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Behaviour of Reinforced Concrete Beams with Coconut Shell as Coarse Aggregates

Ravi Kumar Thakurai[1], Prof. P. K. Sharma[2]
[1]*P.G. Student,* [2]*Professor, Department of Civil Engineering, BIT Sindri, Dhanbad, Jharkhand*

Abstract: ***With the increase of demand of concrete structure in our society, the source of concrete material like cement, sand, stone are continuously decreasing. That's why we should think about the alternative material of these. And probably the best alternative is organic wastes. coconut shell has been used as a partial replacement of coarse aggregate respectively for M-20 concrete. The use of coconut shell could be a valuable substitute of coarse aggregate that can be used as a housing construction, such as concrete. In this project sand, cement and coarse aggregate was replaced coconut shell respectively as various percentage (%), by weight for M-20 nominal mix. The concrete cubes were tested for compressive strength at the age of 7 days and 28 days.***
Keywords: Coconut shell, compressive strength, flexural strength, density.

I. INTRODUCTION

Concrete is known to be the most widespread structural material due to its quality to shape up in various Concrete is known to be the most widespread structural material due to its quality to shape up in various geometrical configurations. In some conditions, might assume that normal weight concrete is inconvenient due to its density (2200-2400kg/m3).Replacing partially; the normal weight aggregate concrete with lower weight aggregates produces light weight aggregate concrete.

The development in the construction industry all over the world is progressing. Attempts have also been made by various researchers to reduce the cost of its constituent and hence total construction cost by investigating and ascertaining the usefulness of material which could be classified as local materials. Some of these local materials are agricultural or industrial waste which includes coconut shell, concrete debris, fly ash, coconut among others which are produced from milling stations, thermal power station, waste treatment plant and so on. As a result of the increase in the cost of construction materials, especially cement, crushed stone (coarse aggregate), fine sand (fine aggregate); there is the need to investigate the use of alternate building materials which are locally available.

In this changing time, Demand of construction material is increased due to infrastructural development across the world. Now time has come to think of some alternative materials for sustainable use in concrete mix. Day by day mount and type of waste materials has increased accordingly creating environmental issues. Coconut is grown in more than 93 countries. South East Asia is regarded as the origin of coconut. India is the third largest, having cultivation on an area of about 1.78 million hectares.

Coconut shell is one of the waste material can also be used as a aggregate in concrete due to some reasons like large scale cultivation of coconut in coastal region of India including Kerala, Andhra Pradesh, Goa, Konkan, etc. due to tough made tissue, shell is not decomposed easily and remain as solid waste for years.

II. OBJECTIVE OF STUDY

The objectives of the study are:-

A. To cast specified number of cubes, by replacing fine aggregate with coconut shell by 10%, 15%, & 20% and to compare their property with standard mix(M20).
B. To find which percentage replacement is much cost efficient without affecting itsstrength.
C. To determine basic characteristics of the concrete such as compressive strengthdensity.
D. To prove that aggregate replaced concretes which are lightweight can be used for structural applications with equivalent strengths to normal weight concrete.
E. The coconut shell aims at analysing compressive strength of concrete (M20-1:1.5;3) produced using coconut shell as substitute for conventional coarse aggregate with 15%, 30%, 50% partial replacement.

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III. LITERATURE REVIEW

J.P. Ries studied that Lightweight aggregate (LWA) plays important role in today's move towards sustainable concrete, Lightweight aggregates contributes to sustainable development by lowering transportation requirements, optimizing structural efficiency that results in a reduction in the amount of overall building material being used, conserving energy, Reducing labor demands and increasing the survive life of structural concrete.

Amarnath Yerrmalla et al. studied the strength of coconut shells (CS) replacement and different and study the transport properties of concrete with CS as coarse aggregate replacement. They concluded that a. Increase in CS percentage decreased densities of the concrete with CS percentage increased the 7 days strength gain also increased with corresponding 28 days curing.

Agbedeand Menessh, the construction industry relies heavily on conventional materials such as cement, granite and sand for the production of concrete. The high and increasing cost of these materials has greatly hindered the development of shelter and other infrastructural facilities in developing countries

Adewuyi and Adegoke, Concrete is a combination of cement, fine and coarse aggregates and water, which are mixed in a particular proportion to get a particular strength. The cement and water react together chemically to form a paste, which binds the aggregate particles together. The mixture sets into a rock-like solid mass, which has considerable compressive strength but little resistance in tension.

IV. EXPERIMENTAL PROGRAMME

A. Properties Of Material

1) Cement

Table: 1 Physical properties of Portland pozzolana cement (PPC)

Sl.no	Physical properties	Values
1.	Specific gravity	3.12
2.	Standard consistency (%)	32
3.	Initial setting time (minutes)	105
4.	Final setting time (minutes)	260

2) Sand

Table: 2 Physical properties of sand

Sl.no	Physical properties	Values
1.	Retained in sieve size (micron)	300
2.	Specific gravity	2.51
3.	Fineness modulus	2.36
4.	Water absorption (%)	4.16

3) Coarse Aggregate

Table: 3 Physical properties of coarse aggregate

Sl.no	Physical properties	Values
1.	Retained in sieve size (mm)	12.5
2.	Specific gravity	2.69
3.	Fineness modulus	7.357
4.	Water absorption (%)	1.78

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4) Coconut Shell

TABLE: 4 Physical properties of coconut shell

Sl.no	Physical properties	Values
1.	Specific gravity	1.33
2.	Fineness modulus	7.28
3.	Water absorption (%)	26.59

V. RESULTS

A. Compressive Strength of Concrete (Coarse Aggregate Replaced by Coconut Shell)

Table: 5 Comparison of 7 days and 28 days compressive strength

Replacement (%)	7 days compressive strength (N/mm2)	28 days compressive strength (N/mm2)
Normal mix(without replacement)	13.86	21.00
15	12.07	19.81
30	10.72	18.53
50	8.76	17.33

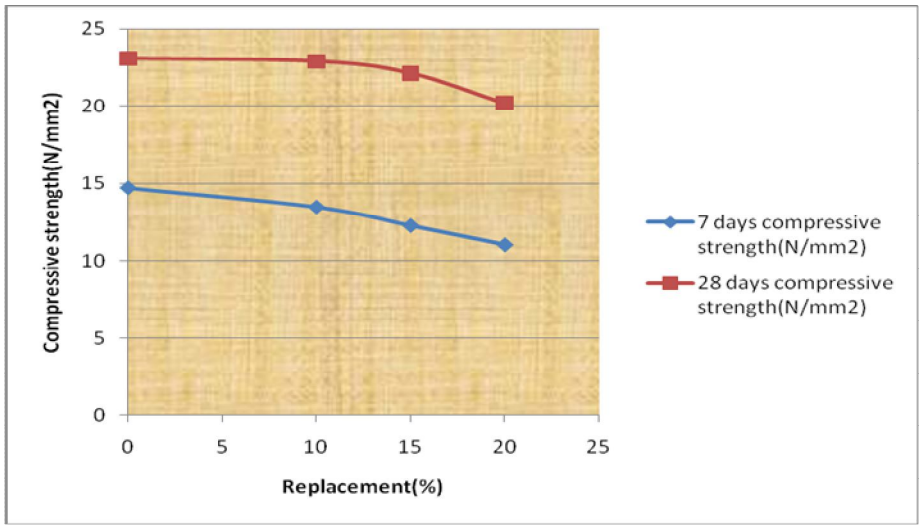

Figure 1: Comparison of 7 days and28days compressive strength

B. Flexural Strength Test Result for Coconut Shells Concrete

Table: 6 Flexural Strength Test Result for Coconut Shells Concrete

CS	7days	14 days	28 days	56 days	90 days
0	3.12	4.31	5.14	5.86	6.07
15	3.19	4.18	4.91	5.33	5.92
30	2.79	3.92	3.92	4.49	5.61
50	2.41	3.41	3.41	4.31	5.31

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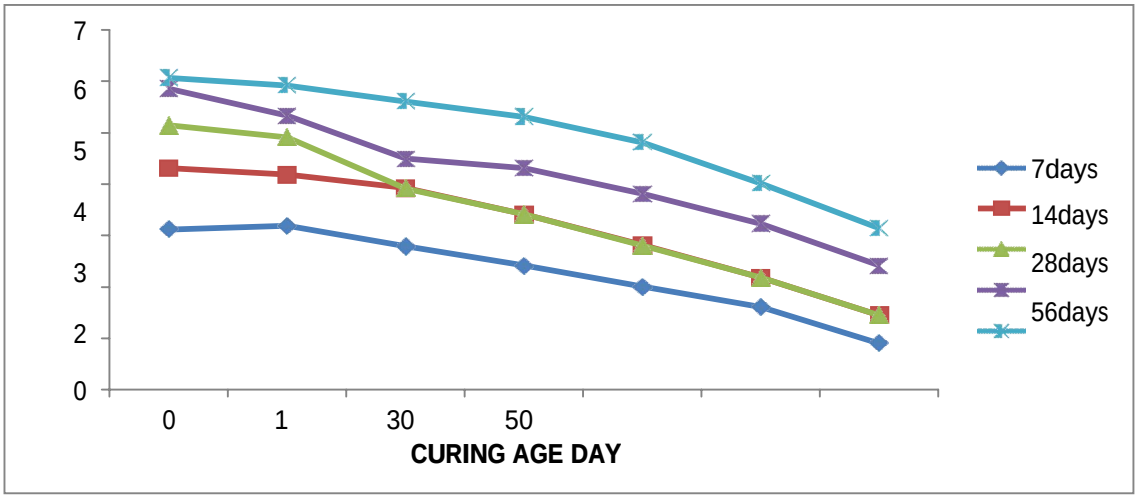

Fig: 2 Flexural Strength Test Result for Coconut Shells Concrete

The result obtained from compressive test conducted on concrete containing various percentage of coconut shell replacing coarse aggregate was as follows:

1) At 15% replacement of coarse aggregate by coconut shell gives 5.66% decrease in the compressive strength of concrete at 28days.

2) At 30% replacement of coarse aggregate by coconut shell gives 11.76% decrease in the compressive strength of concrete at 28days.

3) At 50% replacement of coarse aggregate by coconut shell gives 17.47% decrease in the compressive strength of concrete at 28days.

The result obtained from flexural strength test conducted on concrete containing various percentage of coconut shell replacing coarse aggregate was as follows:

a) At 15% replacement of coarse aggregate by coconut shell gives 4.47% decrease in the flexura;l strength of concrete at 28days.

b) At 30% replacement of coarse aggregate by coconut shell gives 23.34% decrease in the flexural strength of concrete at 28days.

c) At 50% replacement of coarse aggregate by coconut shell gives 33.61% decrease in the flexural strength of concrete at 28 days

VI. CONCLUSIONS

A. All the cases up to 10% replacement the compressive strength approximately same compare to normal mix and beyond 10% the compressive strength decreased upto 13% in sand replacement, decreased up to 17% in coarse aggregate replacement (50%) by coconut shell.

B. As weight of the concrete made by organic waste is light, it can reduce the dead load of the structure.

C. We can use the coconut shell in concrete when budget of construction work is low.

D. Use of the waste coconut in concrete can save the costs and a produce a greener concrete for construction.

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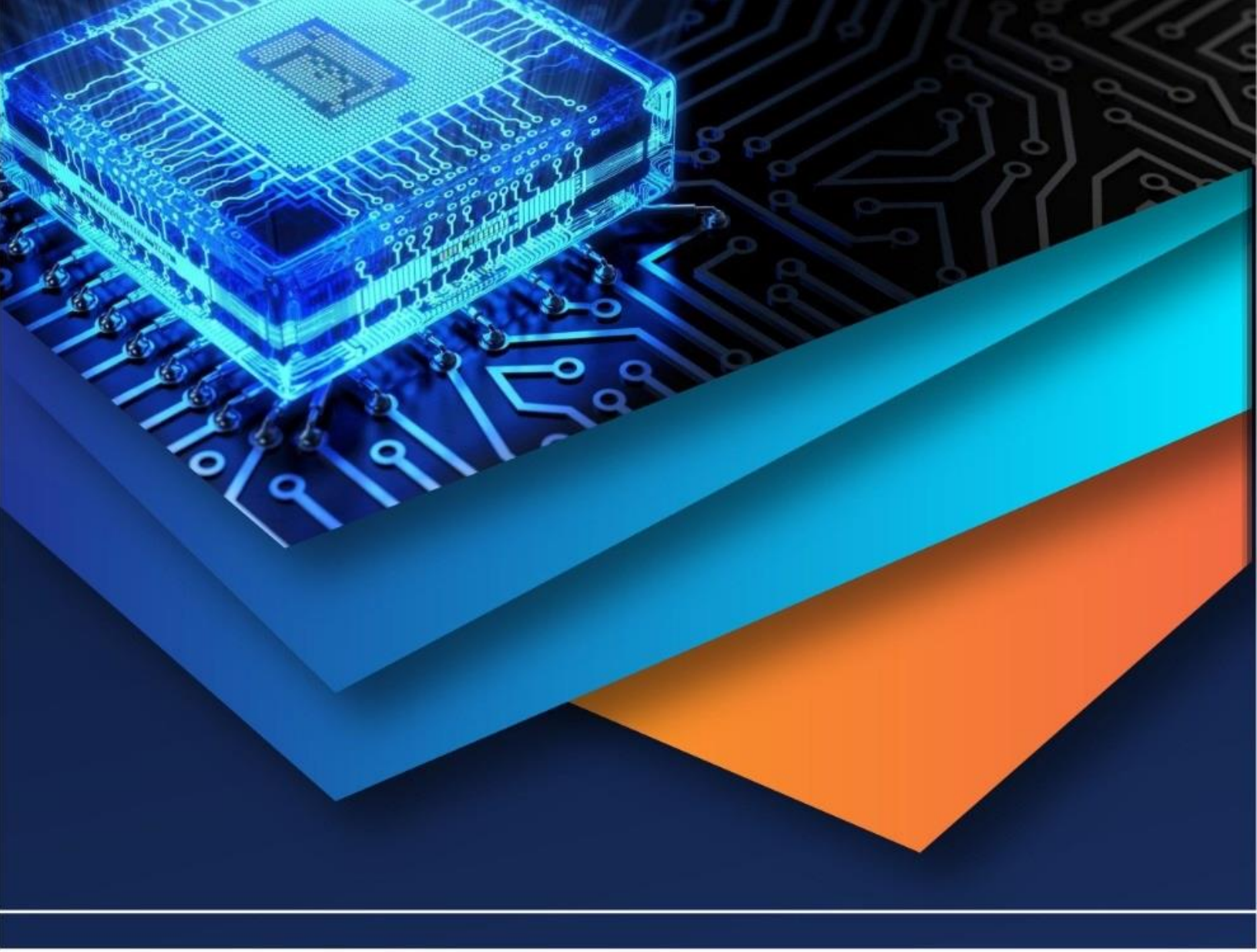

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