm^2)
M_1	0%	1.44	2.02
M_2	5%	1.51	2.10
M_3	10%	1.66	2.13
M_4	15%	1.75	2.44
M_5	20%	1.5	2.15
M_6	25%	1.40	1.80



Graph.3: Split tensile Teat graph result for up to 25%



Graph.4: Split Tensile Test graph at increased percentage

CONCLUSION

- Concrete is used for many structures basically for its compressive strength to support any type of load.
- This work has shown that partial replacement of cement with0%, 5%, 10%, 15%, 20%, 25% of Coconut Shell ash (CSA) and Egg Shell Powder (ESP) in concrete gives an average optimum compressive strength in concrete.
- The use of Coconut Shell ash (CSA) and Egg Shell Powder (ESP) as a partial replacement of cement produced a cheaper structural light weight concrete using the optimum compressive strength value and lower volume of replacement, will enhance the reduction of cement usage in concretes, thereby reducing the production cost and the environmental pollution caused by the dumping of the agricultural waste.

- The flexural strength of the egg shell and coconut shell ash concrete increases with the addition of egg shell powder and coconut shell ash up to 15 percent is taken and from then on words flexural strength decreases.

ACKNOWLEDGEMENTS:

Many individuals have contributed towards fulfilment of this work in one or many ways. This work could not have seen light without the help of all these people. It will be our pleasure and responsibility to acknowledge their contributions

We thank Professor. Dr. Dola Sanjay S, Principal for providing us with all the infrastructural facilities towards successful completion of this work.

We thank Sri. K. Venugopal, Secretary and Correspondent, RCE for providing with good academic and research environment in the department.

REFERENCES

1. R.Nagalakshmi, Experimental study on strength characteristics on M25 concrete with partial replacement of cement with fly ash and coarse aggregate with coconut shell, International Journal of Scientific & Engineering Research, January-2013; 4(1)
2. Amarnath Yerramala et al., Properties of Concrete with Coconut Shells as Aggregate Replacement, International Journal of Engineering Inventions ISSN: 2278-7461, www.ijeijournal.com October2012; 6(1) : 21-31.
3. IS: 12269-1987. Specification for 53 grade ordinary Portland cement.
4. IS: 516–1959 Method of test for strength of concrete.
5. Poon CS, Shui ZH, Lam L, Fok H, Kou SC. Influence of moisture states of natural and recycled aggregates on the slump and compressive strength of concrete. Cement and Concrete Research 2004; 34(1): 31–36