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A Review on Utilization of Coconut Shell as Coarse Aggregate in Concrete

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Abstract - *The cost of producing concrete has been increasing progressively. Therefore, the demand for utilization of agricultural waste as a partially replacement or admixture inside concrete is also increasing gradually. Many researcher scholars are doing research on agricultural waste such as rice husk, palm oil, corn cobs and coconut shells. Agricultural waste is increasingly being utilized in cement, concrete and other construction materials and provides numerous indirect benefits such as reduction in land fill cost, saving energy and protecting the environment from possible pollution. The aim is to produce concrete with improved properties at a lower cost and to maintain environmental sustainability. In this review paper, the utilization of coconut shell as coarse aggregate in concrete for construction work will be the main focus. Coconut shells can be used as aggregates in concrete. The characteristic properties of coconut shell concrete such as workability, flexural tensile, compressive strength and split tensile strength. This paper attempts to answer whether coconut shell is most suitable to be used in concrete to produce a light weight concrete.*

***Key Words*: Coconut Shell, Compressive Strength, Flexural Strength.**

1. INTRODUCTION

Concrete is a widely used construction material that consists of a mixture of cement, aggregates, water and admixtures. Inert granular materials such as sand, crushed stone or gravel form the major part of the aggregates. Traditionally aggregates have been readily available at economic prices and of qualities to suit all purposes. But, the continued extraction of aggregates from nature has caused its depletion at an alarming rate. Therefore, there is a growing demand to find alternate materials that can be used as coarse aggregate in concrete. India produces about 20% of the coconut produced in the world. Within India, Kerala produces 45% of it. Disposal of coconut shells poses environmental issues as it is not easily degradable. Aggregates made by crushing coconut shells can be effectively used in concrete by partially replacing coarse aggregate up to a certain amount. This will not only reduce the unit weight of resulting concrete made, but also provides an efficient solution to the disposal of coconut shells.

Therefore, in order to achieve a comfortable environment, this research will emphasize on utilization coconut shell fillers to form composite materials in constructing of any civil engineering work. Doing, So well reduce the cost of construction. It will also help to reduce agricultural waste and make the world more sustainable.

2. COCONUT SHELL

Coconut shell is the agricultural solid waste which belongs to the family of palm and is obtained from coconut oil industries. Coconut trees are cultivated on around 12 million hectares worldwide. In a mature coconut, the white meat is surrounded by a tough protective shell and this by a thick husk. Coconut is cultivated in more than 93 countries. They are available in substantial amounts in the tropical locations of the world, generally in Africa, Asia and America. South East Asia is regarded as the origin of the coconut. India is the third largest country having cultivated coconut trees over an area of 1.89 million hectares in the year 2011 (Horticulture database 2011). As per the recent Indian horticulture database 2011 statistics, India has risen as the biggest manufacturer of coconut on the globe with a generation of 10840 million nuts. By this, India accounts for 26.9 percentage of the world's output. In India, the four south Indian states, specifically Kerala, Tamil Nadu, Karnataka and Andhra Pradesh produce around 90% of the total coconut production in the nation. Kerala has higher production with 3992 million nuts, whereas Tamil Nadu has 3692 million nuts (Indian horticulture database 2011). The coconut industry in India accounts for over a fourth of the world's total coconut oil output and is set to rise with further growth in demand. Nevertheless, it is the principal contributor to nation's pollution problem as a solid waste in the form of a shell. Presently a low portion of these CS wastes is being utilized for making charcoal shell, mosquito coils, decorative purposes, utensils, etc.

3. Objectives

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.

4. REVIEW OF LITERATURE

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.

Tukiman Siti AminahBt et al. (2009) have investigated the combination of coconut shell and grained palm kernel to replace aggregate in concrete. They found that combination of coconut shell (maximum percentage) and few percentage of grained palm kernel shell have the potential for light weight aggregate in concrete. Also the combination would reduce the material cost in construction due to the cheap and abundant availability of suitable agricultural waste for concrete preparation

Amarnath Yerramala et al. (2012) Properties of concrete with coconut shells (CS) as aggregate replacement were studied. Control concrete with normal aggregate and CS concrete with 10 - 20% coarse aggregate replacement with CS were made. Two mixes with CS and fly ash were also made to investigate fly ash effect on CS replaced concretes. Properties like compressive strength, split tensile strength, water absorption and moisture migration were investigated in the laboratory. The results showed that, density of the concretes decreases with increase in CS percent. Workability decreased with increase in CS replacement. Compressive and split tensile strengths of CS concretes were lower than control concrete.

Yogesh Narayan Sonawane et al (2013) The paper analyzed compressive strength of concrete (M20-1:1.5:3) produced using coconut shell as substitute for conventional coarse aggregate with 0%, 25%, 50%, 100% partial replacement. Three sample cubes are prepared for M20 grade concrete mix for each case another aim of this paper is to spread awareness about use of coconut shell as construction material in civil engineering.

Parag S. Kambli et al (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.

R. Robert Singh et al. (2017) Coconut Shell Concrete (CSC) could be used in rural areas and places where coconut is abundant and may also be used where the conventional aggregates are costly. And also adding a steel fibre of certain amount for increasing the strength in concrete and by improve its crack resistance, ductility, energy absorption and impact resistance characteristics. An attempt has been made to examine the suitability of partial replacing 10%, 20% and 30% of coconut shell as for coarse aggregate in concrete of grade M20 and also adding a steel fiber at a certain amount in the concrete. The results found were comparable with that of conventional mix.

Yashida Nadir et al. (2017) An experimental investigation was carried out to study the durability properties of Coconut Shell (CS) aggregate concrete. Effect of mineral admixtures such as fly ash and ground granulated blast furnace slag (GGBFS) as partial replacement of cement on durability properties of CS aggregate concrete was also verified. Four concrete mixes were considered for the study. Control mix, mix with18.5% coarse aggregate replaced by CS by weight, mix with 18.5% CS and 30% cement replaced by fly ash, and mix with 18.5% CS and 15% cement replaced by GGBFS.

Jerin M. George et al. (2016) The properties of concrete using crushed coconut shell as coarse aggregate were investigated in an experimental study. Coarse aggregate was replaced by crushed coconut shells in three different percentages namely 25%, 50% and 100%. Workability, compressive strength, flexural strength and splitting tensile strength of the above said mixes were compared with normal concrete properties. The results from the study is expected promote the use of coconut shell as a substitute for conventional coarse aggregates

Dodda Nagarjun et al. (20170 The high cost of conventional building materials is a major factor affecting housing delivery in world. This has necessitude research into alternative materials of construction and analyzing flexural and compressive strength characteristics of concrete produced using crushed and sieved ,granular coconut as substitute for conventional coarse aggregate with full replacement using m20,m15,m25 grade concrete.

Amarnath Yerramala et al.(2017) Properties of concrete with coconut shells (CS) as aggregate replacement were studied. Control concrete with normal aggregate and CS concrete with 10 - 20% coarse aggregate replacement with CS were made. Two mixes with CS and fly ash were also made to investigate fly ash effect on CS replaced concretes. Constant water to cementitious ratio of 0.6 was maintained for all the concretes. Properties like compressive strength, split tensile strength, water absorption and moisture migration were investigated in the laboratory.

5. CONCLUSION

Coconut Shell Concrete can be used in rural areas and places where coconut is abundant and may also be used where the conventional aggregates are costly. Coconut shell concrete is also classified as structural lightweight concrete. 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.

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BIOGRAPHIES

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