International Journal of Research in Science advanced Technology and management studies (IJRSTMS)

ISSN: 2459-425X • Website: www.ijrstms.com

INVESTIGATION ON GLASS BEADS AND COCONUT SHELL AS PARTIAL REPLACEMENT OF COARSE AGGREGATE IN CEMENT CONCRETE

Dr.RAMACHANDRA C G Dr.NATHALIE Dr.CHEN CHOU Dr.BUCIO PITTY
Department of Civil Engineering, Adhi College of Engineering & Technology, Kanchipuram, India

Abstract

In India, Concrete is the main essential material for construction purpose. Concrete consists of cement, sand, aggregate and in some cases admixtures are used. Since concrete is majorly used in construction field. The high cost of conservative construction materials is dominating factor affecting housing system around the world. This has necessitated research work into substitute materials in construction field. This study investigated the use of coconut shell and glass beads as replacement for coarse aggregates in cement concrete. Concrete cube and cylinder measuring 150mm x 150mm x 150mm and 150mm x 300mm were casted. Compressive strength and split tensile strength were evaluated at 7, 28 days. In this study, M 20 grade of concrete was replaced by coconut shell and glass beads. First part of the study deals with the compressive strength of concrete by partial replacement of coarse aggregate with crushed coconut shell and glass beads with various percentages such as 10%, 15%, 20%, 25% and 30%. Replacement of coarse aggregate by coconut shell attained 28 days compressive strength and split tensile strength. The results showed that coconut shell which has more impact value then crushed stone aggregate which indicates that this aggregate have good absorbance to shock and glass beads which gives more compressive strength than coconut shell concrete and normal concrete due to its hardness of 515 and compressive strength of 36000 psi. Its utilization is cost effective and eco friendly.

Keywords: Construction material; Coconut shell; Glass beads; Compressive strength; Splitting tensile strength; Concrete; Eco friendly

I. INTRODUCTION

The construction industry relies heavily on conventional materials such as cement, granite and sand for the production of concrete. The increasing cost of these materials has greatly hardened the development of shelter and other infrastructural facilities in developing countries. There arises the need for engineering consideration of the use of cheaper and locally available materials to meet desired need enhance the self-efficiency, and lead to an overall reduction in construction cost for sustainable developments.

Concrete versatility, durability, sustainability, and economy have made it the world's most widely used construction material. The term concrete refers to a mixture of aggregates, usually sand and either gravel or crushed stone, held together by a binder of cementatious paste. The material used in concrete required to design and control mixture for a variety of a structure.

In recent years, aggregates became costly for the usage in construction industry. So many innovations were made for replacement of aggregates in concrete. In the past studies, there were many materials like coconut shell, recycled aggregates, brick dust, solid waste etc., which was the replacement of fine and coarse aggregate. Attempts have equally made by various researchers to reduce the cost of its constituents and hence total construction cost, by replacement of the materials which could be classified as agricultural or industrial waste. Some of these wastes include saw dust, coconut shell, fly ash etc.

Increase in percentage replacement by coconut shell reduces compressive strength and split tensile strength of concrete (Miss. Anjali et al. 2015). The coconut shell aggregates have higher water absorption because of higher porosity in its shell structure (S. A. Kakade et al.2015). Coconut shell exhibits more resistance against crushing, impact and abrasion, compared to crushed granite aggregate.(Akshay et al.2014) Waste glass may open a new path of economic and pollution free concrete (T. S. Serniabat et al.2014).

In this study, the glass beads and coconut shell was replaced, as a partial replacement of coarse aggregate. In this project, hardened property of concrete such as compressive strength and split tensile strength, were determined by the partial replacement of coarse aggregate with glass beads and coconut shell in cement concrete with comparison of normal concrete.

International Journal of Research in Science advanced Technology and management studies (IJRSTMS)

ISSN: 2459-425X • Website: www.ijrstms.com

II. MATERIALS AND SETUP

The project work requires preliminary investigations in a methodology manner. Concrete is the mixture of cement, fine aggregate, coarse aggregate. In present of, Ordinary Portland Cement (OPC) of 53 grades was used. The various test on cement were conducted as per IS code provision 1996 (Part-I). The fineness of cement IS-4031 (Part-I):1996 was found to 8%.The standard consistency value of cement IS-4031 (partIV):1996 was founded as 28%.The initial and the final setting time of cement IS-4031 (Part-V):1996 was found to 27 minutes and 530 minutes. The compressive strength test for cement IS-4031 (Part-VI):1996.

Locally available natural river sand was used in this study. The specific gravity of fine aggregate 2.5 was obtained from the test conducted as IS-2386 (Part-III):1963. As per IS-383:1970 the particle size below 4.75mm confirming to the zone II was founded. The water absorption value was founded 8%. As per IS-2386 (Part-III):1963, crushed stone of size less than 12.5mm with specific gravity of 3. The water absorption value was founded by 1.2%.

Design of concrete mix involves determination of proportion of above components for the investigation of normal strength concrete is used. The trial mix was done as per IS-10262:2009. The mix proportion of normal concrete was 1:1.4:2.9.

The compressive and splitting tensile strength of concrete was found by using Compression Testing Machine (CTM) by using cube specimens of 150mm x 150mm x 150mm and cylinder specimens of 150mm diameter and 300mm height respectively. The compressive strength on normal concrete on 7 & 28 days of curing was found to be 18.42MPa and 26.2 MPa. The testing of compressive strength and splitting tensile strength of concrete is shown in figure1.

Fig. 1.a) Compressive strength test b) Splitting tensile strength test

International Journal of Research in Science advanced Technology and management studies (IJRSTMS)

ISSN: 2459-425X • Website: www.ijrstms.com

III. RESULTS AND DISCUSSION

3.1. Comparison of results of NC with CSC

From the table 1, shows the variations in compressive strength as partial replacement of CSC with NC after 7 days & 28 days. The compressive strength of NC, 18.42 N/mm^2 and 26.2 N/mm^2 was attained at 7 days & 28 days. At 7 days of the compressive strength of CSC 10% & 15% indicated 1.1% & 0.43% greater than NC, whereas, CSC 20%, 25 & 30% exhibited 3.3%, 57.4% & 71.2% reduced than the compressive strength when related with NC. At 28 days of compressive strength of CSC 10%, 15% & 20%, indicated 0.75%, 2.3%, 5.03%, greater than NC, whereas, CSC 25% & 30% exhibits 10.54% & 40% lesser than the NC.

Table 1 Compressive strength tests on NC with CSC

Compressive strength of concrete (N/mm^2)					
No of days of curing	10%	15%	20%	25%	30%
CSC for 7 days	18.52	18.5	17.83	11.7	10.76
CSC for 28 days	26.4	26.8	27.52	23.7	18.72

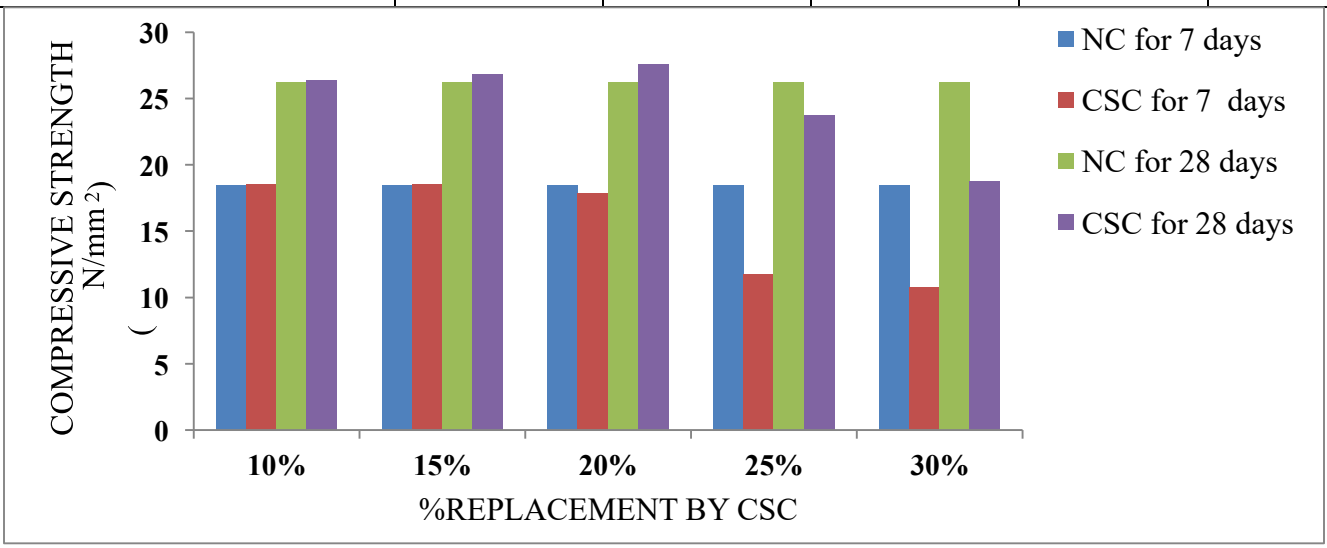

Fig 2. Compressive strength of NC with CSC

3.2. Comparison of results of NC with GBC

From the table 2, shows the variations in compressive strength as partial replacement of GBC with NC after 7 days & 28 days. The compressive strength of NC, 18.42 N/mm^2 and 26.2 N/mm^2 was attained at 7 days & 28 days. At 7 days of the compressive strength of GBC 10%, 15% & 20% indicated 2.5%, 0.5% & 1.2% greater than NC, whereas, GBC 25% & 30% exhibited 21.2% & 71.247.8% reduced than the compressive strength when related with NC. At 28 days of compressive strength of GBC 10%, 15%, 20% & 25% indicated 6.76%, 9%, 23.5% & 1.9 %, greater than NC, whereas, GBC 30% exhibits 40.8% lesser than the NC.

Table 2 Compressive strength tests on NC with GBC

Compressive strength of concrete (N/mm^2)					
No of days of curing	10%	15%	20%	25%	30%
GBC for 7 days	18.9	18.53	18.6	15.2	12.8
GBC for 28 days	28.1	28.82	34.27	26.72	18.6

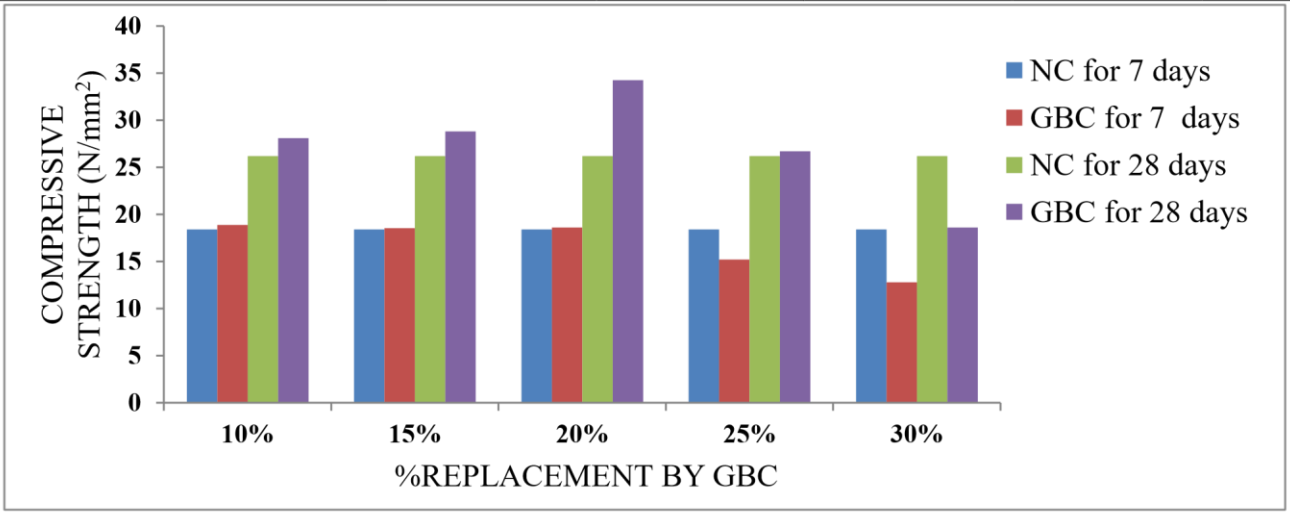

Fig. 3. Compressive strength of NC with GBC

International Journal of Research in Science advanced Technology and management studies (IJRSTMS)

ISSN: 2459-425X • Website: www.ijrstms.com

3.3. Comparison of results of NC with CSC & GBC

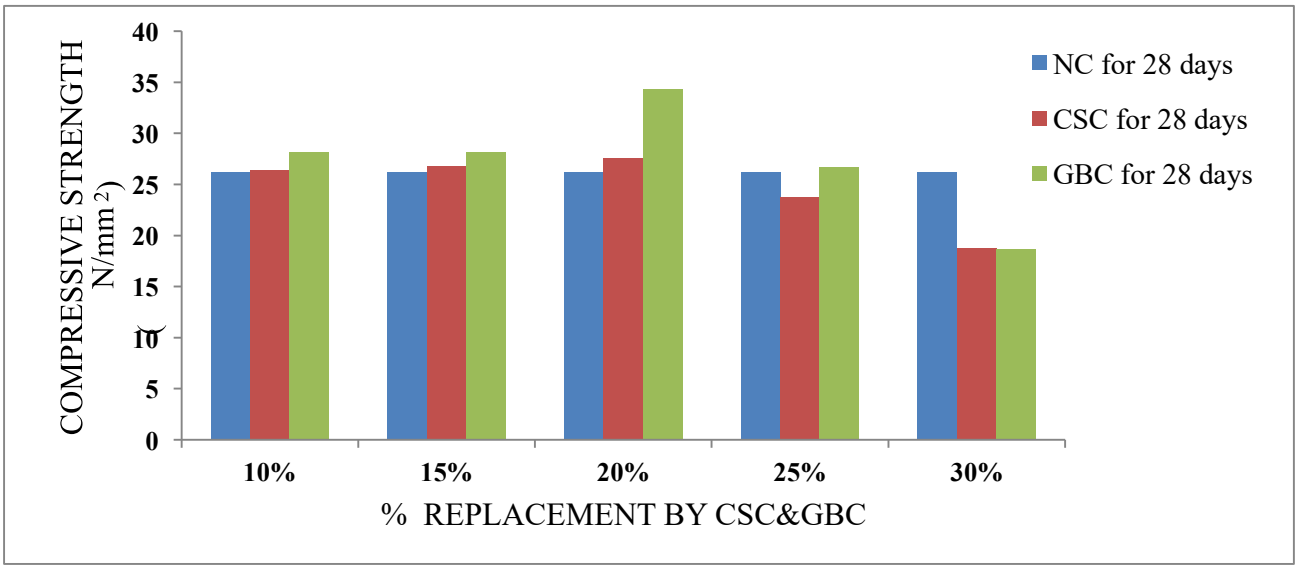

Fig. 4.

Compressive strength of NC with CSC & GBC

3.3. Comparison of splitting tensile strength of concrete

From the table 3, shows the variations in splitting tensile strength as partial replacement of CSC with NC after 28 days. The splitting tensile strength of NC, 3.046 N/mm^2 was attained at 28 days. At 28 days of the splitting tensile strength of CSC 10%, 15% & 20% indicated 4.68%, 0.97% & 1.6% greater than NC, whereas, CSC 25% & 30% exhibited 32.6% & 85% reduced than the splitting tensile strength when related with NC. At 28 days of the splitting tensile strength of GBC 10%, 15% & 20% indicated 1.3%, 2.86% & 5.86% greater than NC, whereas, GBC 25% & 30% exhibited 43.3% & 60% reduced than the splitting tensile strength when related with NC.

Table 3 Splitting tensile strength on NC with CSC &GBC

Splitting strength of concrete (N/mm^2)					
No of days of curing	10%	15%	20%	25%	30%
CSC for 7 days	3.2	3.08	3.1	2.3	1.07
GBC for 28 days	3.09	3.14	3.24	2.12	1.1

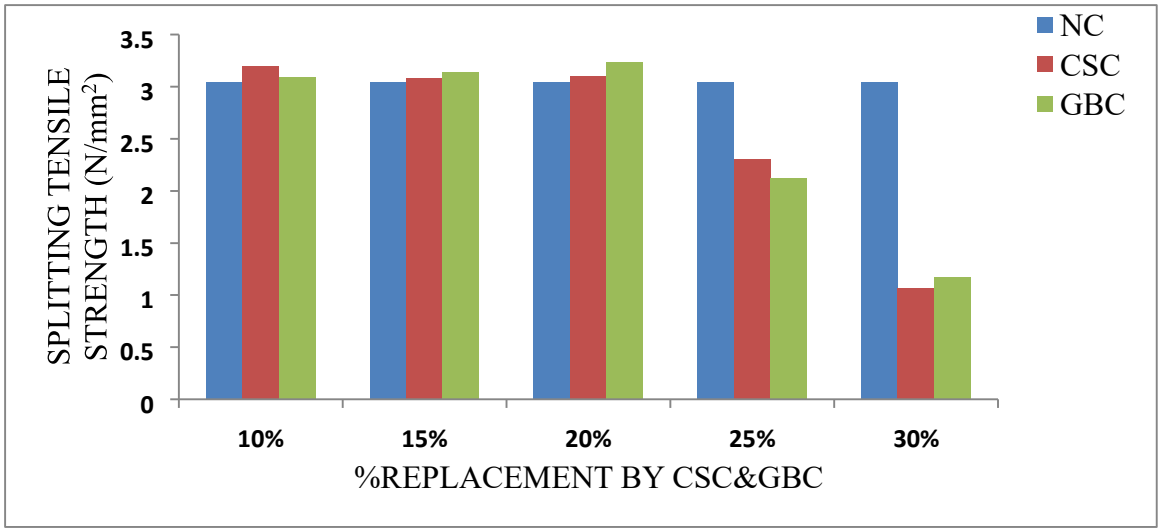

Fig 4. Splitting tensile strength of NC with CSC & GBC

IV. CONCLUSION

The following conclusion drawn from the work,

1. Using the coconut shell and glass beads as coarse aggregate in concrete can reduce the material cost in construction because of the low cost.
2. The coconut shell aggregates have higher water absorption because of higher porosity in its shell structure. The aggregate impact value of coconut shell aggregates are much lower compared to crushed stone aggregate which indicates that this aggregates have good absorbance to shock.
3. The experimental results show that the early compressive strength of concrete made of natural coarse aggregate and Waste glass coarse aggregate is approximately same
4. Increase in percentage replacement by C.S & G.B reduces compressive strength and split tensile strength of concrete.
5. When compared to NC, GBC & CSC gives higher compressive & splitting tensile strength respectively.
6. When compared to GBC & CSC, GBC gives higher compressive & splitting tensile strength respectively.

REFERENCES

a) *Amarnath Yerramala, Ramachandrudu C (October 2012) "Properties of Concrete with Coconut Shells as Aggregate Replacement", International Journal of Engineering Inventions, Volume: 1, Issue: 6, pp: 21-31.*

b) *Miss. Anjali s. Kattire, Miss. Priyanka a. Bhujugade,Mr. Shashiraj s. Chougule (Nov 14 To Oct 15) " Investigation Of Coconut Shell As A Replacement Of Coarse Aggregate In Concrete ", Journal Of Information, Knowledge And Research in Civil Engineering, Volume: 3, Issue: 2, pp: 195-198.*

c) *T.Agarna, S.Durga, R.Chandrakala, B.Divya, Er.K.Jegan mohan (March 2016) "Partial Replacement of Coarse Aggregate with Waste Glass Pieces and Steel Waste", International Journal of Engineering Science and Computing, Volume: 6, No: 3, pp: 2265-2268.*

d) *Ajim S Shaikh, Sagar B Thorat, Rahul V Unde, Prasad S Shirse (Aug-2015) "Advance Concrete-Aggregate replaced by Coconut Shell", International Research Journal of Engineering and Technology, Volume: 02 Issue: 05, pp: 698-702.*

e) *Akshay S. Shelke, Kalyani R. Ninghot, Pooja P. Kunjekar, Shraddha P. Gaikwad (2014) " Coconut Shell as Partial Replacement for Coarse Aggregate", International Journal of Civil Engineering Research, Volume: 5, Issue: 3, pp: 211-214.*

f) *S. A. Kakade, Dr. A. W. Dhawale(May-June 2015) "Light Weight Aggregate Concrete By Using Coconut Shell", International Journal of Technical Research and Applications, Volume: 3, Issue: 3, pp: 127-129.*

g) *Palak Patel, Dr. N.K. Arora, Shraddha R. Vaniya (2015) "Experiments on Replacement of Coconut Shell as Coarse Aggregate in Concrete", International Journal of Engineering Development and Research, Volume: 2, Issue: 2, pp: 886-867.*

h) *T. S. Serniabat, M. N. N. Khan, M. F. M. Zain (October 2014) "Use of Waste Glass as Coarse Aggregate in Concrete: A Possibility towards Sustainable Building Construction", International Scholarly and Scientific Research & Innovation Volume: 8, No: 10, pp: 10751078.*

i) *Tajamul Magrey , Bilal Malik , Mohd Akeeb Dar, Nazeer Bijran (2016) "Cocunut shell and Waste Glass based Concrete – A comparative Study", International Journal of Engineering Development and Research, Volume: 4, Issue: 1, pp: 359-371.*