Indian J.Sci.Res. 20(2): 69-71, 2018

ISSN: 0976-2876 (Print)
ISSN: 2250-0138(Online)

EXPERIMENTAL STUDY ON STRENGTH AND FLEXURAL BEHAVIOUR OF REINFORCED CONCRETE USING RICE HUSK ASH AND STEEL FIBER

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ABSTRACT

The motivation for exploring the benefits of Rice Husk Ash (RHA) as a cement replacement material and the addition of steel fibres for reducing brittleness in concrete. The RHA used in the study was the residue of burnt raw rice husk sintered in a furnace at 800C. The fine particle size of the RHA provided an early pozzolanic reaction upon cement hydration and thus resulted in high cementing efficiency. The project reports on a comprehensive study on the strength and flexural behaviour of concrete containing RHA and Steel Fibre. The study includes workability of fresh concrete, compressive strength, splitting tensile strength, flexure strength for hardened concrete. RHA content was used from 5% to 20% in the interval of 5% in weight of cement and also to improve the strength of concrete Steel Fibre was added and fibre volume fraction was 0.5%, 1%, 1.5% and 2% in volume basis. The addition Steel Fibre improves the tensile strength properties. The test was conducted in 7 days and 28 days on the specimen and the result are compared with the conventional concrete. The laboratory results shown that steel fibre addition, improves the tensile strength properties. The performed experiments show that the behaviour of rice husk ash concrete is not similar to that of Portland cement concrete when rice husk ash is added. RHA concrete gave excellent improvement in strength for 15% replacement (30.8% increment compared to the control mix) of cement and also it reduced the workability of concrete.

KEYWORDS: RHA, Steel Fiber, Aggregate, Cement

The main advantages of using the RHA in concrete are Improve the workability at low replacement levels and with pozzolana of low carbon content. Reduced the bleeding and segregation. It will lower the heat of hydration. It will lower creep and shrinkage occurs in the concrete. High resistance to chemical attack at later ages (due to lower permeability and less calcium hydroxide available for reaction). Low diffusion rate of chloride ions resulting in a higher resistance to corrosion of steel in concrete. Reduction in the use of energy for cement production.

BENEFITS OF USING STEEL FIBER

The use of steel fibre in concrete can improve its many properties. The benefits of using steel fibres in concrete are as follows:

Steel Fibres are generally distributed throughout a given cross section whereas reinforcing bars or wires are placed only where required. Steel fibres are relatively short and closely spaced as compared with continuous reinforcing bars of wires.

It is generally not possible to achieve the same area of reinforcement to area of concrete using steel fibres as compared to using a network of reinforcing bars of wires. Steel Fibbers are typically added to concrete in low volume dosages (often less than 1%), and have been shown to be effective in reducing plastic shrinkage cracking.

Steel fibres typically do not significantly alter free shrinkage of concrete, however at high enough dosages they can increase the resistance to cracking and decrease crack width.

Objective

The main objective of this project is to study the following properties. To study the mechanical properties such as compressive strength, tensile strength and flexural strength of control specimen and flexural behaviour of reinforced concrete beam. To study the behaviour stress and strain of the beam and study crack propagation. To study the Ductility and stiffness of concrete.

Scope

The scope of this project is find out the behaviour of RHA and Steel Fiber in concrete, thereby optimum of RHA and Steel Fiber that can be used in various applications such as pavements, industrial floors, etc., thus enhance the concrete quality.

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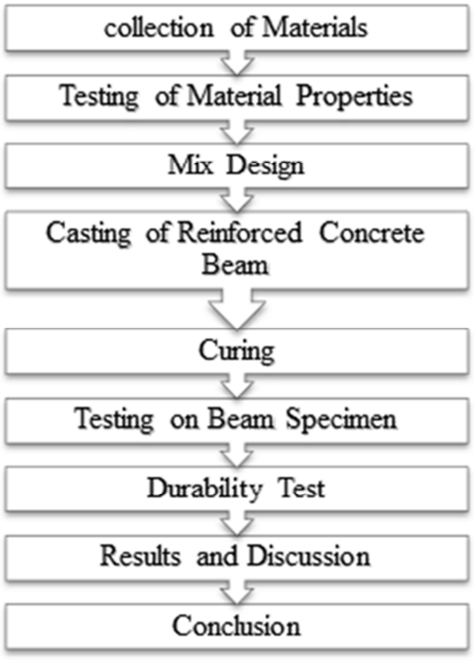

Figure 1: Methodology

MATERIALS USED

Cement

The Bureau of Indian Standards has classified OPC in three difference grades. The classification is mainly based on the compressive strength of cement – sand mortar cubes of face area 50 cm^2 composed of 1 part of cement and 3 parts of standard sand by weight with a water – cement ratio arrived by a specified procedure. The grades are (i) 33 grade (ii) 43 grade (iii) 53 grade. The grade number indicates the minimum compressive strength of cement sand mortar in N/mm^2 at 28 days, as tested by above mentioned procedure. In this project, chettinad 53 Grade Ordinary Portland Cement is used.

Fine Aggregate

Aggregate which is passed through 4.75 IS sieve and retained on 75 micron (0.075mm) IS sieve is termed as fine aggregate. Fine aggregate is added to concrete to assist workability and to bring uniformity in mixture. In the project, the natural river sand which conforming IS 383 – 1970 is used as fine aggregate.

Coarse Aggregate

The coarse aggregate for the works should be river gravel or crushed stone. The aggregate which passed through 75 mm sieve and retain on 4.75 mm are known as coarse aggregate.

Water

Water is used for mixing and curing process and it should be clean and free from injurious amount of oils, acids, alkalis, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel. Potable water is generally considered satisfactory for mixing concrete.

Utilization of RHA as a pozzolanic material in cement and concrete provides several advantages, such as strength improvement, increase the durability properties, reduced materials cost due to cement savings and environmental benefits related to the disposal of waste materials. The two main reasons to add RHA in concrete are strength increase and low permeability and in addition other properties are improving the modulus of elasticity, strength at later ages and durability properties.

Steel Fiber

Steel fibers can be defined as discrete, short lengths of steel having ratio of its length to diameter (i.e. Aspect ratio) in the range of 20 to 100 with any of the several cross – sections and that are sufficiently small to be easily and randomly dispersed in fresh concrete mix using conventional mixing procedure. The aspect ratio is importance indicator as to the ability of the steel fiber to disperse in the concrete. The crack – arrest and crack – control mechanism of steel fiber results in the improvement of all properties associated with cracking, such as strength, ductility, energy absorption and the resistance of impact, fatigue and thermal loading.

Mix Ratio

Table 1: Mix Ratio

Cement	Fine Aggregate	Coarse Aggregate	Water
413.33	674.8	1206.86	186
1	1.633	2.92	0.45

The ratio becomes in terms of per cubic metre of concrete is

1 : 1.633 : 2.92 : 0.45

CONCLUSION

The partial replacement of cement by RHA indicates that at long term ages, the RHA concrete

showed higher compressive strength in comparison with conventional concrete. The optimum replacement level of RHA was found to be 15% for M30 grade of concrete. Normal consistency of RHA with partial replacement of cement was comparable to OPC. However, there is an increase in the consistency of RHA-Cement due to increase in RHA content in the cement due to the presence of unburnt particles, which absorb more water.

Increased in the amount of RHA in the mix resulted in a dry and unworkable mixtures unless Superplasticizer was added. The inclusion of Superplasticizer in RHA concrete improved the workability and cohesiveness of the concrete. Spilt tensile strength. Flextural strength. we are going find out flextural behaviour in the RHA and addition of steel fibre concrete.(2M X 0.23M X 0.30M).

REFERENCES

Dabai M.U., Muhammad C., Bagudo B.U. and Musa A., 2009. "Studies on the Effect of Rice Husk Ash as Cement Admixture", Nigerian Journal of Basic and Applied Science, **17**(2): 252-256.

Farah Alwani Wan Chik, Badorul Hisham Abu Bakar, Megat Azmi Megat Johari and Ramadhansyah Putra Jaya, 2011. "Properties of Concrete Block containing Rice Husk Ash subjected to GIRHA", IJRRAS, **8**(1): 57 – 64.

Ghassan Abood Habeeb and Hilmi Bin Mahmud, 2010. "Study on Properties of Rice Husk Ash and Its Use as Cement Replacement Material", Materials Research, **13**(2): 185-190.

Godwin Akeke A., Maurice Ephraim E., Akobo I.Z.S and Joseph Ukpata O., 2013. "Structural Properties of Rice Husk Ash concrete", International Journal of Engineering and Applied Sciences, **3**(3): 57–62.

IS 10262, 2009. 'Indian Standard code of Recommended Guidelines for Concrete Mix Design', Bureau of Indian Standards, New Delhi.

IS 2386, 1963. 'Indian Standard methods of test for aggregates for concrete', Bureau of Indian Standards, New Delhi.

IS 383, 1970. 'Indian Standard Code of Coarse and Fine Aggregates from Natural Sources for Concrete', Bureau of Indian Standards, New Delhi.

IS 456, 2000. 'Indian Standard Code of Plain and Reinforced Concrete Code of Practice', Bureau of Indian standards, New Delhi.

Kalyan Kumar Moulick, 213. "Replacement of Ordinary Portland Cement by Rice Husk Ash to produce ordinary concrete of Grade M10, M15 and M20", International Journal of Emerging Technology and Advanced Engineering, **3**(3): 583 – 590.

Kartini K., 2011. "Rice Husk Ash – Pozzolanic Material for Sustainability", International Journal of Applied Science and Technology, **1**(6): 169 – 178.

Khassaf S.I., Jasim A.T. and Mahdi F.K., 2014. "Investigation The Properties Of Concrete Containing Rice Husk Ash To Reduction The Seepage In Canals", International Journal of Scientific & Technology Research, **3**(4): 348 – 354.

Makarand Suresh Kulkarni, Paresh Govind Mirgal, Prajyot Prakash Bodhale and Tande S.N., 2014. "Effect of Rice Husk Ash on properties of concrete", Journal of Civil Engineering and Environmental Technology, **1**(1): 26-29.

Maurice Ephraim E., Godwin Akeke A. and Joseph Ukpata O., 2012. "Compressive strength of concrete with rice husk ash as partial replacement of ordinary Portland cement", Scholarly Journal of Engineering Research, **1**(2): 32-36.

Padma Rao P., Pradhan Kumar A. and Bhaskar Singh B., 2014. "A Study on Use of Rice Husk Ash in Concrete", International Journal of Education and applied research, **4**(2): 75 – 81.

Sivakumar A. and Sounthararajan V.M., 2013. "Performance Evaluation of Steel Fibres in Rice Husk Ash Substituted Concretes", J. Eng. Technol. Sci., ITB Journal Publisher, **45**(3): 257-274.