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COCONUT SHELL CONCRETE BLOCKS

Submitted

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ABSTRACT

Coconut is grown in more than 93 countries. India is the third largest, having cultivation on an area of about 1.78 million hectares for coconut production. Annual production is about 7562 million nuts with an average of 4248 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 tonnes. If a substitute for aggregate can be obtained naturally and the source is abundant and can be regenerated, obtaining the aggregate would deplete its source. On the other hand, as coconut shells are abundantly available and it has been successfully utilized in many fields. Our study mainly focusses on the effect of coconut shell on the strength of concrete when used in replacement of aggregate. It is also abundantly available agricultural waste from local coconut industries. In developing countries, where abundant coconut shell waste is 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.

INTRODUCTION

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. 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.
Concrete obtained using coconut shell as a coarse aggregate satisfies the minimum requirements of concrete. Coconut shell aggregate resulted acceptable strength which is required for structural concrete.

LITERATURE REVIEW

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

Olutoge (2010) studied the saw dust and palm kernel shells (PKS). Fine aggregates are replaced by saw dust and coarse aggregates by palm kernel shells in reinforced concrete slabs casting. Conventional aggregates were replaced by saw dust and PKS in same ratios of 0%, 25%, 50%,75% and 100%. It was seen that at 25% sawdust and PKS can produce lightweight reinforced concrete slabs that can be used where low stress is required at reduced cost. 7.43% reduction can be achieved in terms of cost for every cubic meter of slab production with use of sawdust.

Amarnath Yerramala Ramachandrudu C (2012) in his experimental study, coarse aggregate was partially replaced by coconut shell and fly ash. Percentages of replacement by coconut shell were 10%, 15%, 20% and Percentages of coconut shell replacement by fly ash were 5%, 25%. He concluded in his study that workability decreased with increase in CS replacement. Compressive and split tensile strengths of CS concretes were lower than control concrete.

PROPERTIES OF COCONUT SHELL

1. Coconut shell has high strength and modulus properties.
2. It has added advantage of high lignin content. High lignin content makes the composites more weather resistant.
3. It has low cellulose content due to which it absorbs less moisture as compare to other agriculture waste.
4. Coconuts being naturally available in nature and since its shells are non-biodegradable; they can be used readily in concrete which may fulfil almost all the qualities of the original form of concrete.

ADVANTAGES OF COCONUT SHELL CONCRETE BLOCKS

1. Producing economic concrete by reducing the cost of material.
2. Coconut shells are more resistant towards crushing, impact and abrasion.
3. Useful for low-cost housing and partition wall.
4. Place where availability of coconut shell is in abundance.
5. Production of light weight concrete.

DISADVANTAGES OF COCONUT SHELL CONCRETE BLOCKS

1. Coconut shell cannot use in large proportion in concrete.
2. Coconut shell not useful for high rise building.

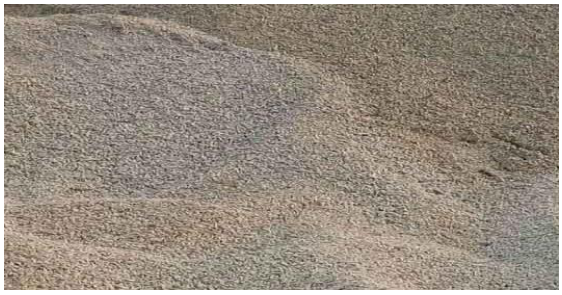
PROCEDURE

- 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.

MATERIALS USED AND ACTUAL METHOD

Portland Pozzolana cement of PPC 53 grade conforming to both the requirements of IS: 12269 type I was used. Normal aggregate of maximum size 20mm was used as coarse aggregate. Well graded sand passing through 4.75mm was used as fine aggregate. The freshly discarded Coconut shells were collected. The coconut shells were crushed using concrete hammers to a size such that it passes through a 20mm sieve and retained on 4.75mm sieve. Crushed shells were washed to remove fibres, mud, etc. from them. The washed shells were dried in sunlight for 2 days. The crushed edges were rough and spiky. Further broken the shells into small chips manually using hammer and sieved through 12mm sieve. The material passed through 12mm sieve was used to replace coarse aggregate with coconut shells.
A nominal mix of 1:2:4 was used and total 12 cubes were made from which 3 cubes were made by replacing 0% of aggregate (nominal concrete), another 3 cubes were made by replacing 25% of aggregate, another 3 cubes by 50% replacement of aggregates and the last 3 cubes by replacing 100% of aggregates. After that compressive strength test was taken.

Coarse Aggregate



Fine Aggregate

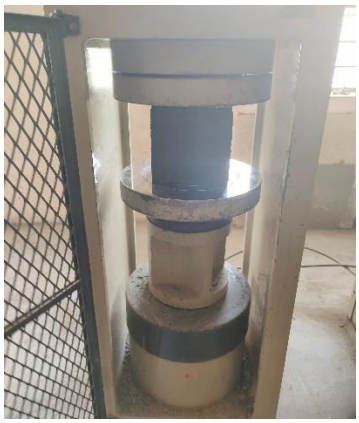
Portland Pozzolana Cement

Crushed Coconut Shells

COMPRESSIVE STRENGTH

Compressive strength test is the test measuring the maximum amount of compressive load a material can bear before fracturing.

$$\text{Compressive Strength} = \frac{Load}{C/S\,Area}$$



RESOURCES USED

Sr. No.	Particulars	Specification	Quantity	Remark
01	Compression Testing Machine	Compression TestingMachine – 2000KN capacity	01	--

02	Moulds	Cast Iron: for 150 mm cube with ISI certificationmark IS:10086	06	--
03	Vibrating Table	Vibrating Table top 500mm 500mm withedges	01	--
04	Tamping Rod	16mm dia., 600mm lengthand having one bullet end.	01	--

RESULTS

% REPLACEMENT OF AGGREGATES	TRIAL NO.	LOAD (KN)	COMPRESSIVE STRENGTH (MPa)	AVERAGE COMPRESSIVE STRENGTH (MPa)
0	1	530	23.55	
	2	545	24.22	24.51
	3	580	25.77	
25	1	559	24.84	
	2	510	22.66	22.82
	3	472	20.97	
50	1	341	15.15	
	2	336	14.93	14.48
	3	301	13.37	
100	1	220	9.77	
	2	155	6.88	7.61
	3	140	6.20	

CONCLUSIONS

- In our study, we replaced coarse aggregate with coconut shell, by volume. Specimens were cast by replacing 0%,25%,50% and 100% of coarse aggregate with coconut shells. Tests were conducted on the cast specimens after 28 days as mentioned in the IS code.
- Its corresponding compressive strengths were obtained as 24.51N/mm^2, 22.82N/mm^2, 14.48N/mm^2 and 7.61N/mm^2.
- From the above results we can see that in coconut shell concrete where 25% of the coarse aggregate is replaced, shows properties similar to the nominal mix and 50% replaced coconut shell concrete shows properties similar to light weight concrete which can be used as filler materials in framed structures, flooring tiles, thermal insulating concrete etc.
- Up to 20-25% of aggregate replaced by coconut shell is good according to strength and cost wise.
- Also, it helps in reducing up to 15% pollution in environment.