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Study of Strength of Concrete by Using Coconut Shell

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Abstract

In this constructed environment, the rising cost of building construction materials is the factor of great concern. The prices of building materials are rising day by day. The coarse aggregates are the main ingredients of concrete. In this paper, the utilization of coconut shell as a coarse aggregate has been discussed based on the results obtained from comprehensive review of literature. We all want that our buildings must be strong and should build with the construction material of reasonable rates. Every construction industry totally relies on cement, sand and aggregates for the production of concrete. Nowadays, most of the researchers are doing the research on the material which can reduce the cost of construction as well as increase the strength. Some of the waste materials are used in concrete according to their properties. For instance fly ash, rice husk, slag and sludge from the treatment of industrial and domestic waste water have been found suitable as partial replacement for cement in concrete. The coconut shell is a material which can be a substitute for aggregates. The shell of the coconut is mostly used as an ornament and as a source of activated carbon. Coco's Nucifera trees, otherwise known as coconut palm trees, grow abundantly along the coast line of Kerala. As a result coconut shells are abundantly available and it has been successfully utilized in many fields. It mainly represents an experimental study on the effect of coconut shell on the strength of concrete when used in replacement of aggregate. The tests were conducted on concrete with varying percentage of coconut shell (5%, 10% and 15%). Data presented include strength and slump value of concrete. The use of coconut shells can also help the prevention of the environment and also help economically. Sun drying shell should be used to make sure biodegradable materials decay before its mixing with concrete. It also contributes to sustainable construction. The aim of this paper is to spread awareness about the utilization of coconut shell as a construction material in civil engineering.

Keywords: *Coconut Shell, Concrete, ,*

1. Introduction

1.1 Concrete: - A composite material that consists essentially of a binding medium, such as a mixture of Portland cement and water, within which are embedded particles or fragments of aggregate, usually a combination of fine and coarse aggregate. Concrete is by far the most versatile and most widely used construction material worldwide. Due to continually increasing demands for the concrete quality (mainly durability) and huge advances in admixture and concrete technology, it is now possible to produce many different kinds of concrete.

1.2 Materials/Constituents of Concrete:-A composite material is made up of various constituents. The properties and characteristics of the composite are functions of the constituent materials' properties as well as the various mix proportions. Before discussing the properties of the composite, it is necessary to discuss those of the individual constituents as well as the effects of the mix proportions and methods of production.

Cement: - is the hydraulic binder (hydraulic = hardening when combined with water) which is used to produce concrete. Cement paste (cement mixed with water) sets and hardens by hydration, both in air and under water. Cement is the "glue" that binds the concrete ingredients together and is instrumental for the strength of the composite.

CEM I	**Portland cement**
CEM II	**Composite cements (mainly consisting of Portland cement)**
CEM III	**Blast furnace cement**
CEM IV	**Pozzolana cement**
CEM V	**Composite cement**

2. Literature Review

Concrete is an artificial material similar in appearance and properties to some natural lime stone rock. It is a man made composite, the major constituent being natural aggregate such as gravel, or crushed rock, sand and fine particles of cement powder all mixed with water. The concrete as time goes on through a process of hydration of the cement paste, producing a required strength to withstand the load. The use of coconut shell as coarse aggregate in concrete has never been a usual practice among the average citizens, particularly in areas where light weight concrete is required for non-load bearing walls, non-structural floors, and strip footings. Although

coarse aggregate usually take about 50% of the overall self weight of concrete. The cost of construction materials is increasing day by day because of high demand, scarcity of raw materials, and high price of energy. From the standpoint of energy saving and conservation of natural resources, the use of alternative constituents in construction materials is now a global concern. For this, the extensive research and development works towards exploring new ingredients are required for producing sustainable and environment friendly construction materials. The recycling of solid wastes in civil engineering applications has undergone considerable development over a very long time. The utilization of fly ash, blast furnace slag, recycled aggregates, red mud, Kraft pulp production residue, waste tea etc., in construction materials shows some examples of the success of research in this area. Similarly, the recycling of hazardous wastes for use in construction materials and the environmental impact of such practices has been studied for many years. Coconut is grown in more than 93 countries. South East Asia is regarded as the origin of coconut. India is the third largest, having cultivation on an area of about 1.78million hectares. Annual production is about 7562 million nuts with an average of 5295 nuts per hectare. The coconut industry in India accounts for over a quarter of the world's total coconut oil output and is set to grow further with the global increase in demand. However, it is also the main contributor to the nation's pollution problem as a solid waste in the form of shells, which involves an annual production of approximately 3.18 million tones. Coconut shell represents more than 60% of the domestic waste volume. Coconut Shell, which presents serious disposal problems for local environment, is an abundantly available agricultural waste from local coconut industries. In developing countries where abundant agricultural and industrial wastes are discharged, these wastes can be used as potential material or replacement material in the construction industry. This will have the double advantage of reduction in the cost of construction material and also as a means of disposal of wastes.

Use of waste in concrete: - A research effort has been done to match society's need for safe and economic disposal of waste materials. The use of waste materials saves natural resources and dumping spaces, and helps to maintain a clean environment. The current concrete construction practice is thought unsustainable because, not only it is consuming enormous quantities of stone, sand and drinking water, but also two billion tons a year of Portland cement, which releases green-house gases leading to global warming. Experiments has been conducted for waste materials like- rubber tyre, e-waste, coconut shell, blast furnace slag, waste plastic, demolished concrete constituents, waste water etc. Construction waste recycle plants are now installed in various countries but they are partly solution to the waste problems.

2.2 COCONUT SHELL AS COARSE AGGREGATE:-

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 as well concrete using coconut shells as replacement for crushed granite and to assess the potential use of coconut shell concrete as a structural material as contribute to knowledge on the use of waste materials in construction. 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.

Coconut shell

3. Methodology

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.

PROCEDURE:-

3.1 Mix proportions: - In order to investigate properties of Coconut Shell concretes, three mixes of coconut shell M20 concrete were made. Each mix containing 6 cubes of coconut shell concrete. The natural coarse aggregates were replaced as 0%, 5%, 10and 15% by coconut shells. The mixes of M20 were having the following proportion of coconut shell:-

DESIGNATION	PROPORTION OF COCONUT SHELL	PROPORTION OF AGGREGATE	NUMBER OF CUBES
A	5%	95%	6
B	10%	90%	6
C	15%	85%	6
NOMINAL MIX	0%	100%	3

Table 7

3.2 Weight of materials in each mix:-The ratio of cement, sand and aggregate in M20 concrete is 1:1.5:3. The natural coarse aggregates were replaced as 0%, 5%, 10and 15% by coconut shells. Weights of materials are calculated accurately with the help of electric weighing machine. Each mix was weighted differently and the constituents were mixed in the machine to form the concrete. All the mix A, B, and C were having the following proportion of cement, sand, aggregate, and coconut shell .

4. Result

Compressive Strength:-The strength of all the concretes increased with curing age. Control concrete gained 31 percent and 50 percent over its 28 day compressive strength at 3 days and 7 days of curing respectively. Strength of the coconut shells concretes increased 24-42 percent at 3 days and 38-84 percent after 7 days of curing than its corresponding 28 day strengths respectively. This observation suggests that as coconut shells percentage increased the 7 day strength gain also increased with corresponding 28 day curing strength. The coconut shells concretes, especially 20% (M20) replacement level the concretes failed to maintain same strength gain, which had first 7 days of curing. This may be due to lack of sufficient bond between the particles. As the first 7 days of

curing, majority of the compressive strength of the concretes depends on paste strength. However, at later age, the strength of concrete depends on strength of the paste, strength of the aggregate and bond strength between the aggregate particles and cement paste. Evidently, in the present investigation, the visual observations on specimens failed in compressive strength test suggested that the coconut shells particles were separated from the paste phase. The 28 day compressive strength of M20 concrete was 91 percent when compared to nominal concrete. Furthermore, the strength decreased with coconut shells replacement. The trend of the results was in line with the earlier studies.

Visual observations during mixing and compaction of all the concretes suggested that the concretes were homogenous; there was no segregation and bleeding, the mixes were compactable. The fresh state performance of the Coconut Shell concretes was comparable with control concrete. The concretes had low slump, the slump values of the concretes were between 20-26 mm. The slump decreased with increase in coconut shell percentage. . Furthermore, for M20 mix, in which, the total aggregate was replaced by 15% coconut shell shown a slump value of 20-25. This observation suggests that addition of coconut shell decreases workability .The decreased workability of coconut shell concretes may be due to coconut shell particle shape. Flat shaped coconut shell particles could have restricted overall movement of the aggregate particles and thus reduced workability. The workability was found to be increasing with increase in the replacement percentage of aggregates with coconut shell. Coconut shell concrete probably has better workability due to the smooth surface on one side of the shells and also due to the smaller size of coconut shells compared to conventional aggregates.

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CUBES DESIGNATION	COMPRESSIVE STRENGTH (KG/CM^2)	COMPRESSIVE STRENGTH (N/MM^2)	AVERAGE (N/MM^2)
A	180	18	18.7
	194	19.4	
B	178	17.8	18.4
	190	19.0	
C	198	19.8	19.5
	192	19.2	
D	172	17.2	18
	188	18.8	
	180	18.0	

5. Conclusion

1. Up to 15% of aggregate replaced by coconut shell is good according to strength and cost wise.
2. Increase in percentage replacements by coconut shells reduced the strength and density of concrete.
3. It helps in reducing up to15% pollution in environment.
4. 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.
5. Trying to replace aggregate by coconut shell partially to make concrete structure more economic along with good strength criteria.
6. From one cube calculation bulk amount of shell replacement can be evaluated & reduces over all construction cost.
7. This can be useful for construction of low cost housing society
8. Solves problems of disposal of coconut shell.
9. Slump of concrete increases as percentage of coconut shell increases.
10. It leads to sustainable development.
11. Continuous extraction of aggregate from rocks will lead to its depletion.

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APPLICATIONS OF COCONUT SHELL CONCRETE:-

- Partition wall
- Compound wall
- Low cost housing
- Slum clearance projects (area is less=18-20m^2)
- Rural areas, where cost of coarse aggregates is more
- Places, where availability of coconut shell is in abundance.

References

1. *I.S 516-1959, Indian Standard: METHODS OF TESTS FOR SRENGTH OF CONCRETE*
2. *I.S 456-2000, Indian standards: PLAIN AND REINFORCED CONCRETE-CODE OF PRACTICE*
3. *http://www.wikipedia.com*
4. *http://www.scribd.com*
5. *http://shodhganga.inflibnet.com*
6. *http://www.liquisearch.com*
7. *S.K. DUGGAL*
8. *http://www.eaasjournal.org/survey/userfiles/files/v3i307%20civil%20engineering.pdf*
9. *K. Gunasekaran, "Utilization of Coconut Shell as Coarse Aggregate in the Development of Light Concrete", Thesis- SRM University, 2011.*
10. *Majid Ali and NawawiChouw, "Coir Fiber and Rope Reinforced Concrete Beam under Dynamic Loading", Thesis- University of Auckland, New Zealand, 2009.*
11. *Dewanshu Ahlawat and L.G.Kalurkar, "Strength Properties of Coconut Shell Concrete" International Journal of Civil Engineering & Technology (IJCIET), Volume 4, Issue 7, 2012, pp. 20 - 24, ISSN Print: 0976 – 6308, ISSN Online: 0976 – 6316.*

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