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PARTIAL REPLACEMENT OF COCONUT SHELL IN CONCRETE AS COARSE AGGREGATE

Rakesh Kumar Muduli[*1], Ranjeeta Madhei[*2], Swatismita Sahoo[*3], Shibasis Dehury[*4], Ananya Punyotoya Parida[*5]

[*1,2,3,4]Student, Civil Engineering, Gandhi Institute For Technology, Bhubaneswar, Odisha, India.

[*5]Professor, Department of Civil Engineering, Gandhi Institute For Technology, Bhubaneswar, Odisha, India.

ABSTRACT

The increasing cost of conventional aggregates affects the economy of our country. Due to this, excessive exploitation of aggregates occurs. It creates environmental issues and as a result, certain restrictions were put forward by the government, in order to stop these exploitations. Now, it is essential to find out a new source of aggregates. In the present work, coconut shell is selected as a partial replacement of coarse aggregate in concrete. Coconut shell is a waste material, and the amount of these wastes is increasing day by day. Usage of these as aggregates will reduce its presence as a waste material from earth. Coconut shell is a lightweight material thus producing light weight concrete. It also helps in reducing the cost of concrete manufacturing. In this project, coarse aggregate is replaced by 5%, 10%, 15%, 20%, 25% and 30% of coconut shell. Design mix used is M15 (1:2:4) grade and the testing of specimens was conducted after 7, 14 and 28 days of curing. In this research we have done compressive Strength comparison between conventional concrete with replacement coconut shell concrete. Its usage is cost effective.

Keywords: Coconut shell, Coarse Aggregate, Replacement.

I. INTRODUCTION

Concrete is premier construction material around the world and is most widely used in all types of construction works, like infrastructure, low and high- rise buildings and domestic development. With increased population and modern living habits, production of waste material is increased at fast pace and its disposal has become a genuine problem. To minimize the waste, we can utilize the waste material for some positive activity. Coconut shell can be used as a coarse aggregate to produces low-cost concrete and light weight concrete. Furthermore, the usage of coconut shell in construction can reduce of environmental pollution. In this project we have do concrete using fine aggregate, coarse aggregate, coconut shell used percentagewise, cement and water.

II. METHODOLOGY

This chapter describes the methodology and materials used to achieve the objectives. The main materials characterized in the present study are cement, fine aggregate, coarse aggregate, and coconut shell; experimental methodology followed for characterization of these materials are discussed. A brief introduction about the above materials and methodology is presented in the following section in this chapter.

Material Specification

For the production of concrete, the constituent materials are cement, fine aggregate, coarse aggregate, coconut shell and water. To get better workability and strength, the material used should have better quality. To maintain the safety of any structure, provisions are provided as per IS 456:2000.

Ordinary Portland Cement

Ordinary Portland cement is the most important type of cement and is a fine powder produced by grinding Portland cement clinker. The OPC is classified into three grades, namely 33 grade, 43 grade, 53 grade depending upon the strength of 28 days. It has been possible to upgrade the qualities of cement by using high quality limestone, modern equipment's, maintaining better particle size distribution, finer grinding and better packing. Generally, use of high-grade cement offers many advantages for making stronger concrete. Ordinary Portland cement (OPC) of 53 Grade (UltraTech cement, Ambuja cement) was used throughout the course of the investigation. Cement was carefully stored to prevent deterioration in its properties due to contact with the

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moisture. The various tests conducted on cement are initial and final setting time, specific gravity, fineness, and compressive strength.

Fine Aggregate

Fine aggregate is the essential ingredient in concrete that consists of natural sand or crushed stone. The quality and fine aggregate density strongly influence the hardened properties of the concrete. The concrete or mortar mixture can be made more durable, stronger, and cheaper if you made the selection of fine aggregate on basis of grading zone, particle shape and surface texture, abrasion and skid resistance and absorption and surface moisture.

Coarse Aggregate

Aggregates constitute the bulk of a concrete mixture and give dimensional stability to concrete. To increase the density of resulting mix, the aggregates are frequently used in two or more sizes. The most important function of the fine aggregate is to assist in producing workability and uniformity in mixture.

Coconut Shell

Coconut shells used in the study are brought from local temple. The coconut shells are sundried for five days before using it as an aggregate. The cleaning of coconut shell is carried with the help of sandpaper, the smaller extractions on the outer face of coconut is cleaned with the help of water. The outer shell is then broken in smaller parts up to 20 mm. The broking of coconut shell is done with the help of 30 kg hammer. Then the broken pieces are passed through IS 20 mm sieve and pieces are retained on a IS 16mm sieve are used.

Water

Water is a key ingredient in the manufacture of concrete. Water used in concrete mixes has two functions: the first is to react chemically with the cement, which will finally set and harden, and the second function is to lubricate all other materials and make the concrete workable.

III. MIX DESIGN CALCULATION

Although coconut shell replacement concrete contains the same basic ingredients as the conventional concrete only coconut shell added, the proportions of the ingredients can vary percentagewise.

Mix proportion for M15 grade of conventional concrete

Volume of the cube = (150*150*150) mm^3

Unit weight of concrete = 2400 Kg/m^3

Total concrete required for 1 cube = Unit weight of concrete*Volume

$= 2400*3.375*10^{-3} = 8.1$ Kg

Material required for M15 grade concrete, (M15 = 1:2:4)

Total weight of concrete = Total part

=>1 part = Total weight of concrete/Total part

Total part of concrete, x+2x+4x =7x

=>7x = 8.1 Kg

=>x = 8.1/7 = 1.15 Kg(Cement)

Sand =>2x = 2*1.15 = 2.3 Kg

C.A =>4x = 4*1.15 = 4.6 Kg

Material calculation of 5%, 10%, 15%, 20%, 25%, 30% replacement concrete

Sand = 2.3kg

Cement = 1.15kg

Sand and cement calculation are same for all percentage.

Total weight of coarse aggregates =4.6 kg (for one cube)

1. 5% of coarse aggregate = 4.6*5/100 = 0.23kg (Coconut Shell)

Remaining Coarse aggregate = 4.37kg

2. 10% of coarse aggregate = 4.6*10/100 = 0.46 kg (Coconut Shell)

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Remaining Coarse aggregate = 4.14kg

3. 15% of coarse aggregate = 4.6*15/100 = 0.69 kg (Coconut Shell)

Remaining Coarse aggregate = 3.91kg

4. 20% of coarse aggregate = 4.6*20/100 = 0.92 kg (Coconut Shell)

Remaining Coarse aggregate = 3.68kg

5. 25% of coarse aggregate = 4.6*25/100 = 1.15 kg (Coconut Shell)

Remaining Coarse aggregate = 3.45kg

6. 30% of coarse aggregate = 4.6*30/100 = 1.38 kg (Coconut Shell)

Remaining Coarse aggregate = 3.22kg

IV. TEST RESULTS

Conventional Concrete

Table 1: 0% Replacement

Days	Compressive strength		
	1	2	Mean (N/mm²)
7 days	12.8	10.6	11.7
14 days	14.2	13.7	13.92
28 days	15.5	15.5	15.5

Table 2: 5% Replacement

Days	Compressive strength		
	1	2	Mean (N/mm²)
7 days	10.5	10.1	10.3
14 days	12.5	11.9	12.2
28 days	15.5	15.3	15.4

Table 3. 10% Replacement

Days	Compressive strength		
	1	2	Mean (N/mm²)
7 days	9.1	8.7	8.9
14 days	10.6	9.8	10.2
28 days	14.5	13.9	14.2

Table 4. 15% Replacement

Days	Compressive strength		
	1	2	Mean (N/mm²)
7 days	8.4	7.1	7.75
14 days	9.3	9.1	9.2
28 days	10.8	10.5	10.65

Table 5. 20% Replacement

Days	Compressive strength		
	1	2	Mean (N/mm²)
7 days	5.3	5.1	5.2

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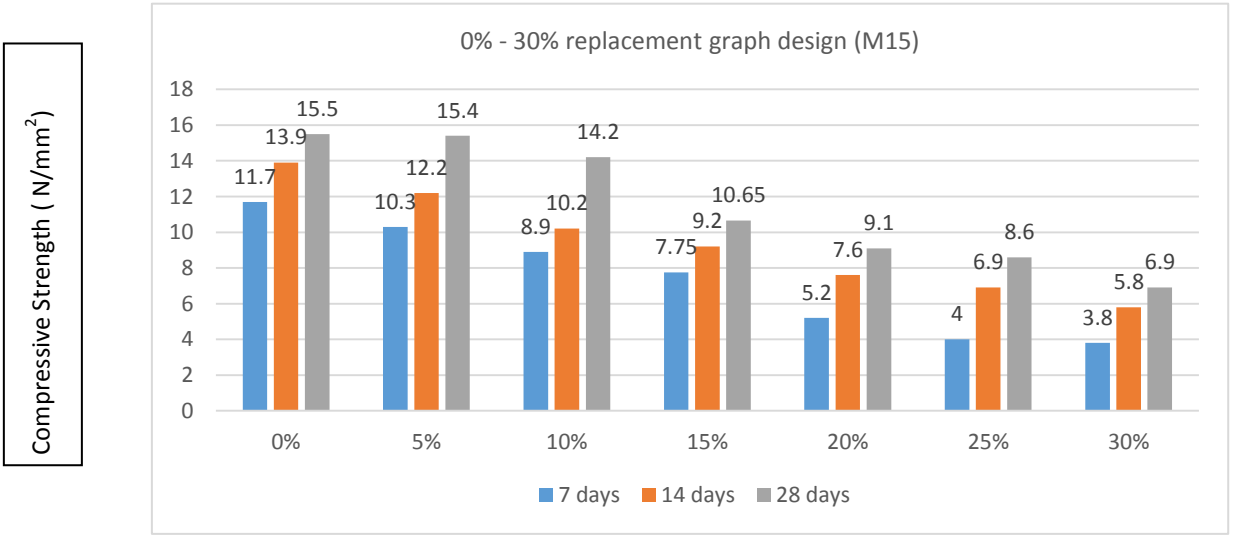
14 days	**7.9**	**7.3**	**7.6**
28 days	**9.3**	**8.9**	**9.1**

Table 6. 25% Replacement

Days	**Compressive strength**		
	1	**2**	**Mean (N/mm²)**
7 days	**4.1**	**3.9**	**4**
14 days	**7.1**	**6.7**	**6.9**
28 days	**8.9**	**8.3**	**8.6**

Table 7. 30% Replacement

Days	**Compressive strength**		
	1	**2**	**Mean (N/mm²)**
7 days	**8.4**	**7.1**	**3.8**
14 days	**5.9**	**5.7**	**5.8**
28 days	**7.1**	**6.7**	**6.9**



Column Chart

V. APPLICATIONS

Coconut shell concrete used in partition wall, compound wall, because in this experiment we know that the compressive strength of coconut shell replace concrete decreasing percentagewise as compared to conventional concrete so that we can use this concrete for partition wall, compound wall. It is used as low-cost housing because coconut shell price is very economy as compared to conventional aggregate. This concrete used in rural areas, where cost of coarse aggregate is more.

VI. CONCLUSION

Till now from our experiment, we have concluded that, in addition of 5% replacement of coconut shell as coarse aggregate we will got compressive strength of concrete nearly same as the conventional concrete. In addition of 10%, 15%, 20%, 25%, and 30% replacement of coconut shell as coarse aggregate we will get that the compressive strength of concrete as compared to conventional concrete decreases so we used this percent of replacement in temporary work like garden, walking area, parking area, etc. we can use 5% of replacement of coconut shell in permanent construction work like building, road construction, boundary wall, partition wall, etc.

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VII. FUTURE SCOPE

keeping insight the economic condition and cost-effective construction this project has really very good future scope. We have done various tests on the concrete by partially replacing the coarse aggregate by 5%, 10%, 15%, 20%, 25% and 30% with coconut shell. For future development in the project there can be some improvement in the materials and can add some admixture to increase in the properties and strength of the concrete. This concrete can be used in any type low/medium load bearing structure. This concrete applicable on partition wall, compound wall, low-cost housing.

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