iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 4 **Issue:** V **Month of publication:** May 2016

DOI:

www.ijraset.com

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Volume 4 Issue V, May 2016
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

A Review of Experimental Investigation on Coconut Shell as Replacement on Concrete as Course Aggregate in their Strength

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Abstract - The aim of the work is to study the suitability of coconut shell, as a partial replacement of coarse aggregate. The chemical compositions of coconut shell taken under study are almost similar to that of ordinary cement. In this experiment work coconut shell plays a major role as it is used in all the combination of concrete cube. The proportion of the mineral and mixtures is applied in testing cubes for their compression strength.
Keywords – concrete, coconutshell coarse aggregate, strength.

I. INTRODUCTION

A. General

Infrastructure development across the world created demands for construction material. Concrete is the premier civil engineering material. Concrete manufacturing involve consumption of ingredients like cement, aggregates, water & admixtures. Among all the ingredients, aggregates form the major parts. Two billion of aggregate are produced each year in the United States. Production is expected to increase to more than billion tons per year by the year similarly; the consumption of the primary aggregate was 110 million tones in the UK in year 1960 and reached nearly 275 million tones by 2006. Use of natural aggregates in such a rate leads to a question about the preservation of natural aggregates sources. In addition, operation associated with aggregates extraction and processing is the principal causes environmental concern. In light of this in the contemporary civil engineering construction, using alternative materials in place of natural aggregate in concrete production makes concrete as sustainable and environmentally friendly construction material. Coconut shell being a hard and not easily degrade material if crushed to size of sand can be a potential material to substitute sand. At present, coconut shell has also been burnt to produce charcoal and activated carbon for food and carbonated drink and filtering mineral water use. However, the coconut shell is still under utilized in some places. The chemical composition of the coconut shell is similar to wood. It contains cellulose, lignin, pentosans and ash

B. Objective

The overall objective of the project is to investigate the feasibility of incorporating coconut shell as a replacement for coarse aggregate in concrete.

The specific objectives of the project are as follows:

1) To find economical solution for high construction material.
2) To prepare light weight concrete by using coconut shell as coarse aggregate .

II. LITERATURE REVIEW

The various literatures of light weight concrete with the characteristics of high compressive strength are reviewed in this chapter. Along with that the use of coconut shell as coarse aggregate to replace the coarse aggregate is also reviewed for analyzing the strength. The abstract and conclusions of various authors in their literature is stated in this chapter for the study of strength characteristics of concrete.

Parag S. Kambli & Sandhya R. Mathapati. (2014) prepared three different Mix Designs for M20, M35, M50 grades of concrete. Percentage replacement by coconut shell varied as 0%, 10%, 20%, 30%, 40% respectively. It is concluded in this study that for M20 grade concrete cubes with 30% replacement of CS aggregates had given strength of 23 MPa at 28 days. Concrete cubes with 30% replacement of CS aggregates had given strength of 42 MPa at 28 days for M35. For M50 grade concrete cubes with 30%

replacement of CS aggregates had given strength of 51 MPa at 28 days

Damre Shraddha and Shrikant Varpe (2014) replaced conventional coarse aggregate with coconut shell and concluded that- with 50% replacement of coarse aggregates by coconut shells, the strength attained reduces invariably from 10%-20% as compared to the conventional coarse aggregate concrete. With 50% replacement of coarse aggregates by coconut shells, the flexural strength attained reduces invariably from 10%-15% as compared to the coarse aggregate concrete

Siti Aminah Bt Tukiman and Sabarudin Bin Mohd (2009) replaced the coarse aggregate by coconut shell and grained palm kernel in their study. Percentage of replacement by coconut shell were 0%, 25%, 50%, 75% and 100% respectively. Conclusion is that the combination of these materials has potential of being used as lightweight aggregate in concrete and also has reduce the material cost in construction

J.P. Ries (2011) studied that Lightweight aggregate (LWA) plays important role in today's move towards sustainable concrete, Lightweight aggregates contributes to sustainable development by lowering transportation requirements, optimizing structural efficiency that results in a reduction in the amount of overall building material being used, conserving energy, Reducing labor demands and increasing the survive life of structural concrete.

Amarnath yerrmalla (2012) et al studied the strength of coconut Shells (CS) replacement and different and study the transport properties of concrete with CS as coarse aggregate replacement. They concluded that

A. *Increase in CS percentage decreased densities of the concrete.*
B. *With CS percentage increased the 7 days strength gain also increased with corresponding 28 days curing strength.*

Vishwas p. kulkarni (2013) studied that Aggregates provide volume at low cost, comprising 66 percent to 78 percent of the concrete. Conventional coarse aggregate namely gravel and fine aggregate is sand in concrete will be used as control.

While natural material is coconut shell as course aggregate will be investigate to replace the aggregate in concrete. Lightweight concrete is typically made by incorporating natural or synthetic light weight aggregates or by entraining air into a concrete mixture. Coconut shell exhibits more resistance against crushing, impact and abrasion, compared to crushed granite aggregate. Coconut shell can be grouped under lightweight aggregate. There is no need to treat the coconut shell before use as an aggregate except for water absorption. Coconut shell is compatible with the cement. The 28-day air-dry densities of coconut shell aggregate concrete are less than 2000 kg/m3 and these are within the range of structural lightweight concrete. Coconut shell aggregate concrete satisfies the requirements of ASTM C 330.

Maninder Kaur & Manpreet Kaur (2012) published a review paper in which it is concluded that use of coconut shells in cement concrete can help in waste reduction and pollution reduction. It is also expected to serve the purpose of encouraging housing developers in investing these materials in house construction. It is also concluded that the Coconut Shells are more suitable as low strength-giving lightweight aggregate when used to replace common coarse aggregate in concrete production.

Gopal Charan Behera, Ranjan Kumar Behera presented the comparative cost analysis and strength characteristics of concrete produced using crushed coconut shell as substitutes for conventional coarse aggregate. The main objective was to encourage the use of coconut shell waste as construction materials in low-cost housing.

III. EXPERIMENTAL INVESTIGATION

A. Compressive strength

Out of many test applied to the concrete, this is the almost important which gives an idea about all the characteristics of concrete. By this single test one judge that whether concreting has been properly or not. For cube test two type of specimens either cubes of 150mm×150mm×150mm or 100mm×100mm×100mm depending upon the size of aggregate are used. For most of the work cubic moulds of size 150mm×150mm×150mm are commonly used.

This concrete is poured in the mould and tempered properly so as not to have any voids. After 24 hours these moulds are removed and test specimens are put in water for curing. The top surface of these specimens should be made even and smooth. This is done by putting cement paste and spreading smoothly on whole area of specimen.

B. Flexural strength

From the study it has been clear that flexural strength of coconut shell replaced concrete were more than the conventional concrete in normal condition. But above percentage of replaced concrete showed nominal strength as that of conventional concrete.

C. Split tensile strength

From the study it has been clear that split tensile strength of coconut shell replaced concrete were more than the conventional concrete in normal condition. But above percentage of replaced concrete showed nominal strength as that of conventional concrete. split tensile is tabulated in table and it was plotted in figures.

IV. CONCLUSION

Based on limited experimental investigation on the compressive strength of concrete, Flexural strength, Split tensile strength the following observations are made regarding the resistance of partially replaced coconut shell scrap.

A. In comparison of coconut shell concrete itself, in between 35%,45%,55% the strength is achived in 35%.
B. To comparison of conventional concrete to the coconut shell concrete the strength of the coconut shell concrete not attained target strength.
C. The application of coconut shell concrete to flooring concrete and surface coatings. etc.
D. This project suggests reduction in amount of coarse aggregate.
E. On one hand the waste disposal problem is solved and on other hand the coconut shell is gainfully utilized.
F. In our location the coconut shell concrete is not use for structural elements but we used for non structural elements.

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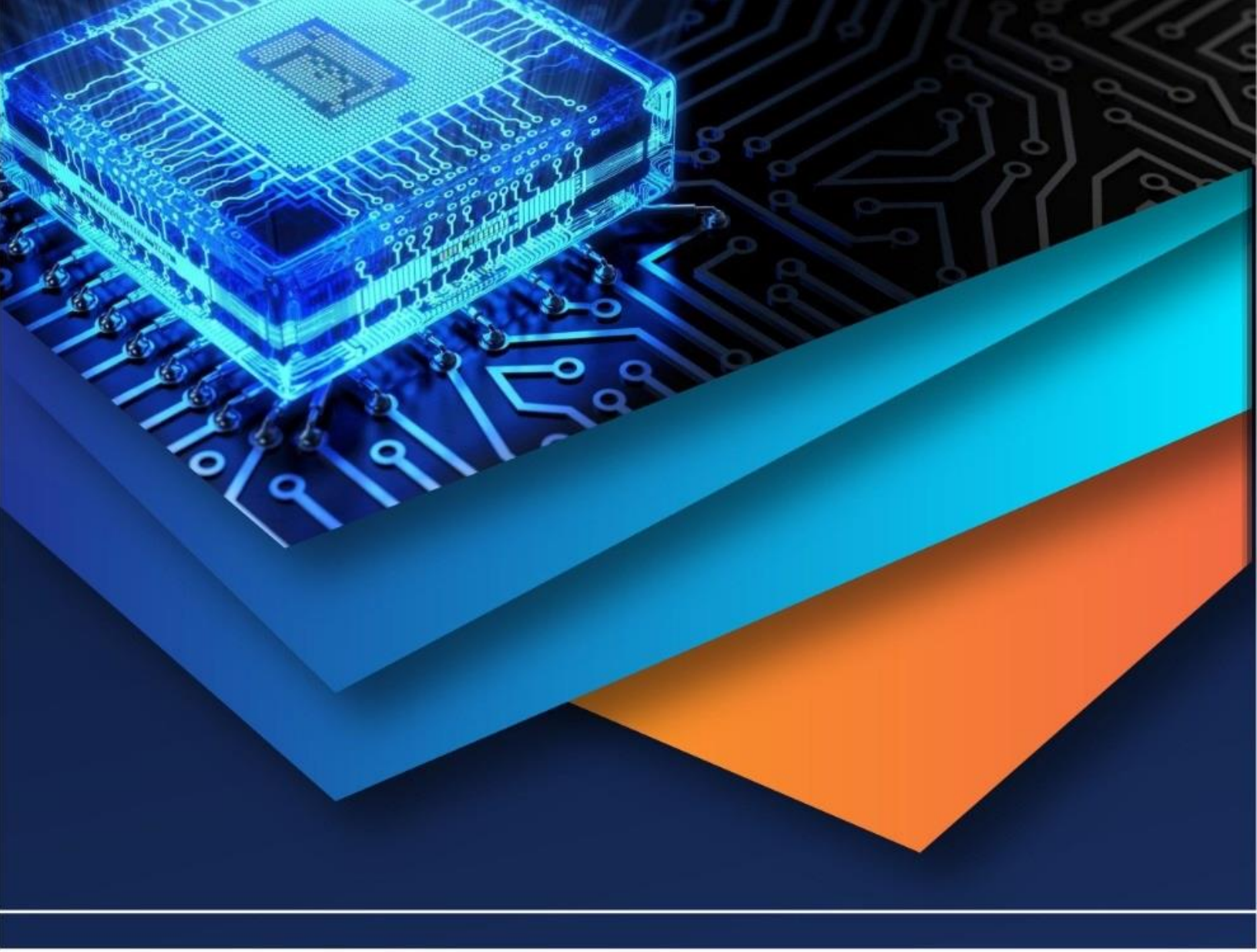

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