International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 04, April-2017

Replacement of Coarse Aggregate by Using Naturally Available Materials

Kaushik Rahate
Civil Engineering
Gharda institute of Technology lavel
Khed, India

Rahul Kelkar
Civil Engineering
Gharda institute of Technology lavel
Khed, India

Sudhakar Singh
Civil Engineering
Gharda institute of Technology lavel
Khed, India

Mayuresh Khajanwadkar
Civil Engineering
Gharda institute of Technology lavel
Khed, India

***Abstract*—The major part of construction industry is based on concrete. In concrete the vital and costly material after cement is aggregate. Hence it affects economy. Also coconut being widely produced in states of Maharashtra, Kerala, Karnataka and region nearby seashore. Coconut shells can be available in adequate quantity. According to study on coconut shell concrete it is found that the course aggregate in concrete can be replaced by coconut shell and it gives 65% strength that of conventional concrete. From references it reflects that there is study on partial replacement coarse aggregate by coconut shell is done. Also rubber latex is used for increasing strength of concrete. Coconut shell and rubber latex used as admixture in concrete gives different strength and results. If we combine coconut shell and rubber latex together the concrete of higher strength and economical as well as eco-friendly concrete can be obtained. In this project the aggregates will be replaced by coconut shell and rubber latex as admixture to change the properties of concrete as well as to achieve maximum strength than normal concrete. The tests conducted on fresh concrete are Slump cone, Compaction factor test and Vee-bee test. Also tests conducted on hard concrete are Compressive strength, Flexural strength and Split tensile test. The Coconut shell rubber latex concrete is very economical than conventional concrete and it is also eco-friendly and strength of both the concrete is approximately same.**

Key words : Coconut Shell, Concrete, Rubber Latex

I. INTRODUCTION

Concrete is a homogeneous material which is formed by mixing of Cement Sand and Aggregate in presence of water. Generally cement is used as binder material and sand as filler material which occupies the voids between aggregate.

Aggregate is the most common material in concrete and it occupies more than 70-80% of total volume in concrete and it provides strength to the concrete. Now a days due to huge demand of concrete in construction work it is essential to developed or find such sources or material which can replace sand and aggregate in concrete. As aggregate is most common material in concrete and it is acquired from crushing of stones in stone queries which requires huge manpower and mechanical equipment. While crushing of stones it produces very small dust particles having less density and get easily mixed with air which creates adverse impact on environment as well as on the health of the workers at the sight. To overcome such problems, aggregate can be replaced with coconut shell. In India 13 billion nuts of coconut produced every year which is huge source of coconut shell aggregate. Coconut shell concrete is a mixture of cement sand aggregate and crushed coconut shell aggregate. In this type of concrete the crushed stone aggregate is replaced partially or fully with crushed coconut shell, to utilize the environmental sources and to protect the environment. Thus the main aim is to utilize the coconut shell and to achieve the strength with different percentage of coconut shell aggregate in concrete.

II. OBJECTIVES

- Check the feasibility of coconut shell as a replacement for course aggregate in the construction of concrete.
- Prove that coconut aggregate replaced in concretes which are lightweight can be used for structural applications with equivalent strengths to normal weight concrete.
- Make sustainable concrete with more economical for constructions.
- Study the behavior of compressive and split tensile strengths.
- Compare the result with conventional concrete.

III. MATERIALS AND PROPERTIES

A. Cement

Ordinary Portland cement of 43 grade conforming to Indian Standard code IS 12269-1987 was used throughout in the concrete mixes used in this project.

TABLE I. PROPERTIES OF CEMENT

Normal consistency	*Specific gravity*	*Initial setting time*	*Compressive strength*	*Specific gravity*	*Fineness modulus*
35%	2.98	32.33 min	32.22 N/mm	2.62	2.39

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 04, April-2017

TABLE II.CHEMICAL COMPOSITION OF CEMENT

Chemical composition and specific gravity of the materials CEMENT	**Chemical Composition (%)**
SiO2	21.8
Al2O3	6.6
Fe2O3	4.1
CaO	60.1
MgO	2.1
Na2O	0.4
K2O	0.4
SO3	2.2
Others	-
LOI	2.4
Specific gravity	3.15

B. Coarse aggrigate

In this project, two types of coarse aggregates were used for preparation of concrete, Crushed Coarse Aggregate. (CAI & CAII) and coconut shell Coarse Aggregate. (CSA)
Coarse Aggregate of type I:-
Crushed hard basalt chips of maximum size 10 mm were used in the concrete Mixes.

Coarse Aggregate of type II:-
Crushed hard basalt chips of maximum size 20 mm were used in the concrete Mixes

TABLE III.PROPERTIES OF COARSE AGGRIGATE I

Bulk Density (gm/m3)	Specific Gravity	Fineness Modulus	Water Absorption (%)	Impact value	Abrasion value
1475	2.77	7.07	2.1	32	28

TABLE IV.PROPERTIES OF COARSE AGGRIGATE II

Bulk Density (gm/m3)	Specific Gravity	Fineness Modulus	Water Absorption (%)	Impact Value	Abrasion value
1545	2.77	7.04	2.3	35	30

C. Coconut shell aggregate

Available coconut were hammered and crushed by JAW CRUSHER to smaller pieces and sieved.
The sieved materials were washed with clean water for several times and then dried on sun, made saturated and then required quantity was taken for casting. The CSA aggregates after crushing and sieved by manual means.

TABLE V. PROPERTIES OF COCONUT SHELL

Bulk Density (gm/m3)	Specific Gravity	Fineness Modulus	Water Absorption (%)	Impact Value	Abrasion value
650	1.45	6.26	2.4	8.15	1.63

TABLE VI.CHEMICAL COMPOSITION OF COCONUT SHELL

Sr No	Chemical	Chemical Composition %
1	Cellulose	26.6
2	Hemicellulose	21
3	Lignin	29.4
4	Pentosans	27.7
5	Solvant Extractives	4.2
6	Uronic Anhydrides	3.5
7	Ash	0.6

D. Water

Potable water conforming to IS 456-2000 11 was used for casting and curing

E. Sand

In this investigation, two types of fine aggregates were used for preparation of concrete, Natural fine Aggregate & Crushed Fine aggregate. (NFA & CFA)

Natural Fine Aggregate (River Sand)
Natural fine aggregate (NFA) used for this entire investigation for concrete was river sand conforming to zone-I of IS: 383-1970

TABLE VII. PROPERTIES OF SAND (RIVER SAND)

Bulk Density(gm/m3)	Specific Gravity	Fineness Modulus	Water Absorption (%)
1690	2.75	3.96	1.8

Crushed Fine Aggregate
Crushed fine aggregate (CFA) are crushed fine basalt rock. used for this entire investigation for concrete was manufactured sand conforming to zone-I of IS: 383-1970.

TABLE VIII. PROPERTIES OF SAND (CRUSHED SAND)

Bulk Density(gm/m3)	Specific Gravity	Fineness Modulus	Water Absorption (%)
1710	2.76	3.79	2

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 04, April-2017

IV. TEST ON MATERIALS

1 Cement
1.1 Normal Consistency of Cement
1.2 Initial and Final Setting Times of Cement
1.3 Compressive Strength of Cement
1.4 Specific Gravity of Cement
1.5 Fineness of Cement
2 Coarse Aggregate
2.1 Specific Gravity of Aggregates
2.2 Water Absorption Capacity of Aggregates
2.3 Fineness Modulus of Aggregates
3 Fine Aggregate
3.1 Bulking of sand

V. TEST ON CONCRETE

Compressive Strength Test: A cube compression test is performed on standard cubes of conventional concrete and coconut shell concrete with partial replacement of 25% and 50% of size 150mm x 150mm after 7 days and 28 days of immersion in water for curing. The results for the test are shown in Table No. 20 to Table No. 22. The compressive strength of the specimen is calculated by the following formula: fck = P/A Where, P = Failure load in compression (KN) A = Loaded area of cube (mm2)

Split Tensile Test: The split tensile test is well known indirect test used to determine the tensile strength of concrete. Due to difficulties involved in conducting the direct tension test, a number of indirect methods have been developed to determine the tensile strength of the concrete. In these tests, in general a compressive force is applied to a concrete specimen in such a way that the specimen fails due tensile stresses induced in the specimen. The tensile strength at which failure occurs is the tensile strength of concrete. In this investigation the test is carried out on cylinder by splitting along it's middle plane parallel to edges by applying the compressive load to opposite edges. The arrangement for the test is as shown in fig. The split tensile strength of cylinder is calculated by the following formula. $Ft= 2P/\pi LD$

Where, Ft= Tensile Strength (N/mm2) P= Load at Failure (N) L= Length of Cylinder (mm) D= Diameter of Cylinder (mm)

Flexural test : A specimen of size: 150X150X750 was per pared with conventional concrete and coconut shell concrete and compare test results. Test specimen tested for different support distances like 500 mm, 600mm, etc. Presence of coconut fibers with shell gives resistance against cracking. Presence of coconut fibers resists fine surface cracks which will coopers in conventional concrete.

VI. RESULTS AND DISCUSSION

Various mixed proportion with different percentage of coconut shell aggregate are prepared out of which the best result obtained from the replacement of coarse aggregate with coconut shell up-to 40%. The results which were obtained by replacing the aggregate by treated coconut shell aggregate gives 65% of compressive strength of conventional concrete. And to overcome the moisture content of coconut shell aggregate it is coated with rubber latex and other polymers, which reduces the water absorption of natural coconut shell aggregate from 20% to 12%.

ACKNOWLEDGMENT

We wish to express our sincere gratitude to department of civil engineering, Gharda institute of technology for providing us an opportunity to do our project work on REPLACEMENT OF COARSE AGGREGATE BY USING NATURALLY AVAILABLE MATERIALS. We sincerely thank to our project guide Prof. M. D. GHADGE. Gharda institute of technology for guidance and encouragement in carrying out this project work in the right direction. We are thankful in particular to Prof. G. D. PARULEKAR HOD civil engineering department for their motivation. We express a sense of gratitude for all kind of cooperation to the planning of project work. We also like to thank all the staff of civil engineering department for their supports.

REFERENCES

[1] Mr. Shreeshail B.H. and Chougale J. et.al (2014) : 'effect of coconut fiber on the properties of concrete' published in International Journal of research in engineering and technology. EIssN: 2319-1163/p ISSN 2321-7308
[2] Mr. Sreenivasulu D. and Praveen K. et al (2014) : "Laboratory investigation on coconut shell in concrete: an alternative low cost building material' published in National conference of green engineering and technologies for sustainable future (ISSN: 0974- 2115)
[3] Ghorpade V. G. and Munirathnam K. et al (2013) :'effect of Rubber latex on strength and workability of fiber reinforced high performance concrete with metakaolin admixture' published in International journal of engineering research and applications (IJERA) ISSN: 2248-9622
[4] Salmah H. and Marliza M. et al (2013): 'Treated concrete shell reinforced un saturated polyester composites' published in International journal of engineering and technology, 1310202-8393- IJET-IJENS
[5] Siti Aminah Bt Tukiman and Sabarudin Bin Mohd. (2009) : 'Investigate the combination of coconut shell and grained palm kernel to replace aggregate in concrete' published in National conference on postgraduate research.
[6] Damre s.and Firake H. et al (2014) : 'Sustainable Concrete by Partially Replacing Coarse Aggregate Using Coconut Shell' published in Journal on Today's Ideas –Tomorrow's Technologies, Vol. 2, No. 1, pp. 1–14
[7] Amarnath Y and Ramachandrudu C. (2012) : 'Properties of Concrete with Coconut Shells as Aggregate Replacement'. Published in International Journal of Engineering Inventions ISSN: 2278-7461
[8] IS 9142(1979): Specification for artificial Lightweight Aggregates for concrete masonry unit.
[9] IS 6042(1969): Code of practice for construction of lightweight concrete block.
[10] M. S. Shetty, Concrete Technology Theory and Practice, 1st ed. S. CHAND & Company, New Delhi, 1982, pp. 458-473.
[11] Shaik Aliimran Tippu and Vr.Prasanth Kumar (2015) :'A study on effects of silica fume on mechanical properties of light weight coconut shell concrete eISSN:2319-1163