Issue 9 vol 3 ISSN: 2321-8134

IJFEAT

INTERNATIONAL JOURNAL FOR ENGINEERING APPLICATIONS AND TECHNOLOGY

USE OF COCONUT SHELL AS A PARTIAL REPLACEMENT OF COARSE AGGREGATE IN CONCRETE

Prof. S.P.Mahajan[1]

[1]*Assistant Professor, Department of Civil Engineering, Sipna College of Engineering & Technology,Amravati, Maharashtra, India,* ***sarangmahajan@rediffmail.com***

Abstract

Concrete is the premier construction material around the world and is most widely used in all types of construction works, including infrastructure, low and high-rise buildings, and domestic developments. It is a man-made product, essentially consisting of a mixture of cement, aggregates, water and admixture(s). 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 extensive extraction of aggregates from natural resources has been questioned because of the depletion of quality primary aggregates and greater awareness of environmental protection. However, further research is needed for better understanding of the behavior of coconut shells as aggregate in concrete. Thus, the aim of this work is to provide more data on the strengths of coconut shell concretes at different coconut shells (CS) replacements and study the transport properties of concrete with coconut shells as coarse aggregate replacement. The concrete obtained using coconut shell aggregates satisfies the minimum requirements of concrete. Concrete using coconut shell aggregates resulted in acceptable strength required for structural 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. The coconut shell cement composite is compatible and no pre treatment is required. Coconut shell concrete has better workability because of the smooth surface on one side of the shells. Moisture retaining and water absorbing capacity of coconut shell are more compared to conventional aggregate. The presence of sugar in the coconut shells as long as it is not in a free sugar form, will not affect the setting and strength of concrete. Also, India is facing a big challenge in disposing the waste material in landfills all over the country. The landfill disposal is concluding in high disposal costs and effective environmental problems. If present trend continues, waste production will grow up approximately by 5% per year, which will at last result in soaked limit of landfills by 2020. 9 mixes of M-20 concrete is prepared containing 10%,15%, 20% of coconut shells aggregate as a waste material, replacing coarse aggregate, to evaluate the change in mechanical properties of concrete. The maximum size of aggregate was 20 mm along with this control concrete mix is also prepared.

Index Terms: *coarse aggregate, coconut shells, partial replacement, compressive strength etc.*

---------- *** ----------

1. INTRODUCTION

Almost all over the world various measures aimed at reducing the use of primary aggregates and increasing reuse and recycling have been introduced, where it is technically ,economically and environmentally acceptable. As a result , in developing countries like india the informal sector and secondary industries recycle 15-20% of solid wastes in various building material and component.

As a part of integrated solid waste management plan that includes recycle, reuse and recovery, the disposed solid waste, representing unused resources, may be used as low cost materials. Presently in India, about 960 MT of solid wastes are being generated annually as by-products from industrial, mining, municipal, agricultural and other processes. Of this, 350 MT are organic wastes from agricultural sources; 290 MT are inorganic wastes of industrial and mining sectors. However, it is reported that about 600 MT of wastes have been generated in India from agricultural sources alone.

1.1 Present status of coconut shell

The coconut palm is one of the most useful plants in the world. Coconut is grown in the world. Global production of coconut is 51 billion nuts from an area of 12 million hectares. South East Asia is regarded as the origin of coconut. The four major players India, Indonesia, Philippines and Sri Lanka contribute 78% of the world production. According to FAO statistics (Food and Agriculture Organization) 2007, global production of

coconuts was 61.5 MT with Indonesia, Philippines, India, Brazil and Sri Lanka as the major contributors to coconut production.The total world coconut area was estimated as approximately 12 Million hectares and around 93 percent is found in the Asian and Pacific region. The average annual production of coconut was estimated to be 10 million metric tons of copra equivalents. Of the world production of coconut, more than 50 percent is processed into copra. While a small portion is converted into desiccated coconut 5 and other edible kernel products, the rest is consumed as fresh Nuts. According to a study done by the Central Plantation Crop Research Institute (CPCRI) at Kasargod, the country's coconut production was headed for an all-time high of 5 14,370 million nuts in 2006-07. Higher productivity in Tamil Nadu was the main reason for the escalation in the production. In India, the southern states account for 90 per cent of the total production. Kerala tops with 5400 million nuts while Tamil Nadu with 4190 million nuts is the second highest producer. Currently, the crop is grown in 1.91 million hectares with an annual production of nearly 14000, 15700 &17500 million nuts. As per the recent Government of India statistics 2008-09, 2009- 10 & 2011-12 India has emerged as the largest producer of coconut in the world with a production of 15,840 million nuts. India accounts for 26.9 per cent of the world's production. In India, the four south Indian states namely Kerala, Tamil nadu, Karnataka and Andhra Pradesh account for around 90% of the coconut production in the country.

1.2 Present use of coconut shell

Coconut shells have good durability characteristics, high toughness and abrasion resistant properties; it is suitable for long standing use. Coconut shells are mostly used as an ornament, making fancy items, house hold utensils, and as a source of activated carbon from its charcoal. The powdered shell is also used in the industries of plastics, glues, and abrasive materials and it is widely used for the manufacture of insect repellent in the form of mosquito coils and in agarbathis. The purpose of this experimental work is to develop a concrete with coconut shells as coarse aggregate. The whole entity could be called coconut shell aggregate concrete (CSAC). After the coconut is scraped out, the shell is usually discarded as waste as shown in Figure 1.1. The vast amount of this discarded coconut shells resource is as yet unutilized commercially; its use as a building material, especially in concrete, on the lines of other light weight aggregate is an interesting topic for study. The study of coconut shells will not only provide a new material for construction but will also help in the preservation of the environment in addition to improving the economy by providing new use for the coconut shells. Therefore attempts have been taken to utilize the coconut shells as coarse aggregate and develop the new structural LWC.

2. MATERIALS AND METHODS

The coconut shells are obtained from a local coconut field. They are sun dried before being crushed manually. Coconuts show a wide diversity in size, weight, shape and color, depending on genetic variety and maturity of the nut at harvest. The particle sizes of the coconut shell range from 5 to 20 mm. The surface texture of the shell was fairly smooth on concave and rough on convex faces. The absorption of water in the concrete will not affect its strength since lesser voids can be formed. Moisture retaining and water absorbing capacity of Coconut Shell are more compared to conventional aggregate. The amount of cement content may be more when Coconut Shell are used as an aggregate in the production of concrete compared to conventional aggregate concrete. The presence of sugar in the CS as long as it is not in a free sugar form, will not affect the setting and strength of concrete.

The present study requires preliminary investigations in a systematic manner:

Selection of type of grade of mix, mix design by an appropriate method, trial mixes final mix proportions.

- Estimating total quantity of concrete required for the whole project work.
- Estimating quantity of cement, fine aggregate, coarse aggregate, coconut shells required for the project work.
- Testing of properties of cement, fine aggregate, coarse aggregate and coconut shells.
- Preparing the concrete cubes with coconut shells and gravel.
- Testing those cubes in compression testing machine.

The technique adopted for this study was batching by volume, using a standard mould of 150x150x150 mm for casting the cubes. The mould was assembled prior to mixing and properly lubricated for easy removal of hardened concrete cubes, which were prepared by volume of 0 or 100 percent for granite and coconut shell of the 1:1.5:3 mix ratio. The mixture was

properly turned with shovel until it reached a plastic state and slump test was carried to find the W/C ratio of mix and then it was fed into the lubricated cast iron mould, water curing method was adopted. The moulded concrete cubes were given 24hrs to set before de-moulding. They were then immerse into a curing tank in order to increase the strength of the concrete, promote hydration, eliminate shrinkage, and absorb heat of hydration until the age of test. The cubes were cured for 7, 14 and 28days.

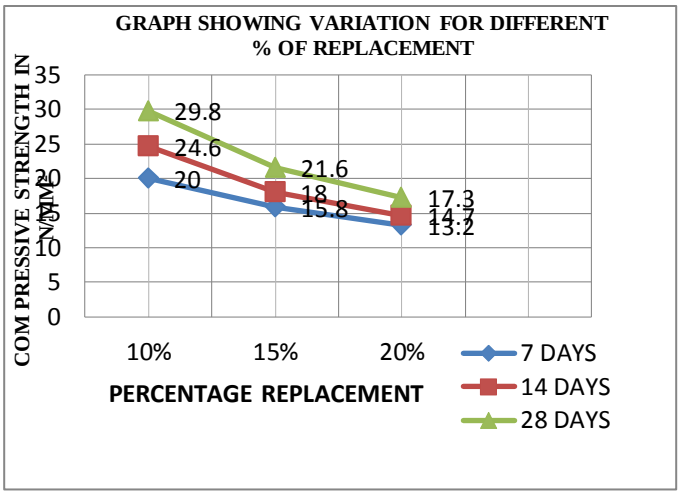
The cubes were then weighted before testing, while densities of the cubes at different times of testing were measured. Prior to testing, the specimen were brought out of the curing tank, left outside in an open air for about 3hrs before crushing. The compressive strength of the cubes were tested using compression testing machine.

3. RESULTS AND DISCUSSIONS

Compressive strength is defined as resistance of concrete to axial loading. Cubes were placed in Compressive Testing Machine (C.T.M), and load was applied. The readings on dial gauge were recorded and compressive strength was calculated. Compressive Strength = Maximum load/ Cross sectional area. As we can see from the graph, 10% and 15% replacement showed satisfactory results . Further if there is increment in the replacement percentages then the strength gets decreased.

Sr. No.	Number of Days	% Replacement of Coconut Shells	Compressive Strength (N/mm^2)
1	7	10%	20.0
		15%	15.8
		20%	13.2
2	14	10%	24.6
		15%	18.0
		20%	14.7
3	28	10%	29.8
		15%	21.6
		20%	17.3

3.CONCLUSION



From the experimental results, the coconut shell has potential as lightweight aggregate in concrete. Also, using the coconut shell as aggregate in concrete we can reduce the material cost in construction because of the low cost and abundant agricultural waste. 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. With 10 to 15 % replacement, the coconut shells gives satisfactory compressive strength of concrete.

REFERENCES

[1] Kabiru Usman Rogo, Selah Abu-Bakr" Exploratory study of coconut shell as aggregate in concrete production", Journal of Engineering and Applied Sciences, Vol.2, Dec 2010.

[2] Gunasekaran K, Kumar P.S, Laxmipathy M" Mechanical and Bond properties of Coconut Shell Concrete" Construction and Building Material (2011),pp 92-96.

[3] Utsev, J.T,Taku,J.K,2012,"Coconut shell ash as partial replacement of ordinary Portland cement in concrete production", International Journal of [1] Olanipekun, E.A., Olusola, K.O. & Ata, O, A comparative study of concrete properties using coconut shell & palm kernel shell as coarse aggregates, Building and Environment 41:297-301,2006. [4] Gopal Charan Behera, Ranjan Kumar Behera, Coconut Shell as Coarse Aggregate, International Journal of Engineering Research & Technology (IJERT), vol.2, Issue 6, June – 2013.