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AN EXPERIMENTAL STUDY ON STRENGTH CHARACTERISTICS OF CONCRETE BY PARTIAL REPLACEMENT OF COARSE AGGREGATE WITH COCONUT SHELL

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ABSTRACT

Coconut shell cement ratio has been optimized to satisfy the criteria of structural lightweight concrete. An experimental study has been done in order to reduce the Coarse aggregate content in concrete by replacing it with the Coconut shell in various percentages ie.(5-30%) for M30 & M40 mix to determine compressive strength, flexural strength, splitting tensile strength were determined and a comparison made with control concrete. and durability of concrete and are compared for both grades and results are tabulated and the optimum percentages are concluded. Coconut shell aggregate is a potential construction material and simultaneously reduces the environmental problem of solid waste.

Keywords: *Coconut shell ,Compressive Strength ,Split tensile strength,Flexural strength.*

I. INTRODUCTION

In this study, the main concern is to find an alternative for coarse aggregate. Substitution of coarse aggregate by Coconut shell will reduces the environmental problem of solid waste. The study focuses to determine the relative performance of concrete by using coconut shell .Concrete of coconut shell gained more strength than concrete with normal cement concrete. The utility of coconut shell as partial replacement in concrete mixes is on rise these days, coconut shell is locally available in abundance. The quantity of Coconut shell produced from Coconut palm. Coconut is grown in 92 Countries in the world. The use coconut shell reduces the environmental problems. The main objective of this research is to determine the feasibility of using solid waste coconut shell as coarse aggregate for structural light weight concrete.

II. MATERIALS USED

Cement, fine aggregates, coarse aggregates, coconut shells were used in preparation of concrete the detailed specifications of the materials are given below.

Cement :
Ordinary Portland cement available in the local market of standard brand of 53 grade confirming to IS 12269 - 1987 was used for the concrete mix. The cement should be fresh and of uniform consistency and there is no evidence of lumps or any foreign matter in the material. The cement should be stored under dry conditions and for as short duration as possible.

Coconut shell
CS is discarded at coconut industries as half-shell rounds. CS was collected from the local coconut oil mills to analyse the properties of CS in this study. CS has maximum thickness in range of 2-8mm they were crushed to the required sizes in the range 3-12 mm in length using the specially developed crusher.

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Fine Aggregate:
Aggregates of size ranges between 0.075mm – 4.75mm are generally considered as fine aggregate. In this experimental work two types of Fine aggregate were used. They are River sand and (Bottom ash). The Fine aggregate are selected as per IS-383 specifications.

Coarse Aggregate:
Aggregate of size more than 4.75mm are generally considered as Coarse aggregate. The maximum sizes of coarse aggregate used in this experimental work are 20 mm and 12 mm. A good quality of Coarse aggregate is obtained from nearest crusher unit. The Coarse aggregate are selected as per IS-383 specifications.

Water:
Water is a liquid at standard temperature of 273.15k (0°C, 32°F). The intrinsic colour of water and ice is a very slight blue hue. Water is a good polar solvent and is often referred to as the universal solvent. Water is used in concrete should be free from acids and alkalis and P^H value is in between 6.5 – 8.5.

III. MIX PROPORTION

For M30 and m40 grade

Cement Kg/m^3	Fine aggregate Kg/m^3	Coarse aggregate Kg/m^3	Water l/m^3
1	1.433	2.457	0.45
1	1.28	2.22	0.40

IV. TEST RESULTS

Compressive strength results of M30 and M40 Grade shown in Table 1

Compressive strength:
Compressive strength is obtained by applying crushing load on the cube surface. So it is also called as Crushing strength. Compressive strength of concrete is calculated by casting 150mm x 150mm x 150mm cubes. The test results are presented here for the Compressive strength of 7 days and 28 days of testing.

Mix	Compressive Strength (N/mm^2)			
	M30 Grade		M40 Grade	
	7 Days	28 Days	7 Days	28 Days
C_1-0%	25.2	35.35	31	41.02
C2-5%	25.8	35.82	32.32	41.63
C3-10%	26	36.84	32.54	41.75
C4-15%	26.25	37.52	32.92	42.82
C5-20%	26.84	38.34	32.6	43.85
C6-25%	27.1	38.52	32.81	44.92
C7-30%	25.2	26.23	26.6	32.25

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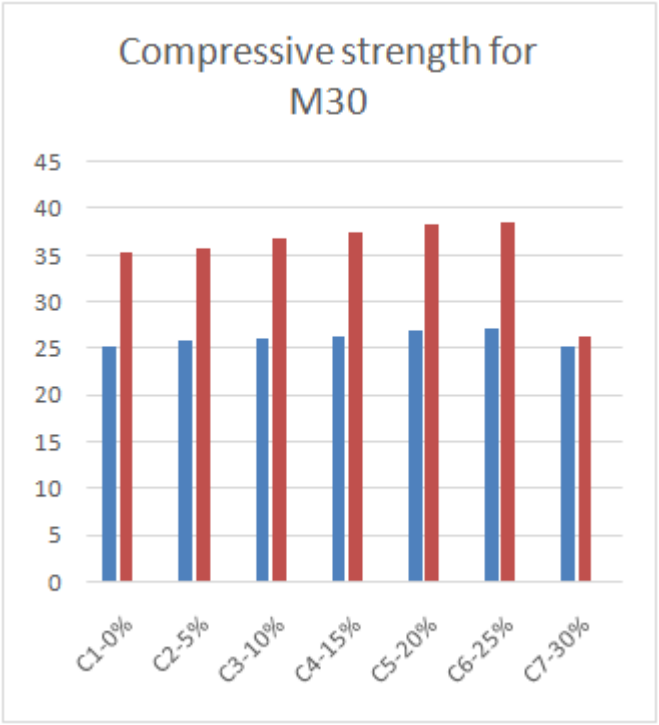

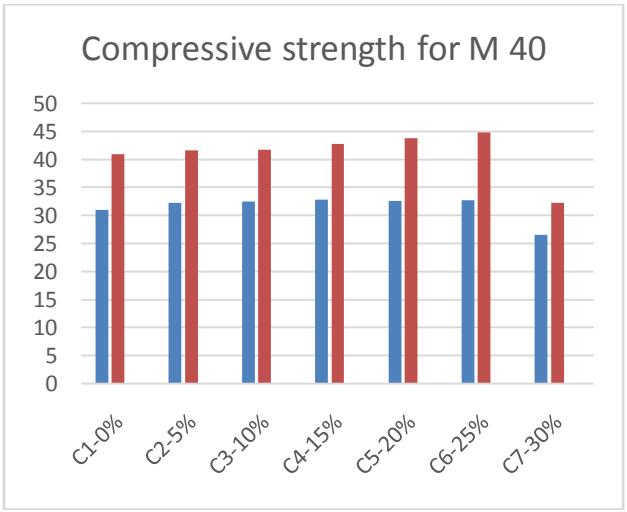

Split tensile strength:

Out of all the properties of concrete, tensile strength is very important one. The tensile strength is calculated by testing cylindrical specimens of size 300mm height and 150mm diameter. Here each set of specimens are tested for 7 days and 28 days of curing. The details of test results are summarized below

Split tensile strength results of M30 and M40 Grade shown in Table No.2

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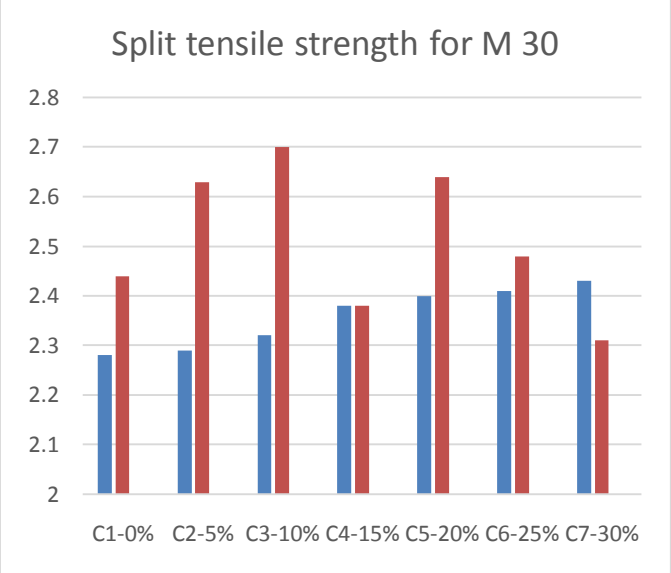
Mix	Split tensile Strength (N/mm^2)			
	M30 Grade		M40 Grade	
	7 Days	28 Days	7 Days	28 Days
C_1-0%	2.28	2.44	3.20	3.82
C2-5%	2.29	2.63	3.24	3.9
C3-10%	2.32	2.70	3.26	3.92
C4-15%	2.38	2.38	3.32	3.94
C5-20%	2.40	2.64	3.48	3.98
C6-25%	2.41	2.48	3.52	4.02
C7-30%	2.43	2.31	2.82	2.26



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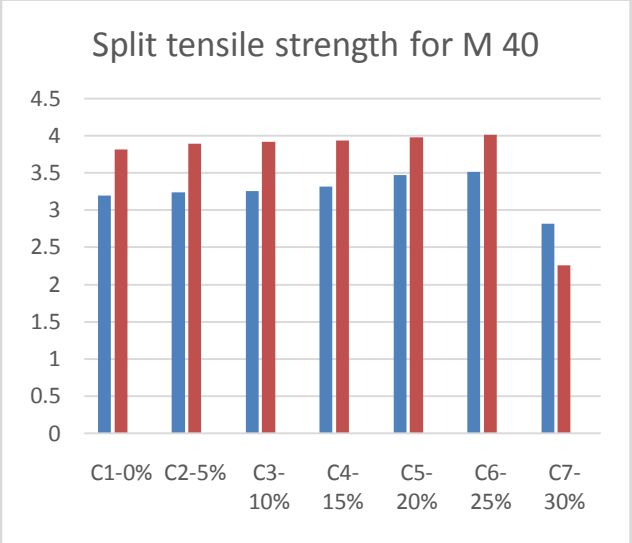

Flexural strength:

To improve the flexural strength of concrete is one main task in present construction activities. Flexural strength for concrete is determined by casting beam specimens. The beam dimensions are of 500mm x 100mm x 100mm. The flexural Strength values for both grades are described as follows .

Flexural strength results of M30 and M40 Grade shown in Table No.3

Mix	Flexural Strength (N/mm^2)			
	M30 Grade		M40 Grade	
	7 Days	28 Days	7 Days	28 Days
C_1-0%	3.8	4.82	4.62	5.69
C2-5%	3.92	5.0	4.68	5.95
C3-10%	3.95	5.13	4.69	5.21
C4-15%	4.02	5.20	4.7	5.18
C5-20%	4.21	5.25	4.71	4.52
C6-25%	4.32	5.3	4.74	4.92
C7-30%	3.60	4.22	4.20	4.14

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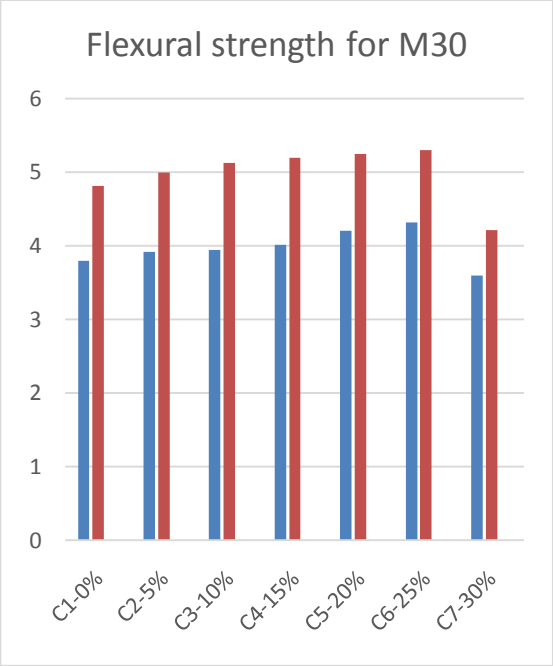

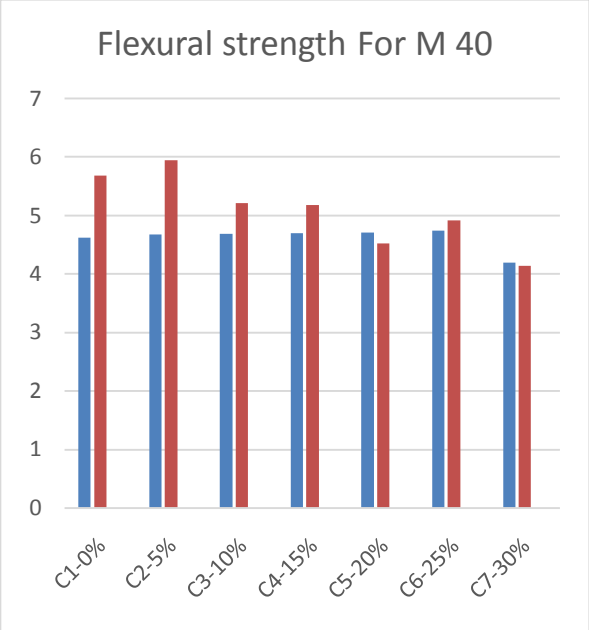

V. CONCLUSION

- The possibility of recycling and reuse of coconut shells which are discarded as waste led to studies into its possible use as coarse aggregate in the development of lightweight concrete
- The test results obtained from this study also provide significant understanding on basic properties, bond behaviour, and durability properties, flexural and shear behavior of coconut shell aggregate concrete

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- Coconut shell exhibits more resistance against crushing, impact and abrasion, compared to crushed granite aggregate. Coconut shell can be grouped under lightweight aggregate. There is no need to treat the coconut shell before use as an aggregate except for water absorption.
- Coconut shell is compatible with the cement. The 28-day air-dry densities of coconut shell aggregate concrete are less than 2000 kg/m3 .
- By seeing the compression strength results, there is a nominal increase in the strength up to 25%of coconut shell replacement and decreasing in the case of above 25 %coconut shell replacement with reference to conventional concrete at 28 days.
- By seeing the split tensile strength results, there is a nominal increase in the strength up to 25%of coconut shell replacement and decreasing in the case of25 %coconut shell replacement with reference to conventional concrete at 28 days.
- By seeing the Flexural strength results, there is a nominal increase in the strength up to 25%of coconut shell replacement and decreasing in the case of25 %coconut shell replacement with reference to conventional concrete at 28 days.
- The resulting values of flexural strength and splitting tensile strength of CSAC were comparable to other concretes. Impact resistance of CSAC is more compare to CC. Modulus of elasticity of coconut shell aggregate concrete is approximately one-third of control

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