iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 3 **Issue:** II **Month of publication:** February 2015

DOI:

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Experimental Study of Coconut Shell Concrete

Chandraul Kirti[1] , Singh Manindra Kumar [2] , Saxena Anil Kumar[3] , Arora T. R.[4]
[1] M.Tech. Student, [2] M.Tech. Student, [3] Associate Professor, [4]Head Of Department
[1,2,3,4]Lakshmi Narayan College of Technology, Department of Civil, Bhopal

Abstract - The rising cost of construction materials in developing countries has necessitated research into the use of alternative materials civil engineering construction. In this study, a concrete mix of 1:1.51:3.06 was used as control, while coconut shells were used to replace crushed granite by volume. 36 cubes were produced and compressive and tensile strengths were evaluated at 7 days, 14 days and 28 days. The density and compressive strength of concrete reduced as the percentage replacement increased. Aggregate replaced by coconut shell with ratios 0%, 20%, 40%, 60%, 80% and 100% with water cement ratio of 0.5. The results of the study showed that concrete produced by replacing 40% of the crushed granite by coconut shells can be used in concrete construction. A potential exists for the use of coconut shells as replacement of conventional aggregate in both conventional reinforced concrete and lightweight reinforced concrete construction. The use of coconut shells as partial replacement for conventional aggregates should be encouraged as an environmental protection and construction cost reduction measure.
Keywords: concrete, coconut shells, compressive strength, coconut shell concrete

I. INTRODUCTION

Coconut shell is used as light weight aggregate in concrete. Coconut shells are by-products of coconut oil production. Coconut shells are used in the production of activated carbon due to hardness and high carbon content. Various researchers have investigated the use of coconut shells and their derivatives in civil engineering construction. Cost reduction of 40% can be achieved if coconut shells are used to replace gravel in concrete. This study was conducted to investigate the properties of concrete using coconut shells as replacement for crushed granite and to assess the potential use of coconut shell concrete as a structural material as well as contribute to knowledge on the use of waste materials in construction.

Fig1.Coconut Shells

Coconut shell is one of the most important natural fillers produced in tropical countries like Malaysia, Indonesia, Thailand, and Sri Lanka. Many works have been devoted to use of other natural fillers in composites in the recent past years and coconut shell filler is a potential candidate for the development of new composites because they have high strength and modulus properties along with the added advantage of high lignin content. The high lignin content makes the composites made with these filler more weather resistant and hence more suitable for application as construction materials. Coconut shell flour is also extensively used to make products like furnishing materials, rope etc. The shells also absorb less moisture due to its low cellulose content the report focuses on studying the effectiveness of coconut shell particles as a source of natural material for reinforcing epoxy resins towards their flexural properties. The coconut shell also has exceptional properties. It has a specific gravity of 1.2, which is about twice the density of hardwood. It is at least twice as hard as hardwood and is also very rich in energy. The hardness of the coconut shell is comparable to lower strength aluminum alloys, making it one of the hardest organic materials produced in nature. It can be ground into 50-micron chips to potentially be used as reinforcement for engineering plastics. Chopped glass fibers are conventionally used as reinforcement to increase strength and stiffness and reduce cost in polymeric composites.

Ground coconut shell is not as hard as glass, but it should bond much better to the matrix, since the bond interface will be organic to organic, rather than organic to silicon oxide. We are currently studying this option. Because of its high mass-density, coconut shells also have a high energy-density.

II. MATERIAL AND METHODOLOGY

The raw materials used in this experimentation were locally available and these included

Ordinary Portland Cement (O.P.C) as binding agent, river sand as fine aggregate, crushed granite and coconut shell as coarse aggregate. Potable tap water was used for mixing and curing throughout the entire investigation. The permissible and tolerance limits of water were checked as per the I.S 456-2000.

Fine Aggregates: River sand was used as the fine aggregate, conforming to Zone-II as per I.S 383-1970.The sand was air dried and sieved to remove any foreign material, prior to mixing.

Physical Property	Test Results
Specific Gravity	2.6
Fineness Modulus	2.83

Coarse Aggregates: Coarse aggregate consists of 50% of self weight of concrete and 70% of volume of concrete.

Physical Property	Test Results
Specific Gravity	2.7
Fineness Modulus	2.73
Water Absorption	0.25

Coconut Shell: Coconut shells were collected from temples to analyze the properties of coconut shell. The physical properties of Coconut shell are shown below.

Physical Property	Test Results
Specific Gravity	1.33
Shell Thickness	2-7mm
Water Absorption (%)	24

III. METHODOLOGY

Concrete Mix Design: M-20 grade of concrete was designed by I.S 10262-1982 method. The natural coarse aggregates were replaced as 0%, 20%, 40%.60%,80% and 100%.The test results were analyzed and compared with theoretical values, obtained from various codes. Due to high water absorption of coconut shell, they were pre soaked in water for 24 hours, prior to mixing. Batching and Mixing: Batching was done as per the mix proportions. Mixing was done in tilting mixer. It was mixed for 2-3 minutes, after addition of water with w/c ratio as 0.5%. Placing and Compaction: Cubes are cleaned and oiled to prevent the formation of bond between concrete and moulds. Place the fresh concrete in cubes in 3 layers, tamping each layer 25times. The entrapped air in concrete is removed by table vibrator. Anything kept on the table gets vibrated. Demoulding is done after placing fresh concrete in moulds, it was allowed to set for 24 hours. It was marked with some permanent identification mark. Concrete cubes are now kept in curing tank for 7, 14 and 28 days. After 28 days, concrete cubes were removed from curing tank to conduct tests on hardened concrete.

IV. TESTING

Testing of concrete is done to determine the various properties of concrete when the cement is partially replaced by RHA.

ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

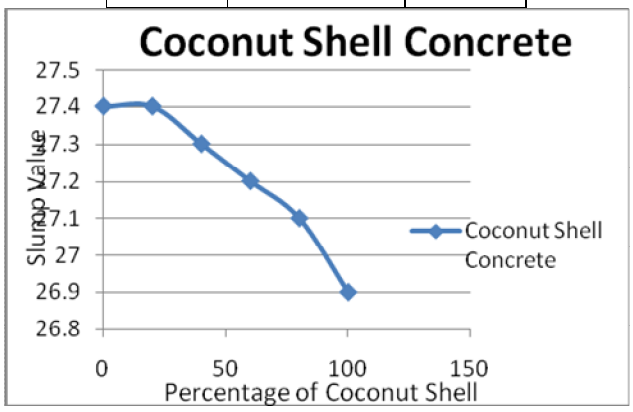
Material properties were found. RHA were tested individually as per IS: 2386 (part III) – 1963. Strength properties were analyzed by conducting compressive strength test as per IS: 516 - 1959 and tensile strength test as per IS: 5816 – 1999 on 7th, 14th and 28th day. The strength property of concrete having RHA was analysed. The strength property of concrete was improved by the addition agricultural waste

V. RESULTS AND DISCUSSION

A. *Slump cone (workability test):*

Table1. Slump Cone Value of Coconut Shell Concrete

% of CS	Slump Value	Slump
0	27.4	2.6
20	27.4	2.6
40	27.3	2.7
60	27.2	2.8
80	27.1	2.9
100	26.9	3.1



Graph1. Slump Cone Value of Coconut Shell Concrete

B. *Compressive strength test*

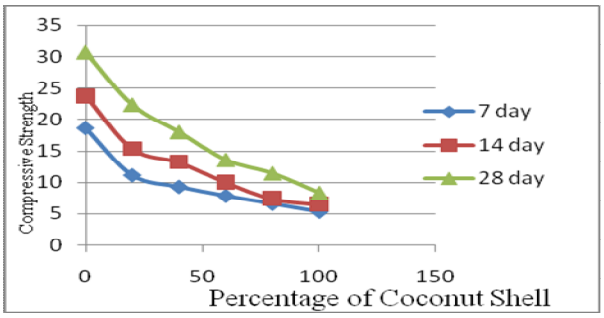
The Compressive Strength of the concrete using Coconut Shell partially replaced with aggregate reduced as percentage of Coconut Shell increases. The result of the compressive strength of concrete cubes show that the compressive strength upto 40% replacement gives good result and highly reduced as percentage of Coconut Shell increase after 40%. However, the compressive strength increased as the no. Of days of curing increased for each percentage Coconut Shell replacement. It is seen from Table 2 that for controlled cube, the compressive strength increases from 09.26 N/mm2 at 7 day to 18.00 N/mm2 at 28days. The strength was near the specified value of 20 N/mm2 for grade M20 concrete as shown in graph 5.

The compressive strength depends on cement content, water to cement ratio, aggregate quality, bond Properties of Concrete with Coconut Shells as Aggregate Replacement between the particles and internal structure of the concrete. In the present investigation the normal aggregate was replaced with coconut shells. In this study, there may be several reasons that might cause strength reduction due to CS replacement in concrete like shape of the particles, bond between the particles and the cement paste, alignment of the particles, water absorption and density of the particles. Furthermore, the particles are of curved shape. Elongated particles reduce compressive strength. Surface texture determines bond between the particles, rough surface can produce good bond. However, coconut shells are rough on one face and relatively smooth on the other face. Therefore, there may not be enough bond between CS particles and cement paste to produce sufficient bond strength and ultimately sufficient compressive or tensile strength of the concrete. Furthermore, elongated and curved particle shape and insufficient bond between

the particles may lead to porous structure. Alignment of the CS particles within the concrete against load application might also contribute to strength. The particles aligned normal to the load direction could have failed due to in sufficient bond strength; the particles aligned parallel to load direction might have not resisted the strength due to thin section and insufficient bond. The absorption of the coconut shells was 8% indicating that the material is porous. Porous material as aggregate leads to reduced density and ultimately reduces strength.

Table 2. Compressive Strength of Coconut Shell Concrete

S.No.		1	2	3	4	5	6
Ratio (%)	CS	0	20	40	60	80	100
	AGG.	100	80	60	40	20	0
Amount (kg)	Cement	384.35	384.35	384.35	384.35	384.35	384.35
	Sand	580.4	580.4	580.4	580.4	580.4	580.4
	CS	0	235.22	470.44	705.66	940.88	1176.1
	AGG.	1176.1	940.88	705.66	407.44	235.22	0
7 Day		18.63	11.11	9.26	7.82	6.56	5.28
14 Day		23.75	15.36	13.2	10.01	7.39	6.47
28Day		30.64	22.33	18	13.56	11.42	8.33



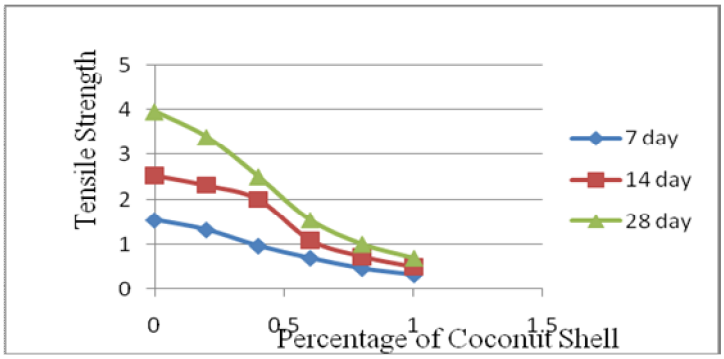
Graph2. Compressive Strength of Coconut Shell Concrete

C. Tensile strength test:

The result of the Tensile strength of concrete cubes shows that the Tensile strength upto 40% replacement gives good result and reduced as percentage of Coconut shell increases after 40%. However, the Tensile strength increased as the no. Of days of curing increased for each percentage Coconut Shell replacement. It is seen from Graph 3 that for controlled cube, the Tensile strength increases from 0.96 N/mm2 at 7 day to 2.51 N/mm2 at 28days.

Table 3. Tensile Strength of Coconut Shell Concrete

S.No.		**1**	**2**	**3**	**4**	**5**	**6**
Ratio	**CS**	0	20%	40%	60%	80%	100%
	AGG.	100	80%	60%	40%	20%	0%
Amount (kg/m3)	**Cement**	384.35	384.35	384.35	384.35	384.35	384.35
	Sand	580.4	580.4	580.4	580.4	580.4	580.4
	CS	0	235.22	470.44	705.66	940.88	1176.1
	AGG.	1176.1	940.88	705.66	407.44	235.22	0
7 Day		1.54	1.32	0.96	0.69	0.46	0.32
14 Day		2.54	2.32	2.01	1.09	0.72	0.49
28 Day		3.96	3.39	2.51	1.55	1.01	0.7



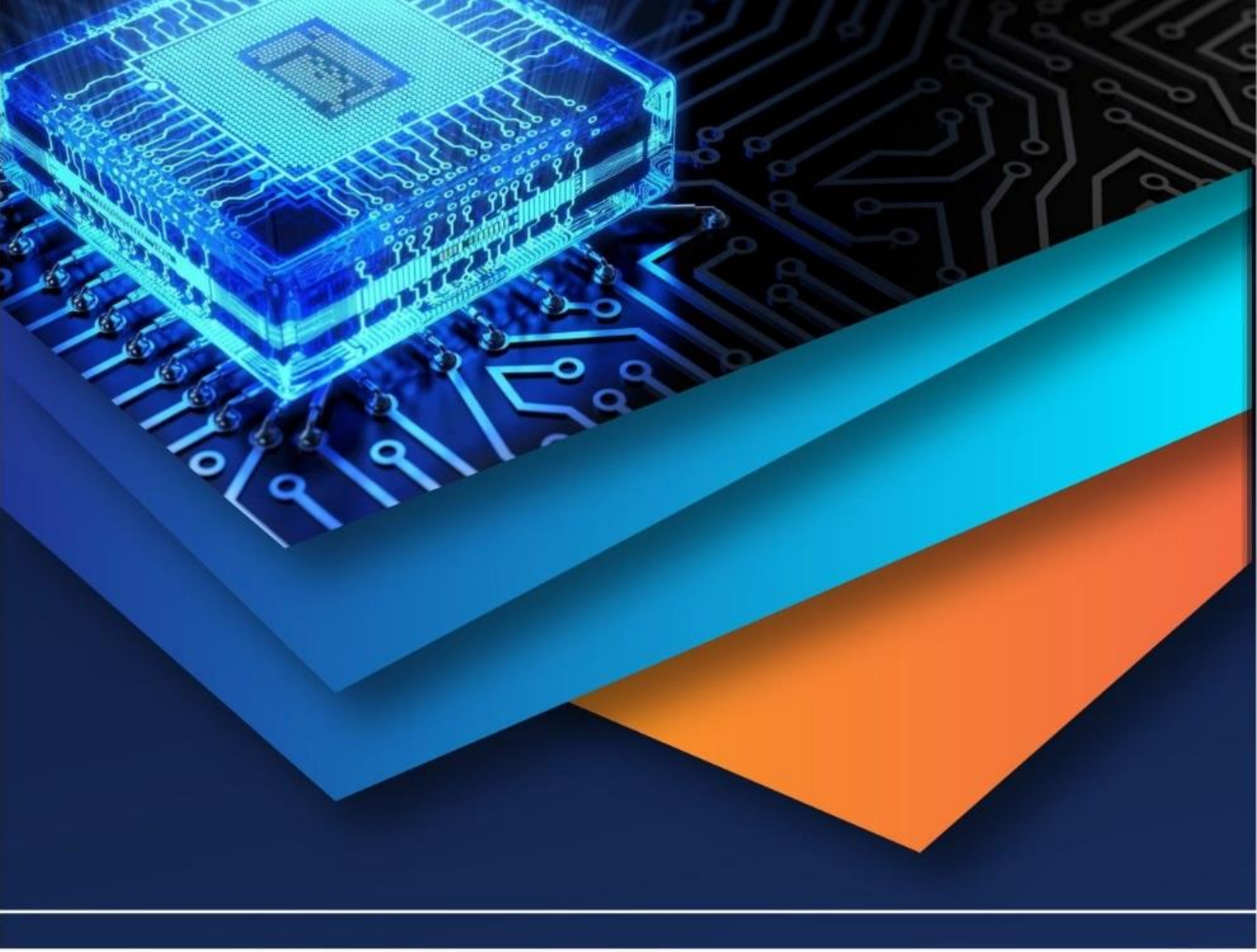
Graph3. Tensile strength of Coconut Shell Concrete

VI. CONCLUSION

A. upto 40% of aggregate replaced by coconut shell is good according to strength and cost wise.
B. Increase in percentage replacements by coconut shells reduced the strength and density of concrete.
C. It helps in reducing up to 40% pollution in environment.
D. It is concluded that the Coconut Shells are more suitable as low strength-giving lightweight aggregate when used to replace common coarse aggregate in concrete production.
E. Trying to replace aggregate by coconut shell partially to make concrete structure more economic along with good strength criteria.
F. From one cube calculation bulk amount of shell replacement can be evaluated & reduces over all construction cost.
G. This can be useful for construction of low cost housing society.

REFERENCES

[1] K. Gunasekaran, "Utilization of Coconut Shell as Coarse Aggregate in the Development of Light Concrete", Thesis- SRM University, 2011.
[2] Majid Ali and NawawiChouw, "Coir Fibre and Rope Reinforced Concrete Beam Under Dynamic Loading", Thesis- University of Auckland, New Zealand, 2009.
[3] Mostafa Jalal, Ali Reza. Pouladkhan, Hassan Norouzi, GhobadChoubdar, "Chloride Penetration, Water Absorption and Electrical Resistivity of High Performance Concrete Containing Nano Silica and Silica Fume", Journal Of American Science, 2012, Vol. 8, Issue 4.
[4] D. Maruthachalam., "Studies of Durability Aspects of Fibre Reinforced Concrete", International Journal of Engineering Science and Technology, 2012, Vol. 4, No.02.
[5] R.Nagalakshmi, "Experimental Study on Strength Characteristics on M 25 Concrete with Partial Replacement of Cement with Fly Ash and Coarse Aggregate with Coconut Shell", International Journal of Science & Engineering Research, 2013, Vol. 4, Issue 1.
[6] http://www.eaasjournal.org/survey/userfiles/files/v3i307%20civil%20engineering.pdf



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY