AN EXPERIMENTAL STUDY ON PARTIAL REPLACEMENT OF COCONUT SHELL IN COARSE AGGREGATE

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ABSTRACT

The high cost of conventional building materials is a major factor affecting housing delivery in world. This has necessitude research into alternative materials of construction and analyzing flexural and compressive strength characteristics of concrete produced using crushed and sieved ,granular coconut as substitute for conventional coarse aggregate with full replacement using m20,m15,m25 grade concrete. The main objective is to encourage the use of these 'seemingly' waste products as construction materials in low-cost housing. It is also expected to serve the purpose of encouraging housing developers in investing these materials in house construction. This project paper aims at analyzing the compressive strength characteristics of concrete produced using crushed, granular coconut as coarse aggregate with partial replacement using m20, m25, m15 grades concrete. Cubes are tested and their properties are determined.

Key words: coconut shell, compressive strength, split tensile strength.

INTRODUCTION

Concrete is the only engineering material used in civil engineering structures which can mould into any shape and size. Preparation of raw materials of concrete is not only causing the extension of materials but also leading to great air pollution by their production. Coarse aggregate are two main ingredients used for the production of concrete and has no alternative in the civil construction industry. Hence it is inevitable either to search for another material or partly replace them by some other materials. The search for any such materials, which can be used as an alternative or as a supplementary for coarse aggregate should lead to global sustainable development and lowest possible environmental impact.

To overcome this effect many researchers have made attempts to use waste material which reduces the disposal problem, atmospheric pollution and improve the mechanical properties of concrete. Here are some of the waste materials that can be used in making concrete such as coconut shells, coconut coir, etc. Use of coconut shells in the concrete to partly replace coarse aggregates respectively is adopted which will enable the concrete construction industry to sustain. Hence these can be used as economical building aggregate materials reducing the problems of environmental pollution and disposal of waste.

LITERATURE REVIEW

R. Ranjith [1], et.al, determined the durability property also lies well within the permissible limits for coconut shell aggregate concrete when comparing conventional aggregate concrete. Considering the strength property it was concluded that the coconut shells were normally suitable to use as substitute for aggregate in concrete production.

Noemi Arena, Jacquetta Lee, Roland Clift [3], et.al, observed that Coconut shells as raw materials are utilized for activated carbon production due to their abundant supply, high density and purity, and because they seem to have a clear environmental advantage.

Shahiron Shahidan[a], Alif Syazani Leman, Mohamad Syamir Senin and Nurul Izzati Raihan Ramzi Hannan [4], et. al, The aim is to produce concrete with improved properties at a lower cost and to maintain environmental sustainability. Coconut shell is suitable to be used in concrete to produce a concrete cool wall panel in order to reduce heat transfer inside a building.

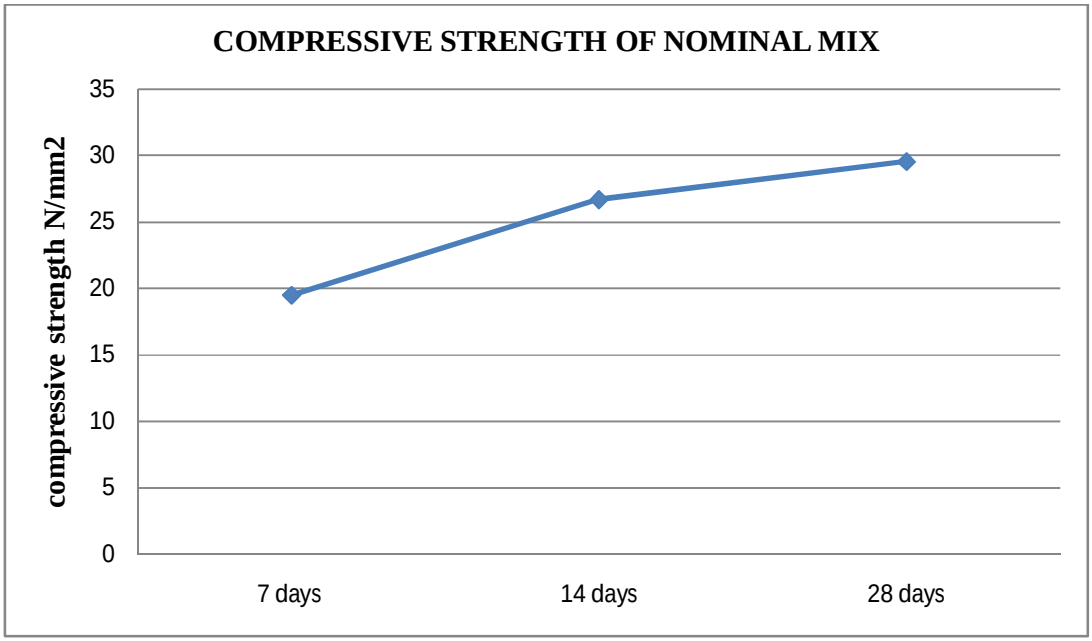
J. Jerlin Regi, P.Vincent, C.Ganapathy [5], et. al, determined the lightweight concrete was made with full replacement of conventional concrete coarse aggregate with crushed coconut shell aggregate of size less than 12.5 mm. Coconut shell treated with 20% poly vinyl alcohol improved the resistance against aggressive environment. But concrete made with treated shell aggregate gave 5% improvement in compressive strength. The optimum compressive strength of coconut shell concrete with 10% silica fume in 28 days is 31.78 N/sq.mm.

KabiruUsmanRogo and SalehAbubakar [6], et. al, studied on the Coconut Shell which can be a substitute for aggregates. They prepared about 72 concrete cubes size 150x150 x150mm with different mixed ratios1:2:4, 1:1.5:3 and 1:3:6 were casted and tested. They concluded that compressive strength in N/mm2 of coconut shell at 7, 14 21, and 28 days with

mix ratios of 1:2:4, 1:1.5:3 and1:3:6 are (8.6, 8.9, 6.4), (9.6, 11.2, 8.7), (13.6, 13.1, 10.7) and (15.1, 16, 5, 11)respectively for gravel (19.1, 18.5, 9.6) (22.5, 23.0, 10.4) (26.7, 24.9, 12.9) and (28.1,30.0, 15) respectively. Since the concrete strength of coconut shell with mix ratio 1:1.5:3attained 16.5N/mm2 at 28 days it can be used as plain concrete. Hence cost reduction of 48% was obtained.

COMPRESSION TEST RESULTS ON NOMINAL MIX CUBES

S.NO	AGE IN DAYS	LOAD AT FAILURE (KN)	COMPRESSIVE STRENGTH (N/MM2)	AVG COMPRESSIVE STRENGTH (N/MM2)
1	7	438.5	19.49	25.203
2	14	598.18	26.58	
3	28	644.6	29.54	

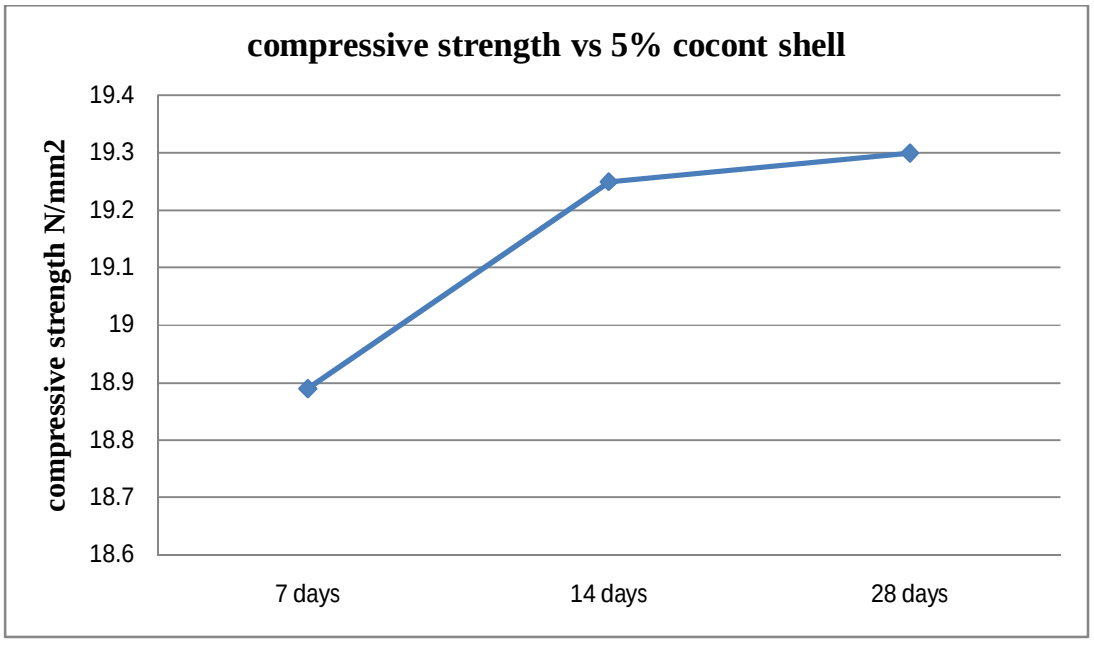


DISCUSSIONS:

- Compressive strength of nominal mix at 28 days is 29.54 N/SQ.MM

COMPRESSION TEST RESULTS ON 5% COCONUT SHELL CONCRETE

S.NO	AGE IN DAYS	LOAD AT FAILURE (KN)	COMPRESSIVE STRENGTH (N/MM2)	AVG COMPRESSIVE STRENGTH (N/MM2)
1	7	425	18.89	19.14
2	14	433	19.25	
3	28	434	19.30	

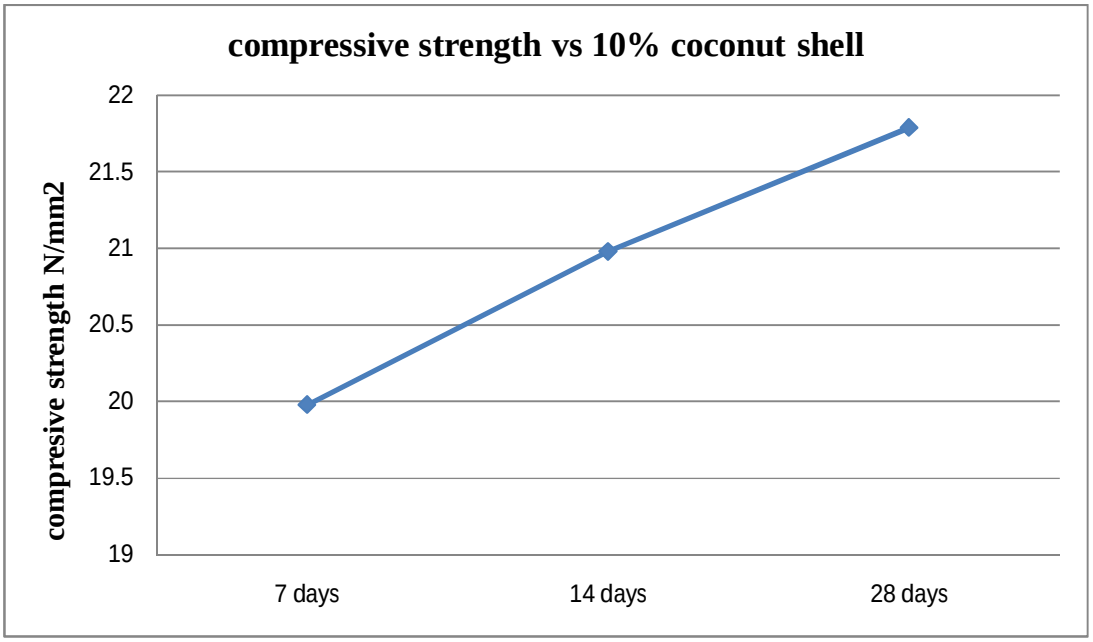


DISCUSSIONS:

Compressive strength of concrete has increased to 19.30 N/sq.mm at 5% coconut shell.

COMRESSION TEST RESULTS ON 10% COCNUT SHELL CONCRETE

S.NO	AGE IN DAYS	LOAD AT FAILURE (KN)	COMPRESSIVE STRENGTH (N/MM2)	AVG COMPRESSIVE STRENGTH (N/MM2)
1	7	450	19.98	20.996
2	14	472	20.98	
3	28	490	21.79	

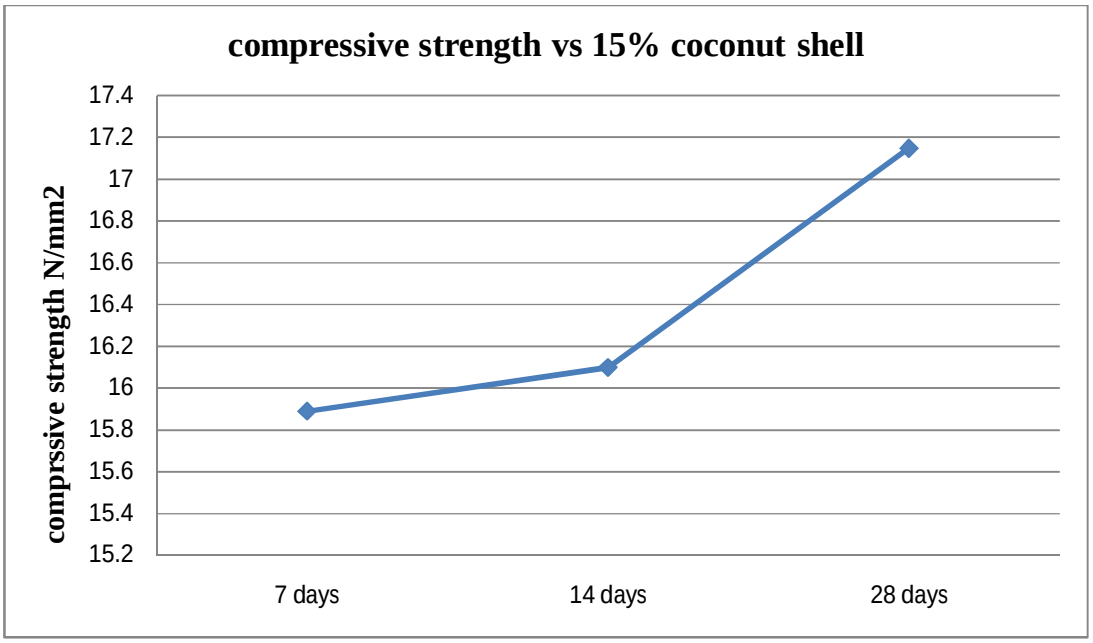


DISCUSSIONS:

Compressive strength of concrete has increased to 21.79 N/sq.mm at 10% coconut shell.

COMRESSION TEST RESULTS ON 15% COCONUT SHELL CONCRETE

S.NO	AGE IN DAYS	LOAD AT FAILURE (KN)	COMPRESSIVE STRENGTH (N/MM2)	AVG COMPRESSIVE STRENGTH (N/MM2)
1	7	358	15.89	16.38
2	14	362	16.10	
3	28	386	17.15	

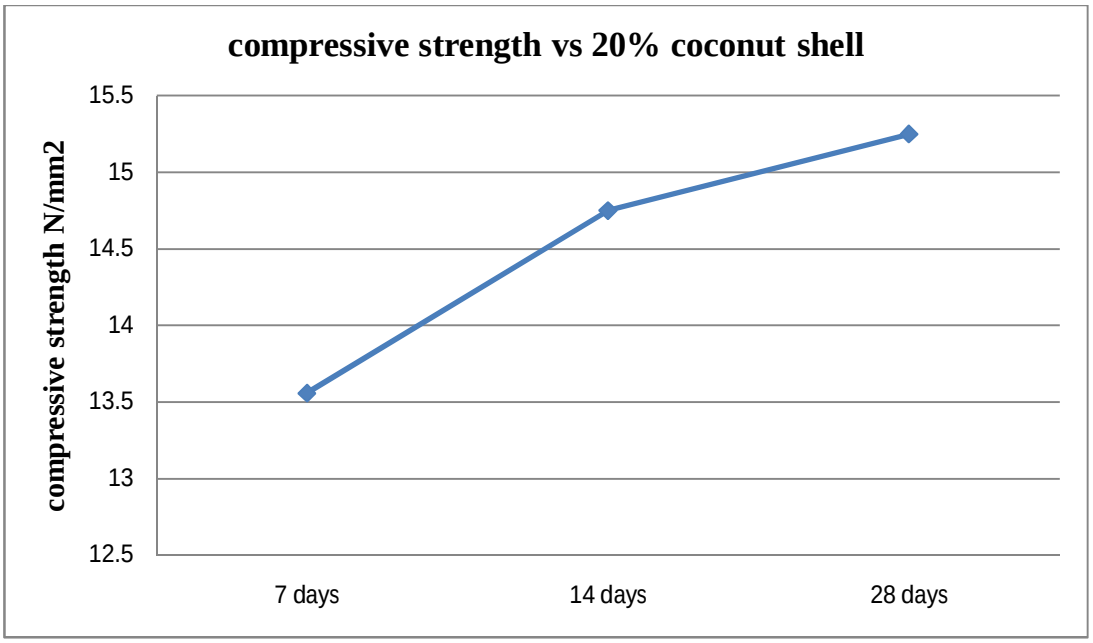


DISCUSSIONS:

Compressive strength of concrete has increased to 17.15N/sq.mm at 15% coconut shell.

COMRESSION TEST RESULTS ON 20% COCONUT SHELL CONCRETE

S.NO	AGE IN DAYS	LOAD AT FAILURE (KN)	COMPRESSIVE STRENGTH (N/MM2)	AVG COMPRESSIVE STRENGTH (N/MM2)
1	7	305	13.56	14.53
2	14	332	14.75	
3	28	343	15.25	

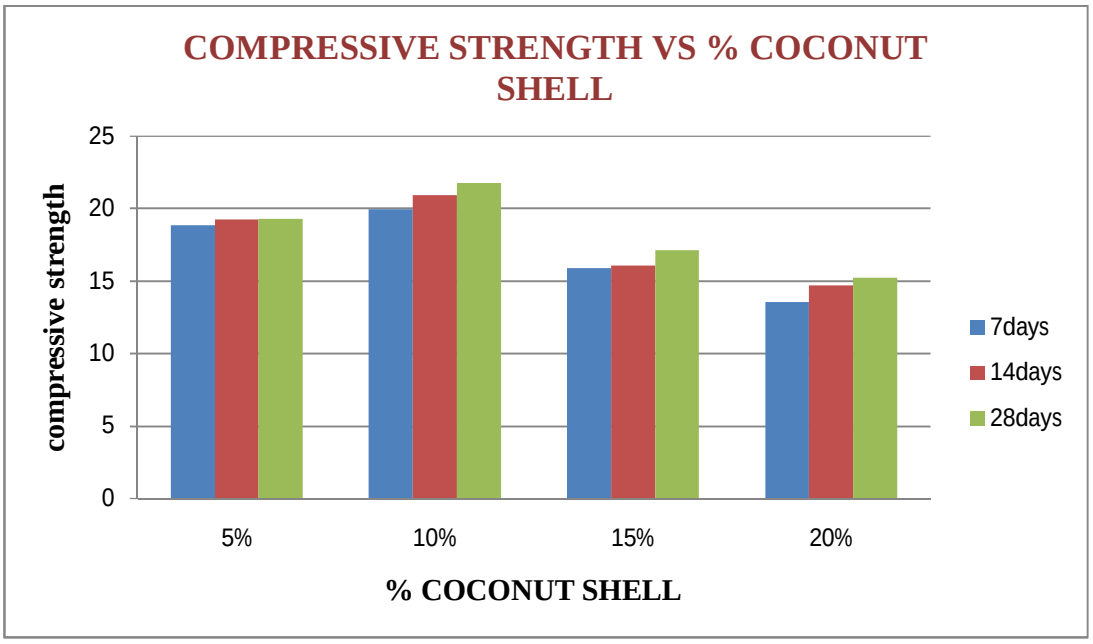


DISCUSSIONS:

Compressive strength of concrete has increased to 15.25N/sq.mm at 20% coconut shell.

COMPARSION ON CUBE COMPRESSION TEST RESULTS OF DIFFERENT % REPLACEMENT OF COCONUT SHELL WITH COARSE AGGREGATE

% of coconut shell	AGE	LOAD	STRENGTH	AVG COMPRESSIVE STRENGTH
5	7	425	18.89	19.14
5	14	433	19.25	
5	28	434	19.30	
10	7	450	19.98	20.99
10	14	472	20.98	
10	28	490	21.79	
15	7	358	15.89	16.38
15	14	362	16.10	
15	28	387	17.15	
20	7	305	13.56	14.53
20	14	331	14.75	
20	28	343	15.25	

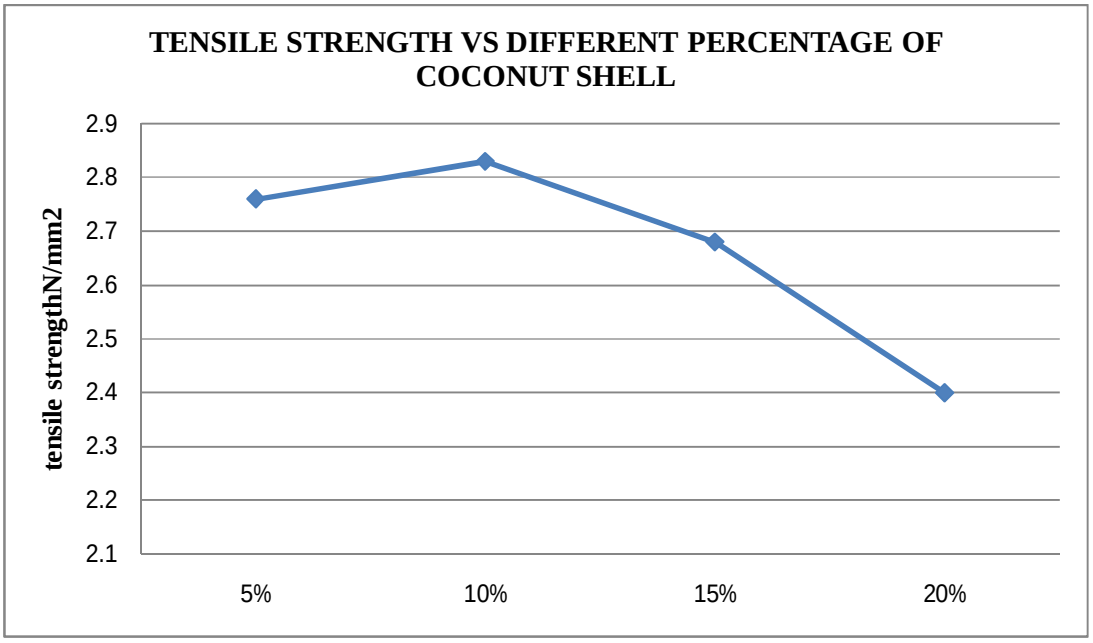


DISCUSSIONS

Finally, by comparing the different percentages of coconut shell the compressive strength, at 28 days i.e., 20.99 N/sq.mm

SPLIT TENSILE TEST RESULTS ON CYLINDER

S.NO	COCONUT SHELL (%)	LOAD AT FAILURE (KN)	COMPRESSIVE STRENGTH (N/MM2)
1	5	195	2.76
2	10	200	2.83
3	15	190	2.68
4	20	170	2.40



DISCUSSIONS

- The cylinder split tensile strength increases by 10% addition of coconut shell as coarse aggregate.
- the cylinder split tensile strength has decreased when addition of increase in percentage of coconut shell as coarse aggregate.

CONCLUSIONS

1. Addition of coconut shells decreases workability and addition of granite powder as fine aggregate replacement increases workability of coconut shells concrete.

2. By replacement of coconut shells in place of aggregates, 10% replacement will have been increased the strength properties of concrete compared to the normal concrete.

3. But the replacement of coconut shells in place of aggregates and replacement of granite powder as fine aggregate will increase the strength properties of concrete compared to the normal concrete.

4. It is concluded that the Coconut Shells are more suitable as low strength-giving lightweight aggregate when used to replace common coarse aggregate in concrete production.

5. This can be useful for construction of low cost housing society.

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