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Light Weight Concrete by Using Coconut Shell as Course Aggregate

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Abstract-The Material such as cement, sand, gravel etc are using in construction is going to be out of reach day by day. First one it is a natural non-renewable material and second one it is going to be costly. Its natural abundance is decreasing on the other hand constructions are increasing. It is not easily available according to requirements. It is a matter of concern in this developing construction area. Nowadays, most of the researchers are doing on some renewable material which can reduce the cost of construction as well as increase the strength. Research on waste material such as fly ash, rice husk, slag and sludge from treatment of industrial and domestic waste is being done. Use of coconut shell in concrete is not only useful economically but also environmentally useful for human being. Coconut shell is one of the main contributors of pollution problem as a solid waste and people burn it for fire purposes which pollute air. Coconut shell used as coarse aggregate in concrete encouraged sustainable and environment friendly material in the construction field. Composites are made by combining two or more natural or artificial materials to maximize their useful properties and minimize their weaknesses and make this material useful.

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Index Terms-lighSt weight coconut shell, cement, coarse aggregate, Mix Design, Compressive strength, flexural strength.

1. THE MAIN TEXT

Infrastructure development across the world created demand for construction materials. Concrete is the premier civil engineering construction material. Concrete manufacturing involve consumption of ingredients, aggregates, water and admixture(s). Among all the ingredients, aggregates form the major part. Two billion tons of aggregate are produced each year the United States. Production is expected to increase to more than 2.5 billion tons per by the year 2020. Similarly, the consumption of the primary aggregate was 110 million tonnes in U.K in the year 1960 and reached nearly 275 million tonnes by 2006.Use of natural aggregate in such a rate leads to a question about the preservation of natural aggregates sources. In addition, operations associated with aggregate extraction and processing are the principal causes of environmental concerns. In light of this, in the contemporary civil engineering construction, using alternative materials in place of natural aggregate in concrete production makes concrete as sustainable and environmentally friendly construction material. Different alternative waste materials and industrial byproducts such as fly ash, bottom ash, recycled aggregates, foundry sand, china clay sand, crumb rubber, glass were replaced with natural aggregate and investigated properties of the concretes. Apart from above mentioned waste materials and industrial byproducts, few studies identified that coconut shells, the agricultural by product can also be used as aggregate in concrete. According to a report, coconut is grown in more than 86 countries Worldwide, with a total production of 54 billion nuts per annum. India occupies the premier position in the world with an annual production of 13 billion nuts, followed by Indonesia and the Phillippines. Limited research has been conducted on mechanical properties of concrete with coconut shells as aggregate replacement. However, further research is needed for better understanding of the behavior of coconut shells as aggregate in concrete. Furthermore, there is no study available in the literature on the transport properties which determine durability of the concrete. Thus, the aim of this work is to provide more data on the strengths coconut shell concretes at different coconuts shells (CS) replacements and study the transport properties of concrete with CS as coarse aggregate replacement.

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2. METHODOLOGY

The ingredients of concrete i.e. cement, fine aggregate, course aggregate, coconut shells are tested before producing concrete. As per Indian standard codes various test are conducted on ingredients materials of the concrete. Firstly the dry ingredients cement, coarse aggregate, fine aggregate and coconut shells are fed in mixer and thoroughly mixed to ensure even distribution. Then the Water is added and the mix is continued. Production of mix (normal concrete of grade M-20) in the laboratory is carried out by IS method of concrete mix design (IS 10262-1982).Coconut shell concrete is produced by adding

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coconut shells in different percentage (i.e. 25%, 50% and 75%) replacement for coarse aggregate.

3. MATERIALS AND METHODS

The materials used in this experiment were locally available and these were Ordinary Portland Cement (O.P.C), sand as fine aggregate, crushed granite and coconut shell both as coarse aggregate. Potable water was used for mixing and curing.The constituent materials used in this investigation were produced from local sources. Ordinary Portland cement of OPC 53 grade conforming to both the requirements of IS: 12269 and ASTM C 642-82 type I was used. Normal aggregate, that is, crushed blue granite of maximum size 20mm was used as coarse aggregate. Well graded river sand passing through 4.75mm was used as fine aggregate. The specific gravities of coarse and fine aggregates were 2.65 and 2.63 respectively. The freshly discarded Coconut shells were collected from a local oil mill. 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 fibers, mud, etc from them. The washed shells were dried in sunlight for 2 days. The crushed edges were rough and spiky. The surface texture of the shell was fairly smooth on concave and rough on convex faces. Coconut shell aggregates used were in saturated surface dry (SSD) condition. 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.

Batching and Mixing:

Weigh Batching was accomplished with the help of electronic weighing balance. Batching was done as for each the mix proportions. Mixing was done in tray. It was mixed for 2-3 minutes, later than addition of water.

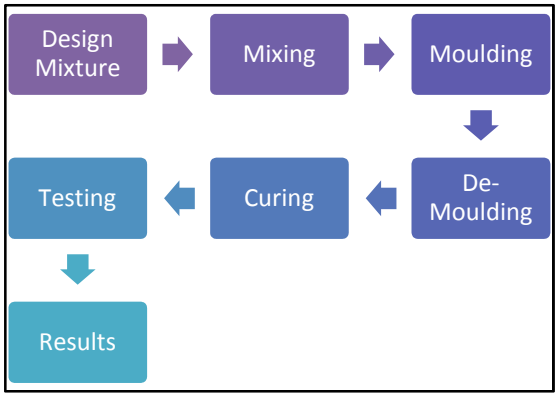
Placing and Compaction:

Cubes and prism are cleaned and oiled to avoid the formation of bond between concrete and iron moulds. Place the fresh concrete in moulds in 3 layers, tamping each layer with temper 25 times. The air which is entrapped in concrete is removed by table vibrator.

Details of Specimens:

Cube: For Compressive test: 150mm x 150mm x 150mm

Rectangle (beam): For **F**lexuraltest: 150mm x 150mm x 300mm.



PREPRATION OF SPECIMEN

4. RESULT AND DISCUSSIONS

4.1 COMPRESSIVE STRENGTH OF COCONUT SHELL CONCRETE (N/MM2) :-

The 25% replacement mix got an average compressive strength of 32.81 MPa which is about 94.25% strength of normal concrete(24MPa). Likewise ,we got a compressive strength of 31.96 MPa and 28.52 MPa for 75% and 100% replacement respectively. The result shows that coconut shell concrete can be even used in high strength applications with replacements within or around 25%. Further we can use higher percentage replacement for non load bearing structures. An examination of the failure surfaces showed the breakage of the Coconut shell aggregate, indicating shell strength had a strong influence on the resultant concrete strength. The flexural strength was found to be (4.44MPa) of normal concrete flexural strength and 80.6% (4.19 MPa) and 76%(4.02MPa) for 25% and 50% replacement mixes respectively. The 100% replacement concrete mix showed negligible flexural and compressive strength. The beam cast with 100% replacement concrete mix showed negligible flexural strength. The beam cast with 100% coarse aggregate replaced with coconut shells broke under its self weight itself. The flexural strength percentages are slightly lower than compressive strength percentages. In concrete with conventional aggregates, the failure in tension occurs as result of breaking of bond between the matrix and the surface of the aggregate used or by fracture of the concrete matrix itself. Thus the surface properties of coconut shells also pay an important role in determining the flexural properties of concrete. The reduction in self weight was found to be 9.56%, 19.16%, 38.32% when 25%, 50% and 100% of coarse aggregate was replaced by coconut shell respectively.

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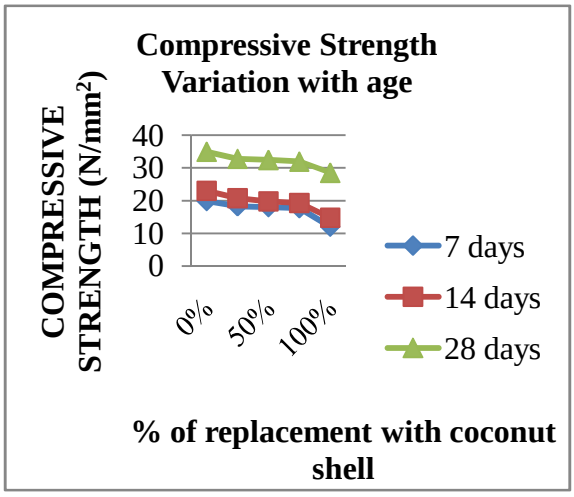
Results are discussed through table and graphical view is given below:-

Days	0%	25%	50%	75%	100%
7	19.83	18.25	17.95	17.68	11.98
14	22.98	20.70	19.78	19.22	14.75
28	34..95	32.81	32.44	31.96	28.52



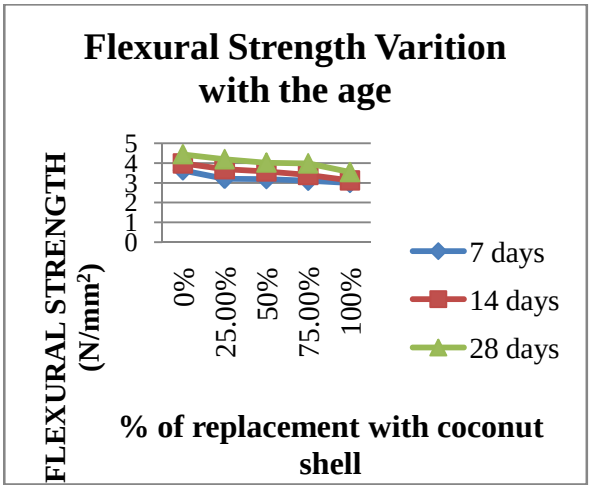
IMAGE

4.2 Flexural Strength of Coconut Shell Concrete (N/mm2)

The maximum flexural strength of 4.44 N/mm^2 was attained at 0% replacement, while the minimum strength of 3.54 N/mm^2 was attained at 100% replacement. At 100% replacement, concrete attained 3.54 N/mm^2 marginally less than 4.44 N/mm^2.Variations of flexural strength with the ages are given below by the help of graph.

Days	0%	25%	50%	75%	100%
7	3.63	3.21	3.18	3.11	2.99
14	3.98	3.69	3.57	3.39	3.12
28	4.44	4.19	4.02	3.98	3.54

TABLE



IMAGE

4.3 Workability of Coconut Shell Concrete:

The word 'workability' signifies much wider and deeper meaning than the other terminology "consistency" often used loosely for workability. Consistency is to indicate the degree of fluidity or degree of mobility. Two tests basically have done for workability namely slump test and compaction factor test with fresh mix.

Test	0%	25%	50%	75%	100%
Slump (mm)	38	35	31	29	24
Compaction Factor	0.85	0.85	0.85	0.85	0.85

TABLE

5. CONCLUSIONS

1. 25% replacement mixture may used in strength required constructions but above this percentage like 50% or 75% replacement concrete may not be used in loaded buildings.
2. 50% and 75% replacement concrete may used in light weight constructions like partition walls, retaining walls, park chairs, tables, gutter lids, slabs and foundations because coconut shells have higher crushing strength and more fire retaining than rock aggregate.
3. It is analyzed that in the replacement of coarse aggregate with coconut shell if increase in the percent of replacement it reduced the compressive strength of the concrete.

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4. It is observed in this study that flexural strength of concrete reduces as the percent of replacement is increases.
5. Density reduced at the increment of percent replacement.
6. Workability increases as the percent of replacement increases as the slump factor and compaction factor increases.
7. Coconut shell concrete has better workability because of the smooth surface on one side of the shells and the smaller size of coconut shells. So we could possibly use coconut shell concrete in concretes where high workability is desirable.

So coconut shell can be used as partial replacement of coarse aggregate as there is marginal difference in strength between coconut shell and convention aggregate. Because of it is a waste material and abundantly available in the area of its production and near the industry used coconut, one can reduce the effective cost of the concrete and it is also helpful for the environmental point of view.

6. FUTURE SCOPE OF THE PROJECT

My study had many limitations, of which the time was a major concern. The durability properties of coconut shell concrete are to be rested before practically applying our project. Durability tests on CSC which may take around a year to complete can be conducted as a future work. The strength properties of CSC depend on the aggregate properties of coconut shells and its individual strength characteristics. Experiments on impact value, crushing value etc can be done in order to analyze the strength properties of coconut shells. When CSC is used along with reinforcement, the surface bonding between coconut shell aggregates and steel comes into play. Therefore study about bond properties of these can be useful. Furthermore the action of coconut shell aggregates in cement matrix is also an area requiring future research. We can also study about the use of coconut shell aggregates along with other non-conventional aggregates like palm kernel shells, coir pith, volcanic debris,etc.

REFERENCES

[1] Damodhara Reddy1, I. V. Ramana Reddy2 & S. Aruna Jyothy3, Associate Professor, Department of Civil Engineering, Sri Venkateswara College of Engineering and Technology, Chittoor, Andhra Pradesh, India, Professor, Department of Civil Engineering, Sri Venkateswara University College of Engineering, Tirupati, Andhra Pradesh, India, Assistant Professor, Department of Civil Engineering, Sri Venkateswara University College of Engineering, Tirupati, Andhra Pradesh, India. (Jan, 2014)

[2] Maninder Kaur, Manpreet Kaur,(2012), "A review on utilization of coconut shell as coarse aggregate in mass concrete", International Journal of Applied Engineering Research, Vol. 7, No.11, pp 05-08

[3] Kumar Sharma, A., & Sharma, S. K. Vibration Computational of Visco-Elastic Plate with Sinusoidal Thickness Variation and Linearly Thermal effect in 2D, Journal of Advanced Research in Applied Mechanics & Computational Fluid Dynamics, 1(1), 2014, 46-54.

[4] Kumar Sharma, A., & Sharma, S. K. Free Vibration Analysis of Visco-elastic Orthotropic Rectangular plate with Bi-Parabolic Thermal Effect and Bi-Linear Thickness Variation, Journal of Advanced Research in Applied Mechanics &Computational Fluid Dynamics, 1(1), 2014, 10-23.

[5] Sharma, S. K., & Sharma, A. K. , Effect of Bi-Parabolic Thermal and Thickness Variation on Vibration of Visco-Elastic Orthotropic Rectangular Plate, Journal of Advanced Research in Manufacturing, Material Science & Metallurgical Engineering,1(2), 2014, 26-38.

[6] Amarnath Yerramalaa Ramachandrudu Cb a,bStructures and Materials laboratory Department of Civil Engineering, Intell Engineering College, Anantapur, India

[7] Siti Aminah BtTukiman and Sabarudin Bin Mohammed, Faculty of Civil Engineering and Earth Resources, University Malasiya Pahang

REFERED CODES ARE-

1. I.S 383-1970: "Specifications for coarse and fine aggregates"
2. I.S:456:2000 "Indian Standard: Plain and Reinforced Cement Concrete"
3. IS: 8112:1989 43 Grade Ordinary Portland Cement- Specification
4. I.S: 1199:1959
5. I.S: 516:1959
6. I.S: 383:2016
7. I.S: 2386:1963 (PART 1)
8. I.S: 2386:1963 (PART 2)
9. I.S: 2386:1963 (PART 3)
10. I.S: 2386:1963 (PART 4)

REFERED BOOKS ARE

1. Material testing laboratory manual by C.B. Kukreja.
2. Concrete technology (theory and practice) by M. L. Gambhir. Concrete technology laboratory manual by M. L. Gambhir.