



Properties of Concrete by using Coconut Shell as Coarse Aggregate

Vijay Kumar Shukla¹, Bharti Sharma², Amarnath Gupta³Assistant professor^{1,2}, Student³

Department of Civil Engineering

VEC Lakhanpur Surguja University Ambikapur, Chhattisgarh, India

Abstract:

The most affecting factor in construction is its cost. In most of the construction work concrete is used which consist which consist cement, sand, coarse aggregate and water. The compressive and flexural strength of concrete is mostly depend on the compressive and flexural strength of coarse aggregate. In present day the coarse aggregate is obtained from natural resources for example natural rocks etc. But artificial aggregate are also in practice. In India coconut is widely used for various purposes like worship, industries etc. By use of coconut its shell remains as by-product which can be useful for construction work in place of coarse aggregate. In this experiment coarse aggregate of concrete are partially replaced by coconut shell as 5%, 10%, 15%, 20%, 25%, 30%. The concrete are examine for compressive strength and compare with conventional concrete of grade M20. All test of cement, sand, aggregate and concrete was done as per IS code.

1. INTRODUCTION

Compressive strength is main property of concrete. Coarse aggregate is ingredient of concrete produce compressive strength in concrete. Cost of construction material increases cost of structure but it may reduce to some amount by using by-product in construction. Coconut shell (C.S.) is hard outer part of coconut having composition of cellulose, hemi-cellulose and lignin as major composition which protect it from decay. In India about 11,930,000 tone coconut produced per year. And about 29, 82,500 tone coconut shell produced per year in India. When such amount of shell is used in construction work partially with coarse aggregate, some amount of conventional aggregate may save.

2. LITERATURE REVIEW

The Literature available reveals that the coconut shell concrete can be used for low strength structure and use of this make light weight concrete. Firstly from the research by C.J. Ewansiha, J.E. Ebhoaye, I.O. Asia, L.O. Ekebafé and C. Ehigie Chemistry Department, College of Education, P.M.B , Igueben, Nigeria Ambrose Alli University, Ekpoma, Nigeria, which give the composition of coconut shell Concluded that the composition of coconut shell such as Ca, Mg , P, Mn, Ka, make it hard And produced strength. From the research by Martone P, Estevez J, Lu F, Ruel K, Denny M, Somerville C, Ralph J, "Discovery of Lignin in Seaweed Reveals Convergent Evolution of Cell-Wall Architecture." Current biology (2009) CB 19 (2): 169–75 and "Lignin and its Properties: Glossary of Lignin Nomenclature". Dialogue/ Newsletters (2001) 9 (1), Lignin Institute gives the presence of lignin in coconut shell which protect it from decay by weather action and presence of moisture in it. In the paper Review On Utilization Of Coconut Shell As Coarse Aggregates in Mass Concrete by Maninder Kaur & Manpreet Kaur, Department of Civil Engineering, PEC, Chandigarh were investigated on the "Use of coconut shells in cement concrete can help in waste reduction and pollution reduction". The need

of the hour is to encourage the use of the 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. In the paper Properties of Concrete with Coconut Shells as Aggregate Replacement by Amarnath Yerramala Ramachandrudu C were investigated on M20 Grade of concrete. And suggest that the coconut shell concrete make light- weight concrete. From all above reviews an investigation on coconut shell concrete is necessary to find out the suitable construction material in which make economical structure

3. MATERIAL AND METHOD

3.1 Coarse aggregate

The various property of coarse aggregate is obtained by using IS: 2386-1963 Part- III. Size of coarse aggregate used for determination of specific gravity must be passing through 20mm size sieve and retaining on 10mm sieve.

Table.1. Properties of coarse aggregate

Sl. No.	property	value
1	Specific gravity	2.73
2	Water absorption	1.5%

20mm nominal size of aggregate are used and gradation of coarse aggregate was done according to the IS: 383 -1970.

3.2 Fine aggregate

Generally the size of aggregate which is passing through 4.75 mm sieve size is called fine aggregate. For determination of properties of fine aggregate IS2386-1963 (part III) is used and for gradation IS 383: 1970 is used.

Table .2. Properties of sand

Sl. No.	property	value
1	Specific gravity	2.65
2	Sieve analysis	ZONE- III

3.3 Cement

Cement is a binding material on concrete. For making of concrete ordinary Portland cement of grade 43 are used. Testing of cement is don according to IS: 431(part IV)-1988. The property of cement is shown below –

Table.3. Properties of cement

Sl. No.	property	value
1	Consistency of cement	28%
2	Setting time	40 minute 600 minute
	a) Initial b) Final	
3	Specific gravity	3.15
4	Fineness test	5%

Fineness of cement is necessary for make suitable Gel of cement during hydration process. Size of cement is a factor which affects the rate of hydration.

3.4 Coconut shell (C.S.)

The properties of coconut shell are determining same as conventional aggregate. Properties are shown in table below –

Table .4. Properties of coconut shell

Sl. No.	Property	Value
1	Specific gravity	1.19
2	Water absorption	2.7%

The gradation of Coconut shell is also same as conventional aggregate. 20mm nominal size of coconut shell is used.

4. EXPERIMENTAL PROGRAM

4.1 CONCRETE MIX DESIGN

Concrete mix design for M20 grade concrete is prepared according to IS code 10262-2009 as follows –

- 1) Water content = 198 liter /m³
- 2) Cement content = 396 kg/m³
- 3) Water - cement ratio = 0.5
- 4) Aggregates:
 - Coarse aggregate fraction= 0.64
 - Fine aggregate fraction= 1- 0.64=0.36

5) Mix Calculation –

- a) Volume of concrete = 1m³
- b) Volume of cement = (396/3.15) x (1/1000)
= 0.126 m³
- c) Volume of water = (198/1) x (1/1000)
= 0.198 m³
- d) Volume of aggregates in all -
= 1-0.126-0.198
= 0.68 m³
- e) Coarse aggregate = d) x fraction of coarse aggregate
x Specific gravity (G) of coarse aggregate x 1000
= 0.68 x 0.64 x 2.73 x 1000
= **1189 kg/m³**
- f) Fine aggregate = d) x fraction of fine aggregate x
Specific gravity (G) of fine aggregate
x 1000
= 0.68 x 0.36 x 2.65 x 1000
= **649 kg/m³**

Table.5.Proportions for 1m³

water	Cement	Fine aggregate	Coarse aggregate
198 liter	396kg	649 kg	1189 kg

Mix proportion is – 1: 1.64: 3.002

(Cement: fine aggregate: coarse aggregate)

4.2 CASTING

Casting is generally defined as moulding of concrete. In this process dry mix of cement, sand, and aggregate (coarse aggregate +coconut shell) are prepared and then water is mixed in dry mix. Water is taken as obtained in concrete mix design. Mix all ingredients properly and make a homogeneous mix. Making cubes of size 150mm x 150mm x 150mm and cubes are removed after 24 hr. all cubes are cured for 28 days. In this experiment 6 cubes for each replacement of coarse aggregate is casted. About 42 cubes are casting for this experiment.

4.3 TESTING

Compressive strength of cubes is determined by compression test on compression testing machine of capacity 2000KN. For testing of compressive strength IS 516: 1959 used. According to IS516:1959 load of 140Kg/cm²/minute applied on the cubes until the cubes are cracks. Strength of concrete is fixed by using criteria of IS456: 2000.



Figure .1.Testing of compressive strength of cubes

5. RESULT

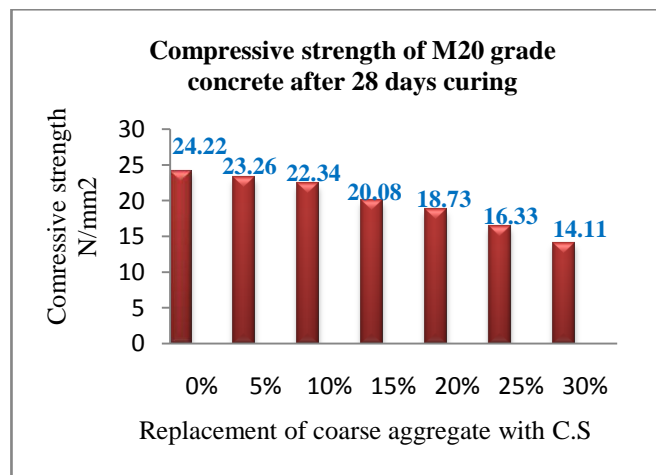
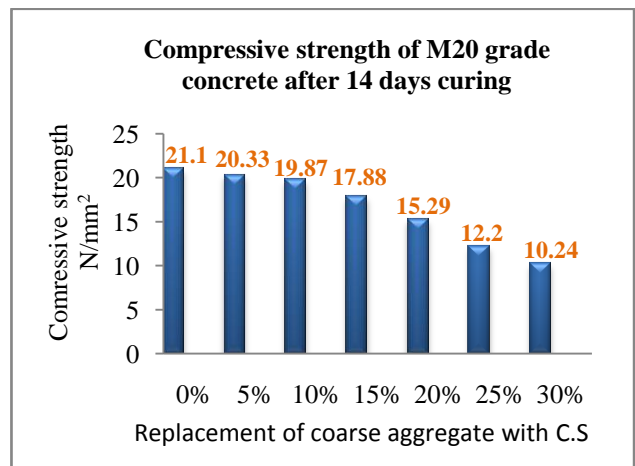
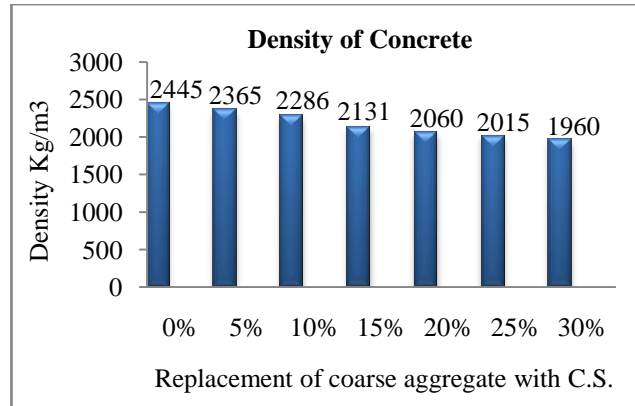
Result of cubes is shown below in table 5.1 and table 5.2 -

Table.6. Density of concrete

Sl. No.	Percentage of replacement	Density Kg/m ³
1	0%	2445
2	5%	2365
3	10%	2286
4	15%	2131
5	20%	2060
6	25%	2015
7	30%	1960

Table.7. Compressive strength of cubes

Sl. No.	Percentage replacement of	Compressive strength after 14 days curing in N/mm ²	Compressive strength after 28 days curing in N/mm ²
1	0%	21.10	24.22
2	5%	20.33	23.26
3	10%	19.87	22.34
4	15%	17.88	20.08
5	20%	15.29	18.73
6	25%	12.20	16.33
7	30%	10.24	14.11



6. CONCLUSION

From experimental investigation it is clear that coconut shell is not suitable construction material. From investigation it is clear that as the percentage of coconut shell increase in the concrete compressive strength decreased gradually. But by using the coconut shell density of concrete is also decreased which make light weight concrete and reduce dead weight of the structure.

7. REFERENCES

- [1].Parag S. Kambli, Sandhya R. Mathapati “Application of Cocconut Shell as Coarse aggregate in concrete” International Journal of Engineering Research and Application Vol.6, Issue3, march 2014.
- [2]. Amarnath Yerramala Ramachandrudu, “ Properties of Concrete with Coconut Shells as Aggregate Replacement” International Journal of Engineering Invention, Vol. 1, Issue6, Oct 2012.
- [3]. M.S. Shetty “Concrete Technology theory and practice” S. Chand Publication.
- [4]. Indian Standard code IS: 383. 1970. “Specification for Coarse and Fine Aggregates from Natural Sources for Concrete”- Code of practice. Bureau of Indian Standards, New Delhi.
- [5]. Indian Standard code IS2386.1963. “Method of test for aggregate for concrete” -Code of practice. Bureau of Indian Standards, New Delhi.
- [6]. Indian Standard code IS:10262:2009. “Recommended Guidelines for Concrete Mix Design”- Code of practice. Bureau of Indian Standards, New Delhi.
- [7].Indian Standard code IS: 516. 1959. “Methods of Tests for Strength of Concrete”- Code of practice. Bureau of Indian Standards, New Delhi.

8. BIOGRAPHIES

Vijay Kumar Shukla, Assistant professor, Civil Engineering Department, VEC Lakhanpur Surguja University Ambikapur, Chhattisgarh, India.

Bharti Sharma, Assistant professor, Civil Engineering Department, VEC Lakhanpur Surguja University Ambikapur, Chhattisgarh, India.

Amarnath Gupta Engineering Student (B.E.), Civil Engineering Department, VEC Lakhanpur Surguja University Ambikapur, Chhattisgarh, India.