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Coconut: A Revolutionary Alternative In Construction Industry

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***Abstract*- As there is an economic boom there is an increasing demand for infrastructure in order to accommodate the requirement. As this will lead to high demand for natural construction material and this will deplete them quickly. This paper has been presented in order to give the developers an insight about the usage of alternate material and how it make the whole project structurally and economically feasible. A number of literature has been reviewed and ultimately the coconut shell has been highlighted for a variety of function such as landfill, light weight concrete and structural concrete. This paper contains a thorough investigation on the application of coconut shell in structural concrete with the percentage of replacement of coconut shell partially. The experiment has been done in this project has considered 7 days and 28 compressive strength of concrete with no replacement 5%, 10%, 15%, 20% and 25%.The coconut shells are widely available natural material and can be helpful to contribute to the sustainability of the construction.**

Keywords- Coconut shell, Concrete, Sand Aggregate

I. INTRODUCTION

Nowadays, solid waste management is being thought of as a grave concern in India because of a massive population, because of major issue. because the results of that an enormous pile of waste generated, a number of the causes are increase in population, healthiness and ever-changing lifestyles in India,

The environmental restrictions are enacted including the strict management of waste disposal sites, resource restrictions and accenting the awareness of the general public regarding the depletion of natural resources, and therefore the long run impact of temperature change caused by global warming. Annual production represents close to 1.5 ton for each person on the world. Aggregates are the biggest constituent within the concrete. Regarding 70–80% of the degree of structural concrete is occupied by aggregates, within which 25–30% is occupied by fine combination and 40–50% is occupied by coarse combination. Amount and properties of coarse combination has hefty impact on varied characteristics and properties of concrete. Generally, rocks which had been crushed are used as aggregates along with river sand. Because of rise of construction activities, standard combination sources are depleting in no time resulted in inadequacy of resources. For property development, these materials ought to be used sagely and at a similar time different materials have to be compelled to be searched to interchange standard combination. Besides, these crushed aggregates could contain a proportion of irrespirable crystalline silicon dioxide or free silicon dioxide that releases throughout the assembly and handling and will cause health issues or skin irritation.

II. MATERIAL USED

Ordinary Portland cement is used as binding material, Tap water, Crushed quarry rocks and river sands as other ingredients. Crushed coconut shells are used as replacement for coarse aggregates, their description is as follows

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1.Cement - Test were conducted on OPC grade 53 cement and the results are presented in Table 1.

2. Fine aggregate - Sand which is of Zone III was used as fine aggregate great number of test were conducted to determine the properties of natural sand. Sieve analysis was conducted and shown in Table 2 and the other physical properties are presented in Table 3.

3.Crushed coarse aggregates - Crushed coarse aggregates were used in as two categories mixed in a ratio of 2:3 in order to achieve grading of 20 mm size nominal aggregate. Indian Standard was followed to while testing materials. The test results are presented in Table 4.

4. Coconut Shell - Crushed coconut shells were used with particle size of 12 mm for the experimental work. The aggregates were tested for the various parameters shown in the Table 5.

Table 1 Test result of cement

S.N.	Characteristics	Values obtained	Standard values
1.	Normal Consistency	33%	-
2.	Initial Setting time	48 min	Not be less than 30 minutes
3.	Final Setting time	240 min	Not be greater than 600 minutes
4.	Fineness	4.8 %	<10
5.	Specific gravity	3.09	-
Compressive strength:- Cement : Sand (1:3)			
1.	3 days	24.5 N/mm^2	27 N/mm^2
2.	7 days	35 N/mm^2	41 N/mm^2
3.	28 days	53.5 N/mm^2	53 N/mm^2

Table 2 Sieve analysis

IS Sieve Size (mm)	Weight retained (gm.)	% Weight retained	Cumulative weight retained (gm.)	Cumulative percentage weight retained	% finer 100-Col(4)
3.75 mm	-	-	-	-	100
2.36 mm	11	1.1	11	1.1	94.49
1.18mm	190	19	201	20.1	74.59
600µ	328	32.8	529	52.9	44.1
300µ	436	43.6	965	96.4	3.15
150µ	28	2.8	993	99.5	0.7
Pan	7	0.7	1000	100	0

Table 3Test on fine aggregates

Characteristics	Value
Type	Uncrushed (natural)
Specific gravity	2.65
Total water absorption	1.01 %
Fineness modulus	2.699
Grading zone	III

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Table 4 Test on coarse aggregates

Characteristics	Value
Type	Crushed
Maximum size	20 mm
Specific gravity (20 mm)	2.68
Total water absorption (12 mm)	0.8 %

Table 5 Test on crushed coconut shell

Tests on Coarse aggregate	Coconut shell aggregate
Max size	12
Specific gravity	1.29
Bulk density(kg/l)	0.681
Void ratio	0.894
Porosity (%)	47.2
Aggregate abrasion value	4.66
Impact value of aggregate (%)	5.51
Aggregate crushing value (%)	5.28
Water absorption ratio	0.3

III. METHODOLOGY

The present study requires preliminary investigations in a systematic manner

- Selecting the mix, designing the mix by IS code and then by trail methods.
- Finalizing the required quantity of ingredients.
- Determining the respective properties of all the ingredients.
- Casting cubes with coconut replacement as 0%, 5%, 10%, 15%, 20% and 25% of coarse aggregate.
- Testing the casted cubes in CTM(Compression Testing Machine).

Procedure

1. Mix proportions - Coconut shell aggregates Properties were scrutinized by casting cubes of M30. Each mix containing 6 cubes of coconut shell concrete. The natural coarse aggregates were replaced as 0%, 5%, 10%, 15%, 20% & 25% by coconut shells. The mixes of M30 were casted 3 samples each.

IV. RESULT

For the above mentioned samples with varying percentages of coconut shell as replacement for the coarse aggregate compressive strength test was performed following tables as well as chart represent the findings.

Table 6 Compressive strength of Partial replaced concrete

Replacement	7 days	28 days
0%	22.07	32.9
5%	24.235	30.51
10%	20.4	28.85
15%	23.89	30.8
20%	18.56	26.245
25%	18	26.72

Fig.1 Graph representing Compressive Strength of 7 days & 28 days of replaced coconut shell with aggregates

V. CONCLUSIONS

1. It was found that as we increase the percentage of coconut shell the percentage of strength decreases with a kink at 15%.
2. This 7 days strength for shows a gradual decrease in strength however a sudden change is noted at 15%.
3. The value at 15% for 7 days compressive strength was found to be 23.89 MPa.
4. This 28 days strength for shows a gradual decrease in strength however a sudden change is noted at 15%.

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5. The recorded value of 15% 28 days compressive strength is 30.8 MPa.

It can be concluded that the replacement of coconut shell can be replaced upto 15 % to be used in members having high load bearing requirement.

REFERENCES

[1] K. Gunasekaran, R. Annadurai, S. Prakash Chandar, S. Anandh, "Study for the relevance of coconut shell aggregate concrete non-pressure pipe," ELSEVIER/ASEJ , 2016.

[2] Damre Shraddha, Firake Hitali, Dode Pradeep, Shrikant Varpe, "Sustainable Concrete by Partially Replacing Coarse Aggregate Using Coconut Shell," Journal on Today's Ideas – Tomorrow's Technologies, Vol. 2, No. 1, June 2014 pp. 1–14.

[3] Pravin V. Khandve, Shrikant M. Harle, "Coconut Shell As Partial Replacement Of Coarse Aggregate In Concrete: Review," IJPRET, 2014; Volume 2 (9): 62-66.

[4] Cordilia Marboh, Amrita Agnihotri, Rajni Raja Tomar, Rahul Kumar Satbhaiya, "Behaviour Of Reinforced Concrete Beams With Coconut Shell As Coarse Aggregates," in IJEMMR Vol- 1 , Issue- 6 , JUNE - 2015.

[5] Maninder Kaur, Manpreet Kaur, "A Review on Utilization of Coconut Shell as Coarse Aggregates in Mass Concrete," IJAER ISSN 0973-4562 Vol. 7 No.11 (2012) .