



IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

e-ISSN: 2319-8753 | p-ISSN: 2320-6710



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 5, May 2022

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.118



9940 572 462



6381 907 438



ijirset@gmail.com



www.ijirset.com

Replacement of Coarse Aggregate with Coconut Shell in Concrete

Prof. Shaikh S.J.¹, Apurv Oak², Bhavesh Wagh³, Vishal Jadhav⁴, Vishal Sable⁵, Muneeb Shaikh⁶,
Kartik Untwal⁷

Associate Professor, Department of Civil Engineering, MGM's Polytechnic College, Aurangabad, Maharashtra, India¹

Diploma Student, Department of Civil Engineering, MGM's Polytechnic College, Aurangabad, Maharashtra, India²

Diploma Student, Department of Civil Engineering, MGM's Polytechnic College, Aurangabad, Maharashtra, India³

Diploma Student, Department of Civil Engineering, MGM's Polytechnic College, Aurangabad, Maharashtra, India⁴

Diploma Student, Department of Civil Engineering, MGM's Polytechnic College, Aurangabad, Maharashtra, India⁵

Diploma Student, Department of Civil Engineering, MGM's Polytechnic College, Aurangabad, Maharashtra, India⁶

Diploma Student, Department of Civil Engineering, MGM's Polytechnic College, Aurangabad, Maharashtra, India⁷

ABSTRACT: Concrete is widely used construction material, its manufacturing includes utilization of ingredients like cement, sand, aggregates, water and required admixtures. Natural resources such as river sand and coarse aggregate are depleting at an alarming level in developing countries like India. There is a need to explore and to find out suitable replacement material to substitute the natural stone. Coconut are being naturally available in nature and since its shells are non-biodegradable; they can be used readily in concrete. Coconut shell may offer itself as a coarse aggregate as well as a potential construction material in the field of construction industries and this would solve the environmental problem of reducing the generation of solid wastes simultaneously. India is the third largest producer of coconut products in the world. In this experimental study replacement of coarse aggregate with coconut shell is determined. The coarse aggregates were replaced by coconut shell in 4 different percentages 0%, 5%, 10%, and 15%. M40 grade of concrete is adopted and we designed it. 150 X 150 X 150 mm size of mould is used. The purpose of this research is to disseminate awareness of using coconut shell as partial replacement of coarse aggregate in concrete and determining its compressive strength.

KEYWORDS: Concrete, coconut shell, replacement, non-biodegradable.

I. INTRODUCTION

Concrete is the most commonly used construction material in the construction industry, its importance and usage in the modern society cannot be ignored, concrete is the product of mixing cement, fine aggregate, coarse aggregates, water and required admixtures. Now time has come to think of some alternative materials for sustainable used in concrete mix. Day by day amount and type of waste material has increased accordingly creating environmental issues. Coconut is grown in more than 93 countries; India is the third largest producer of coconut products in the world. Coconut shell is one of the waste materials can also be used as an aggregate in concrete due to some reasons like large scale cultivation of coconut in coastal region of India including Kerala Andhra Pradesh, goa, kokan etc. due to tough made tissue, coconut shell not decomposed easily and remain as solid waste for years.

Due to rapid industrialization and constructions in developing country like India, natural resources are depleting constantly. Search of alternative material for making concrete is a prime need in present scenario.

Utilization of concrete is increasing at a very high rate due to infrastructural development activities in the world. Concrete is one of the world's most widely construction material. In addition, concrete is second most consumed substance in the world after water. Approximately 10 billion tons of concrete is produced every year. There are some negative impacts of more production of concrete like continuous extensive extraction of aggregate from natural sources will lead to its depletion and ecological imbalance.

The goal of this study is to discuss on the strength of coconut shell of concrete at high demand for concrete within construction mistreatment traditional weight aggregates like granite and gravel extremely decreases the deposits of natural stone which broken the atmosphere. Coconut shell is associate as agricultural waste.

II. RELATED WORK

In this project, we were started the study on coconut shell concrete and we used Admixture (superplasticizer) to increase the workability, bonding of concrete. We studied all the properties of coconut shell, admixture, coarse aggregate, fine aggregate and cement. M40 grade of concrete is adopted for mix design of concrete for mix design we refer IS10292-2009. 150 X 150 150 mm size of mould is used for testing of concrete blocks and we assume 20% of wastage while mix designing. PPC 53 grade of cement, the aggregate passing from 20 mm sieve and retained on 10 mm sieve is used, fine aggregate passing from 4.75 mm sieve is used, coconut shell passing from 20 mm sieve and retained on 10 mm sieve is used in this study.

An optimum percentage replacement of coconut shell with coarse aggregate were conducted in the present investigation. Coarse aggregate was replaced by coconut shell is different percentages 0%,5%,10%,15%. After 7 and 21 days of curing the specimen is removed from water and then compressive strength tests are performed on the concrete cubes. M40 grade of concrete is casted and water cement ratio of 0.40 was taken in the present investigation.

III. METHODOLOGY

3.1 Collection of Materials

A) Cement

In this study we used Portland Pozzolana cement (PPC) this cement is manufactured by the intergrading of OPC clinker with 10 to 25 per cent of pozzolanic material (as per the latest amendment, it is 15 to 35%). A pozzolanic material is essentially a silicious or aluminous material which while in itself the possessing no cementitious properties, which will, in finely divided form and in the presence of water, react with calcium hydroxide, liberated in the hydration process, at ordinary temperature, to form compounds possessing cementitious properties.

Physical Properties of Cement

- Normal consistency - 32 %
- Initial setting time (min) - 55
- Final setting time (min) - 340
- Specific gravity -3.15
- Fineness - 8%
- Compressive strength - 53 MPa

B) Fine aggregate

Fine aggregates are basically natural sand particles from the land through the mining process, the fine aggregates consist of natural sand or any crushed stone particles that are ¼" or smaller. The particle size less than 4.75 mm classified as fine aggregates. The maximum size used is 80 mm and the range of 80 mm to 4.75 mm is known as coarse aggregate and 4.75 to 150 µm is called 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 sieve analysis is conducted to determine particle size distribution, the aggregate passing from 4.75 mm sieve is used for making the concrete.

Properties of fine aggregate

- Specific gravity - 2.65
- Fineness modulus - 2.86
- Water absorption – 1.8%

C) Coarse aggregate

Coarse aggregate in concrete occupies 65% to 70% of the volume of the concrete. smaller sized aggregates produced higher concrete strength Particle shape and texture affect the workability of fresh concrete. Usually, an aggregate with specific gravity more than 2.55 and absorption less than 1.5% can be regarded as being of good quality. Where aggregates strength is higher, concrete strength is also higher, Fractions from 20 mm to 4.75 mm are used as coarse aggregate. .

Properties of Coarse Aggregates

- Specific gravity - 2.74
- Sieve analysis as per IS code limit
- Water absorption – 0.5%

D) Coconut shell

The study of coconut shell as an alternative for aggregates is another way of using the contributions a coconut tree will provide. The coconut shell was available in various shapes, such as curved, flaky, elongated, roughly parabolic and other irregular shapes. Coconut shells which were already broken into pieces or as a whole are collected from local temples and then washing is done for all the coconut shell then, air dried for 2 days approximately to remove the moisture content. Then crushing is done with the help of hammer and then crushed coconut shell is sieved such that it passes from 20 mm sieve and retained on 10 mm sieve. The material between 20 -10 mm sieve was used to replace coarse aggregate with coconut shells.

Properties of coconut shell

- Its high strength and modulus properties.
- Its high lignin content that makes the composites more weather resistant.
- Its low cellulose content due to which it absorbs less moisture as compared to other agricultural waste.
- Low density and environment friendly
- Coconut shell are more resistant towards crushing, impact and abrasion.

E) Water

The amount of water in concrete controls many fresh and hardened properties in concrete including workability, compressive strengths, permeability and watertightness, durability and weathering, drying shrinkage and potential for cracking. Water is an important factor of concrete as it actually participates in the chemical reaction with cement. Water used for all the experimental study is obtained from the laboratory and it is portable water, adequate for drinking. Thus, it is assumed for making good concrete. portable water conforming to IS 456-2000 is used for casting and curing.

F) Admixture

In this experimental we used water reducing superplasticizer (High Range Water Reducers) They are chemically different from normal plasticizers. Use of superplasticizers permit the reduction of water to the extent up to 30 per cent without reducing workability in contrast to the possible reduction up to 15 per cent in case of plasticizers.

Advantages of Superplasticizer

- Superplasticizers reduces water content
- It reduces cement content
- Also increase workability of concrete
- It reduces permeability of concrete
- It develops the early strength.

Disadvantages of Superplasticizer

- Slump loss are greater than conventional concrete.
- Addition cost for admixture.
- They increase air entrainment in concrete

3.2 M40 Concrete mix design

The mix design for M40 grade of concrete is done as per IS 10262-2009.

Mix proportions for One Cum of concrete

Cement	- 350 kg/m ³
water	-140 kg/m ³ kg/m ³
Fine aggregate	- 896 kg/m ³
Coarse aggregate	-1140kg/m ³
Admixture	-7 kg/m ³
Water- cement ratio	-0.40

Mix proportions for 0.15 Cum of concrete

Cement - 1.418 kg

Water -0.566 kg

Fine aggregate -3.628 kg

coarse aggregate - 4.620 kg

Admixture - 0.27 kg

Water – cement ratio -0.40

Coconut shell - 5% Replacement = 0.230 gm

10% Replacement = 0.460 gm

15% Replacement = 0.692 gm

3.3 System development

1. Crushing of coconut shell is done with the help of hammer.



Fig no 1- Crushing of coconut shell

2. Sieving of coarse aggregate, fine aggregate, coconut shell is done.



Fig no 2 - Sieving of coarse aggregate, fine aggregate, coconut shell

3. Mixing of concrete and filling of concrete in cube in 3 layers.



Fig no 3 - Mixing and filling of concrete in 3 layers

4. Compaction of concrete by using tamping rod in 3 layers giving 30-35 no. of blows to each layer for zero air void.



Fig no 4 - Compaction of concrete.

6. Curing of cubes for 7 and 21 days.



Fig no 5- Curing of cubes for 7 and 21 days.

7. Compressive testing of concrete cubes on universal testing machine after 7 and 28 days



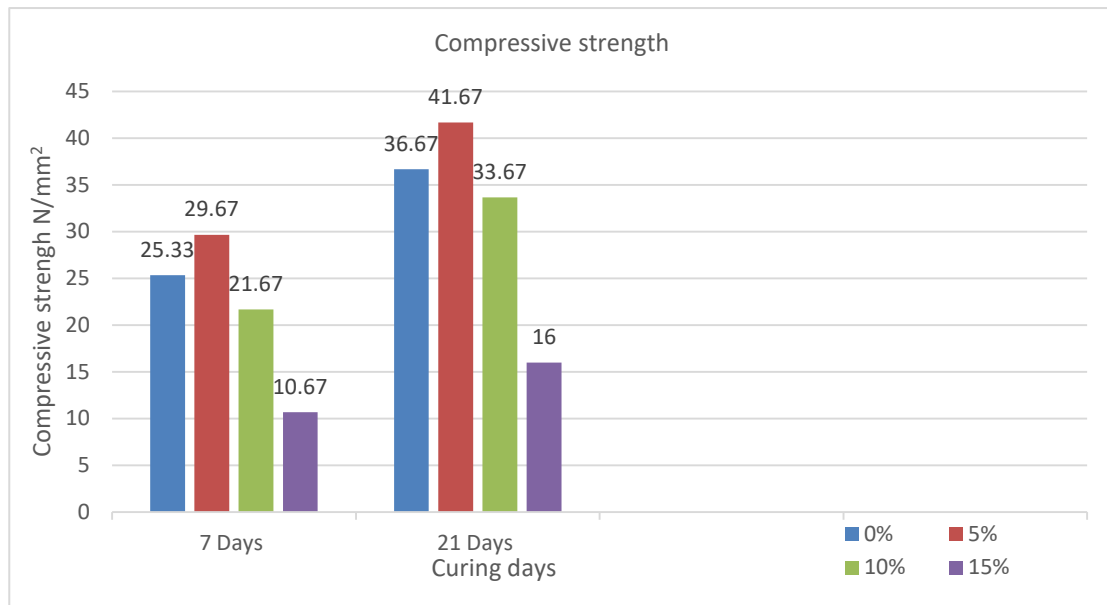
Fig no6 -Compressive testing of concrete cubes on universal testing machine after 7 and 28 days.

IV. EXPERIMENTAL RESULTS

Table No. 1 Compressive strength of concrete

Percentage coconut shell	Cube no.	Compressive Strength at 7days (N/mm ²)	Average (N/mm ²)	Compressive strength at 21 days (N/mm ²)	Average (N/mm ²)
0%	1	28	25.33	31	36.67
	2	23		39	
	3	25		40	
5%	1	29	29.67	44	41.67
	2	27		41	
	3	33		40	
10%	1	23	21.67	35	31.67
	2	20		30	
	3	22		36	
15%	1	10	10.67	21	16
	2	11		17	
	3	11		10	

- From above results at 5% replacement of coarse aggregate with coconut shell concrete gives maximum compressive strength as compared to other percentage.
- For 7 days = 29.67 N/mm² for 21 days = 41.67 N/mm².



V. CONCLUSION

The coarse aggregate was partially replaced by coconut shell in this study. Coconut shell concrete is obtained. At 5% replacement of coarse aggregate with coconut shell concrete gives maximum strength for 7 and 21 days. Mix design Of M40 grade of concrete is determined. Maximum strength is obtained in 7 days is 29.67 N/mm² and for 21 days is 41.67 N/mm². As per results strength of coconut shell concrete is increases at 5% replacement. So, compressive strength is decreases as percentage of coconut shell is increased. Therefore 5% replacement is optimum. Concrete obtained using coconut shell satisfy the minimum requirements of concrete.

REFERENCES

- [1] Dr. B. Rajeevan, and Shamjith K M. A Study on the Utilization of Coconut Shell as Coarse Aggregate in Concrete.
- [2] Prashant B. Raut. Study of behavior concrete structure by using coconut shell.
- [3] Ismail Saifullah, md. Abdul Halim, and md zahur-uz-zaman. Coconut shell as a replacement of coarse aggregate in lightweight concrete.
- [4] Sanjay Kumar Verma and Sagar Shrivastava. Use of Coconut Shell as Partly Substitution of Coarse Aggregate - An Experimental Analysis.
- [5] B. Sandeep Reddy CH. and Gopichand and B. Anusha. Experimental Investigation of Concrete using Coconut Shell as a Coarse Aggregate Replacement.
- [6] Afolayan, J. O., Ejeh, S. P Amartey, Y. D. and Idris. A use of coconut shell as coarse aggregate in lightweight concrete.
- [7] N.Santhoshkumar , P.Bavatharini , M.Gokulapriya and M.Janani , C.Jeeva.. Experimental study on concrete using coconut shell and coir fiber by partial replacement method.
- [8] Jerin M. George, Ashish Babu, George Franco and Aseem Ali P]. Coconut Shell as a Substitute for Coarse Aggregate in Concrete.
- [9] Yogesh Narayan, Sonawane, Chetan and Jaiprakash Chitte. Waste Coconut Shell as a Partial Replacement of Coarse Aggregate in Concrete Mix - An Experimental Study.
- [10] Parag S. Kambli and Sandhya R. Mathapati.. Application of Coconut Shell as Coarse Aggregate in Concrete: A Technical Review.
- [11] Vipul Mhatre, nimesh Pandey, akshay Bhosle, Rohan more, Shweta motharkar Concrete using coconut shell as a coarse aggregate.
- [12] K. Gunasekaran, P.S. Kumar. Lightweight Concrete Using Coconut Shells as Aggregate.



Impact Factor: 8.118



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 **9940 572 462**  **6381 907 438**  **ijirset@gmail.com**



www.ijirset.com

Scan to save the contact details