TO STUDY THE PROPERTIES OF STEEL FIBRE REINFORCED SELF COMPACTING (SFR-SCC) BY USING RICE HUSK ASH (RHA)

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ABSTRACT

The application of Steel Fibre Reinforced Self-compacting Concrete (SFRSC) in the construction of structural elements is seen as an alternative solution to the complication in placing the reinforcement and compaction of normally vibrated concrete but by using steel fibre in self-compacting concrete the bleeding and segregation increases and workability reduces so, we use an alternative called Rice husk ash (RHA) which is used to provide resistance to segregation and bleeding and to increase the workability of SCC. This review has been done to study the properties of steel fibre reinforced self-compacting concrete (SFR-SCC) using rice husk ash and to analyse the strength, workability, segregation, viscosity etc. properties of steel fibre reinforced self-compacting concrete using rice husk ash.

Keywords- Steel fibre reinforced self-compacting concrete (SFR-SCC), Rice husk ash (RHA), Self-compacting concrete (SCC).

INTRODUCTION

The steel fibre is used for reinforcement in concrete and self-compacting concrete. It is generally available in market and also manufactured from wire meshes of waste tyres. But the steel fibre used in concrete and self-compacting concrete show low workability and segregation. So to increase the workability of concrete there is a need of viscosity modifying agent which is costly. Properties of Rice husk ash as a viscosity modifying agent in self compacting concrete has to be studied. Rice husk ash is easily available and it is so economical. Rice husk ash is feasible for producing low cost SCC. Rise husk ash reduces the water absorption of concrete and provide resistance to segregation. Self-compacting concrete (SCC) can be placed and compacted under its own weight without any vibration using super-plasticizers (SPs) and other additives. The most important requirements of SCC are high flow-ability, good passing ability and high resistance to segregation. Therefore, SCC eliminates vibration problems and make use of a higher density of rebar in structural configurations with congested reinforcement where vibration is difficult to meet. Previous studies on effect of RHA on the fresh properties of SCC have demonstrated that the incorporation of RHA decreases the slump flow and increases slump flow time, yield stress, and plastic viscosity, primarily due to the higher reactivity and high surface area of RHA.

LITERATURE REVIEW

Steffen Gru ¨newald, Joost C. Walraven, 21 May 2001 Steel fibres affected the slump flow of concrete mixtures which shows the reduction in workability due increase in friction of steel fibre. The more fibres were added, the more the deformability decreased. Fibres do affect the workability of plain concrete; this study was performed to answer the question to what extent they affect the properties of SCC in the fresh state. It was found that a considerable amount of fibres allowed self-compacting behaviour. There is no resistance to segregation. A method was proposed to design SCC reinforced with steel fibres. It was experienced that it was useful throughout the experiments.

B.Barragán, R.Zerbino, R.Gettu, M.Soriano, C.de la Cruz, G.Giaccio and M.Bravo, 2004 The study shows that Steel fibre reinforced self-compacting concrete (SFR-SCC) with adequate self- compatibility can be developed with fibre dosages of up to 40 kg/m^3. The elimination of conventional bar or mesh reinforcement when SFR-SCC is used results in a considerable reduction in the costs and errors associated with the placing of the re-bars. It is obvious that the work environment will be much better when SCC is used due to less noise and construction time.

Hazrina Ahmad, MohdHisbanyMohdHashim, SitiHawaHamzah and Afidah Abu Bakar, 2006 Steel fibre reinforced self-compacting concrete (SFRSC) is a practical alternative to the conventional reinforced concrete structure. This is due to the

promising properties that allows the material to be utilized in resisting cracks as well as for replacement of conventional reinforcement either partially or totally in slab structures. Nevertheless, in the slab application of SFRSC, special attention has to be taken in the selection of the steel fibre inclusion especially in terms of the volume fraction as well as the construction method. This is due to the importance of maintaining the homogeneity of the mix that is crucial for the performance of the slab structure.

M. A. Ahmadi, O. Alidoust, I. Sadrinejad, and M. Nayeri, 2007 SCC mixes show higher compressive and flexural strength and lower module of elasticity rather than normal concrete. Replacement of 20% of cement with rice husk ash in matrix causes reduction in utilization of cement, and expenditures, also can improve quality of concrete at the age of more than 60 days. According to the study, addition of pozzolans like rice husk ash to the concrete, can improve the mechanical properties of specimens. Results indicate that pozzolanic reactions of rice husk ash in the matrix composite were low in early ages, but by aging the specimens to more than 60 days, considerable effect have been seen in strength.

Shazim Ali Memon, Muhammad Ali Shaikh, Hassan Akbar, 2010 the water absorption decreased with the increase in Rice husk ash (RHA) content at all curing stages. Shows the potential to segregation resistance. RHA used SCC has the possibility of low cost Self compacting concrete (SCC) is feasible. The utilization of RHA in SCC solves the problem of its disposal thus keeping the environment free from pollution. It is clear that water requirement to make the paste of standard consistency increased with the increase in RHA content.

LiberatoFerraraa, Patrick Bamontea, AlessioCaverzana, AbdisaMusaa,b, IremSanalc, 2012 A first observation is about the bending strength at first cracking which appears to be sensitive only to the increase in water content, similarly to the tensile strength by splitting in plain matrices. A reasonable explanation is that the poorer performance in the fresh state (low slump flow, low fluidity, high viscosity and resistance to flow) required some manual filling. The casting process – including the maximum distance that the fluid concrete has to travel from the pouring point – should be explicitly devised to take into account acceptable levels for the spatial dispersion of material's properties, in order to avoid undesirable effects on the structural performance, because of a lack of homogeneity inside the structural members.

M. Pajaka, T. Ponikiewskib, 2013 Steel fibre affects much the post-peak behaviour of SCC. Increase in fibre dosage causes the increase of flexural tensile strength but with no increase in post-peak parameters obtained for deflection higher than 2 mm. The fracture energy increases with the increase of fibre dosage and is higher for hooked end steel fibres than for straight ones steel fibres. The deflection-hardening response was observed in case of SCC reinforced with hooked end steel fibres. On the other hand, the addition of straight steel fibres affects the deflection-softening response.

Divya Chopra, Rafat Siddique, Kunal 2014 Replacement of cement by RHA, has positive effect on all properties of self-compacting concrete Fresh properties results showed that with increase in amount of RHA workability decreased Increase in RHA content increases the compressive strength of concrete. The split tensile strength increased up to 15% replacement of cement by RHA. The most-dense structure was observed for 15% replacement with RHA which resulted in the highest compressive strength for the mix.

Cristina Frazãoa, Aires Camõesb, Joaquim Barrosa, Delfina Gonçalvesc, 2015 The addition of steel fibres to fresh SCC in a content of 60 kg/m3 did not affect significantly the self-compacting requisites. The addition of steel fibres resulted in a very slightly increase of open porosity of SCC. In conditions of extreme aggressiveness, corrosion of steel fibres can induce cracking in concrete, leading to a decrease of tensile strength for the SFRSCC. In terms of compressive behaviour, the addition of steel fibres to SCC has mainly contributed for the increase of the post peak resistance, with a favourable effect in terms of energy absorption capability of this material.

Thiago Melo Grabois, Guilherme Chagas Cordeiro, Romildo Dias Toledo Filho, 2016 Slump flow spread presented by all SCLC (Self-compacting lightweight concrete) mixes were in agreement with normal weight SCC standards and specifications the ''V" funnel tests, the fibre reinforced mixes took too long to flow. All four SCLC concretes did not present any kind of segregation. Compressive strength and Young's modulus of all self-compacting lightweight concrete mixes showed at 28 days

values of around 30–35 M Pa and 20 G Pa, respectively. SCLC mixes presented higher thermal insulation performance than NSCC (Normal weight self-compacting concrete) due to the presence of porous lightweight aggregates.

J.A. Ortiza, A. de la Fuenteb, F. Mena Sebastiab, I. Segurab, A. Aguadob, 2017 The aim of this paper was to present a new cement base material whose coarse fraction of aggregate is 100% recycled and of mixed nature, with properties of self-compatibility and with the inclusion of structural fibres to improve its ductility and toughness, classified as SFR-SCC-RA. Steel fibres reduce the flow-ability of fresh concrete, and this effect is accentuated for fibres of high slenderness ratio.

J. Safaria, M. Mirzaeib, H. Rooholaminia, A. Hassania, 2018 RHA and macro synthetic fibre content and their interaction were found to have significant effect on the consistency and mechanical properties of SCC. RHA reduces the bleeding and increases the viscosity of SCC paste. Incorporating synthetic fibre in higher percentages results in segregation and bleeding. In more viscous mixes containing RHA, the bleeding and segregation problems are negligible. However, the blockage resulting from the use of synthetic fibres still exists.

Anhad Singh Gill, Rafat Siddique, 2018 Use of RHA and MK in SCC proves to be beneficial. The addition of MK (Meta-kaolin) and RHA (RICE HUSK ASH) affected the workability but which can be improved by increasing the slight dose of water reducing admixture. The use of MK and RHA increases the compressive strength, increasing it by 27%, 42% and 48% at 28, 90 and 365 days respectively in relation to the control mix and reduces the water absorption and porosity. There was approximately 45% decrease in water absorption and 46% decrease in porosity when in comparison to the control mix. The compressive strength attained by the mixes prepared with the combination of MK and RHA was higher than the control mix.

CONCLUSION

Steel fibre are available in two forms short steel fibre and long steel fibre. The use of steel fibre increases the tensile strength of the concrete. By use of long fibre the flexural toughness of concrete increases and the workability of concrete decreases. To get workable concrete the short fibres are more preferred over long ones. Short fibres are also used for crack prevention in concrete. But due to the use of steel fibres the segregation and bleeding of concrete increases. The addition of steel fibres resulted in a very slightly increase of open porosity of SCC. From the above reviews the Rice husk ash is used in concrete as a partial replacement of cement. Replacement of 20% of cement with rice husk ash in matrix causes reduction in utilization of cement, and expenditures, also can improve quality of concrete at the age of more than 60 days. The split tensile strength increased up to 15% replacement of cement by RHA. RHA also provides resistance to segregation and bleeding. The workability is reduced due to the use of RHA, but it can be improved by increasing the slight dose of water reducing admixtures. RHA also reduces water absorption and porosity. By using steel fibre in slab/beam the amount of reinforcement required is reduced so, the cost of construction is also reduced. By using RHA the low cost SCC is feasible and provide more strength as compared to normal concrete mix. RHA is also utilized as a viscosity modifying agent.

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