CONCRETE WITH CRUSHED COCONUT SHELL AS COARSE AGGREGATE

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ABSTRACT

The high cost of conventional building materials is a major factor affecting housing delivery in world. This has necessitated research into alternative materials of construction and analyzing flexural and compressive strength characteristics of concrete produced using crushed, granular coconut as substitutes for conventional coarse aggregate with full replacement using M25 grade concrete. The main objective is to encourage the use of these 'seemingly' waste products as construction materials in low-cost housing. It is also expected to serve the purpose of encouraging housing developers in investing these materials in house construction. This project paper aims at analyzing the compressive strength characteristics of concrete produced using crushed, granular coconut as coarse aggregate with partial replacement using M25 grade concrete. Cubes are casted, tested and their properties are determined in this paper.

KEYWORDS: Concrete, coarse aggregate, coconut shell, M25 grade concrete, light weight aggregate.

INTRODUCTION

Coconut Shell (CS) are not commonly used in the construction industry but are often dumped as agricultural wastes. Coconut is grown in 92 countries with a global production of 51 billion nuts of which India produces 9500kt of coconut. In India, industries and informal sectors recycle about 15-20% of solid waste in various building material. In developing countries, coconut shell type waste can be used as a construction material. It has the advantage of reduction of cost and it also serve as a mean of disposal or say recycling of waste. If structural light weight concrete can be developed from coconut shell, it would a great achievement for construction industry. Coconut shells are more suitable as low strength-giving lightweight aggregate when used to replace common coarse aggregate in concrete production. In the following paper the normal weight aggregate has been replaced by coconut shell aggregate and cubes have been casted to test their compressive strength and other physical properties.

MIX DESIGN DETAIL

The mix design for M25 grade concrete was done as recommended in IS 10262-1982 and according to IS 10262-1982 the following data was required for concrete mix design.

1.	Characteristic compressive strength at 28 days	25N/mm^2
2	Cement	Cement used is PPC(fly ash based) according to IS 1489 : 1991(part 1) Fineness - 300m2/kg Compressive strength of 28 days – 33MPa Iniial setting time(min.) – 30 min. Final setting time(max.) – 10hrs. Soundness according to Le Chatelier method – 10mm.
3	Coarse Aggregate .	Crushed coconut shell aggregate of size 3-12mm in length and 2-8mm thickness Specific gravity- 1.40
4	Fine aggregate	River sand was used as the fine aggregate conforming to grading zone II as per IS 383:1970 [159]. Specific gravity- 2.65
5	Maximum free water cement ratio	0.47
6	Workability corresponding to compaction factor	80mm slump.
7	Admixture	No admixture added.

Based upon the above mix design,following mix proportion has been calculated :

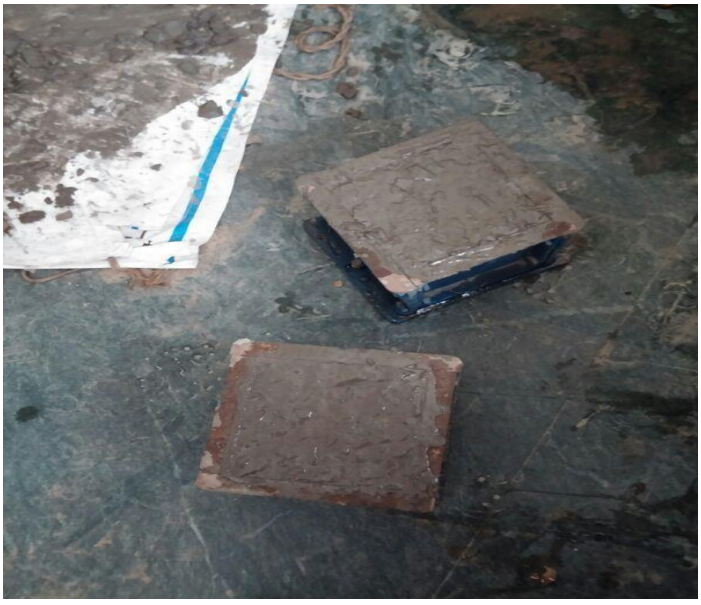
Mass of cement (Kg/m^3)	Mass of water (Kg/m^3)	Mass of coarse aggregate(crushed coconut shell) (Kg/m^3)	Mass of fine aggregate (Kg/m^3)
442.553	208	544.18	603.2
1	0.47	1.22	1.36

The final mass ratio of cement, water, coarse aggregate and fine aggregate was taken as 1:0.47:1.22:1.36.

EXPERIMENTAL INVESTIGATION

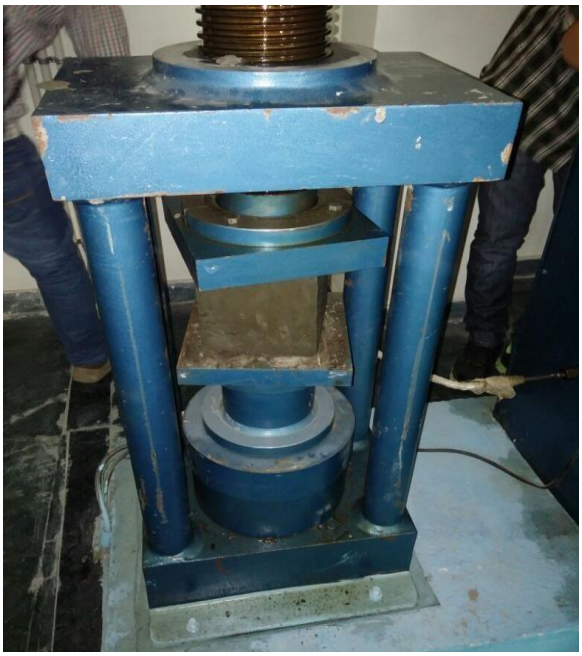
Using the above mix proportion for M25 grade concrete, concrete mix is prepared and the concrete is filled in cubical moulds. The moulds were greased from inside for easy demoulding. Cubes were casted of size 150mm*150mm*150mm as shown in figures 1 and 2 and their compressive strength was tested .

Fig.1 : Concrete with crushed coconut shell as coarse aggregate filled in moulds.



Six cubes were casted and were demoulded after one day and were placed in water. After 7 days,they were tested for their compressive strength.

Fig.2. Testing of compressive strength of concrete cubes.



RESULT

The slump of concrete with crushed coconut shell as coarse aggregate was found out to be 35mm.After testing the six cubes, the average 7 days compressive strength of six cubes was found out to be 12.44Mpa.Comparing with the compressive strength of conventional concrete (concrete with crushed stone as coarse aggregate) that is 19.36Mpa(7 days compressive strength),it is less strong, but its good for places where it has to bear less compressive load.

CONCLUSION

The following conclusions have been drawn:

(1) By replacing the normal weight aggregate by coconut shell aggregates, the mass of coarse aggregate reduces about 47% due to high porosity of coconut shell leading it to low value of specific gravity.

(2) By replacing the normal weight aggregate with coconut shell aggregate, the concrete made from it falls under the category of light weight concrete.

(3) It lacks in compressive strength as compared to conventional concrete but it can be used at places where low strength economical concrete is needed.

REFERENCES

- IS 19262- 1982 (reaffirmed 2004).
- Gunasekaran k "utilization of coconut shell as coarse aggregate in the development of lightweight concrete" page no. 83-84,183-184.
- www.ultratech.com