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A REVIEW STUDY ON USE OF RICE HUSK ASH AS PARTIAL REPLACEMENT WITH CEMENT IN CONCRETE

[1]Er. Mehran Ali , [2]Er. Kshipra Kapoor
[1,2]Universal Institutions of Engg. Universal Institutions of Engineering and Technology, Larlu
mehranalimirza@gmail.com ,hodce.ugi@gmail.com

ABSTRACT

Throughout the world, concrete is being widely used for the construction of most of the buildings, bridges etc. Hence, it has been properly labeled as the backbone to the infrastructure development of a nation. Currently, our country is taking major initiatives to improve and develop its infrastructure by constructing express highways, power projects and industrial structures to emerge as a major economic power and it has been estimated that the infrastructure segment in our country is expected to see investments to the tune of Rs.4356 billion by the year 2009. To meet out this rapid infrastructure development a huge quantity of concrete is required. Unfortunately, India is not self sufficient in the production of cement, the main ingredient of concrete and the demand for exceeds the supply and makes the construction activities very costlier. Hence, currently, the entire construction industry is in search of a suitable and effective the waste product that would considerably minimize the use of cements and ultimately reduces the construction cost.

Keywords - Compressive strength, ductility, flexural strength, Fibre Reinforced Concrete, Steel fiber, Split tensile strength, toughness, workability

INTRODUCTION

The construction industry relies heavily on conventional materials such as cement, sand and granite for production of concrete. Concrete is the basic civil engineering composite. The quality of concrete is determined by the quality of paste/mix. It is the world's most consumed man made material. Its great versatility and relative economy in filling wide range of needs has made it a competitive building material. The demand for concrete for today's infrastructural development is rising day-by -day. In light of this, the non-availability of natural resources to future generation has also been realized. Concrete production is not only a valuable source of societal development but also a significant source of employment. Following a natural growth in population, the amount and type of waste materials have increased accordingly creating thus environmental problems. Historically agricultural and industrial wastes have created waste management and pollution problems. Different alternative waste materials and industrial by-products such as fly ash, bottom ash, recycled aggregates, crumb rubber, saw dust, brick bats etc. were replaced with natural aggregates. Although these materials are traditionally considered as "primitive" and therefore inferior to more highly processes in terms of safety, durability, performance, occupant's health and comfort with respect to environmental issue, consumption of environmental products and energy within the construction industry has created a significant demand for raw materials and for production thereby contributing to the many environmental problems associated with diverse ecosystem.

RICE HUSK ASH (RHA) APPLICATIONS

1. Used in steel industries
2. Due to fine insulating properties of rice husk like low thermal conductivity, high melting point, low bulk density high porosity, it used for the production of high quality steel. It is also used as a coating over the molten metal in the tundish and in ladle which acts as a very good insulator and does not allow quick cooling of metal.
3. Used in cement and construction industries
4. Blended cement is produced by using rice husk ash for fulfilling the increasing need for building material. Rice husk ash is a highly reactive pozzolan. Rice husk ash mainly used a replacement of silica fume or as an admixture in manufacturing of low cost concrete block.
5. Use of rice husk ash as silica source

6. Due to large silica content in rice husk ash, extraction of silica is economical. Silica is used in rubber industries as a reinforcing agent, in cosmetics, in toothpastes, in food industries as an anti-caking agent. There is a growing demand for fine amorphous silica in the production of high performance cement and concrete, use in bridges, marine environments, nuclear power plants etc. Silica aerogels prepared from Rice Husk Ash (RHA) finds application in super thermal insulators, catalyst supports and dielectric materials. It can be an economically viable raw material for the production of silicates and silica.
7. Other uses
8. Indian Space Research Organization has successfully developed a technology for producing high purity silica from RHA that can be used in manufacturing of silicon chip in industry. RHA used in vulcanizing rubber. Use of Rice Husk to synthesize High-Performance Phosphors. Other uses of Rice Husk (RH) are in control of insect pests in Stored Food Stuffs. RHA has been found to be effective as an oil spill absorbent, and for use in waterproofing chemicals, flame retardants, and as a carrier for pesticides and insecticides.

REVIEW OF LITERATURES

The literatures regarding the potential uses of rice husk as one of the suitable aggregates for concrete have been reviewed and are presented below.

Bertil Persson reported that on these mechanical properties, such as strength, creep, elastic modulus and shrinkage of self-compacting concrete and the corresponding properties of normal compacting concrete (NCC). The report included eight mix proportions of sealed or air-cured specimens. The water binder ratio which is used in this (w/b) varying between 0.24 and 0.80. Fifty percent of the mixes were SCC and rests were NCC. The time period at loading of the concrete mix in the creep studies varied between 2 and 90 days. The results indicated that elastic modulus, creep and shrinkage of SCC did not change significantly from the corresponding properties of NCC.

Ahmadi et.al reported the development of Mechanical properties up to 180 days of self-compacting concrete and ordinary concrete mixes with rice-husk ash (RHA), from a rice paddy milling industry. Two different replacement percentages of cement by RHA, 10%, and 20%, and two different water/cementitious material ratios (0.40 and 0.35) were used for the self compacting and normal concrete specimens. The results were compared with those of the self compacting concrete without RHA. SCC mixes show higher compressive and flexural strength and lower modulus of elasticity rather than the normal concrete. Upto 20% replacement of cement with rice husk ash in matrix caused reduction in use of cement and expenditures, and also improved the quality of concrete at the time period of more than 60 days. It was said that RHA provides a good effect on the Mechanical properties after 60 days.

S. S. Vivek et.al in this paper examined the performance of Self Compacting Concrete (SCC) by replacing cement with varying the silica fume (SF). An attempt was made to check performance and properties of fresh concrete by slump flow test, T500 test and the hardened properties of concrete by compression test. There were four mixes of SCC made by replacement of cement with different percentages of silica fume from 5 to 20% with an increment of 5%. Tests were carried out to assess the compressive strength of concrete at different ages namely 7, 14 and 28 days. For SCC, super-plasticizer (Conplast SP430) was added in optimized dosage. It was found that replacement of cement by 10% of silica fume with a water to powder (w/p) ratio of 0.8 gave better results on fresh properties and compressive strength of admixed concrete. The replacement of cement by 15% of silica fume with a w/p ratio of 0.8 gave better results in Slump flow and T50test. Whereas replacement of cement by 5% of silica fume with a w/p ratio of 0.8 gave better compressive strength at the time period of 7 and 14 days but it fails in flow properties and also the replacement of cement by 10% of silica fume with a w/p ratio of 0.8 gave better fresh concrete performance and compressive strength at the time of 28 days.

Yaghuob mohammadi et.al studied that the effect of silica fumes on properties of self-compacting lightweight concrete (SCLC) containing perlite and leca. For this purpose, silica fume has been replaced by different contents. In this study, all mixtures total cementitious materials (cement + silica fume) were kept at 450 kg/m3. Test was carried out such as Slum flow, L-box, U-box, V-funnel and J-ring. This research showed that mixtures without silica fume were not satisfactory.. For all tests added the silica fume demonstrated acceptable values. However, for the SCLC mixture containing 15% silica fume significant results were attained. Adding silica fume, compressive strength of samples increased.

Krishna Murthy N. et.al reported Self-compacting concrete possesses good qualities, productivity and working conditions due to removal of avoids. Designed for self-compacting concrete mix design with 29% of coarse aggregate, replacement of cement with Metakaolin and class F fly ash, combinations of both and controlled SCC mix with 0.36 water/cement ratio and 388 liter/m3 of cement paste volume. After that they introduced Metakaolin and class F fly ash were user friendly for SCC design mix, and considered to be most promising building for the revolutionary changes on structures.

P.Padma Rao, et al studied the Use of Rice Husk Ash in Concrete, In this investigation, a feasibility study is made to use Rice Husk Ash as an admixture to an already replaced Cement with fly ash (Portland Pozzolana Cement) in Concrete, and an attempt has been made to investigate the strength parameters of concrete. Five different replacement levels namely 5%, 7.5%, 10%, 12.5% and 15% are chosen for the study concern to replacement method. Large range of curing periods starting from 3days, 7days, 28days and 56days are considered in this investigation. All materials shall be brought to room temperature, preferably 270+ 30 C before commencing the results. At all the cement replacement levels of Rice husk ash; there is gradual increase in compressive strength from 3 days to 7 days. However there is significant increase in compressive strength from 7 days to 28 days followed by gradual increase from 28 days to 56 days.

OBILADE, I.O. investigated the use of rice husk ash as partial replacement for cement in concrete. In this research work on the properties of Rice Husk Ash (RHA) when used as partial replacement for Ordinary Portland Cement (OPC) in concrete. OPC was replaced with RHA by weight at 0%, 5%, 10%, 15%, 20% and 25%. 0% replacement served as the control. The concrete mix proportion was 1:2:4 by weight. Compressive Strength test was carried out on hardened 150mm concrete cubes after 7, 14 and 28 days curing in water. The concrete used in this research work was made using Binder, Sand and Gravel. The results revealed that the Compacting factor decreased as the percentage replacement of OPC with RHA increased.

Makarand Suresh Kulkarni et al studied the Effect of Rice Husk Ash on Properties of Concrete The main objective of this work is to study the suitability of the rice husk ash as a pozzolanic material for cement replacement in concrete. However it is expected that the use of rice husk ash in concrete improve the strength properties of concrete. Also it is an attempt made to develop the concrete using rice husk ash as a source material for partial replacement of cement, which satisfies the various structural properties of concrete like compressive strength and Flexural strength. From the entire experimental work & studies it is concluded that mix M2 (M0+20% RHA) is the best combination among all mixes, which gives max, tensile, flexure & compression strength over normal concrete.

Velupillai (1997) - The use of RHA will contribute not only, to the production of concrete of a higher quality and lower cost, but also the reduction of carbon dioxide (CO2) emissions from the production of cement. The partial replacement of cement by RHA will result in lower energy consumption associated with the production of cement.

S.RAMESH et al studied the behaviour of cement concrete with rice husk ash. In this study RHA partially replaced to 20% by weight of cement. Experimental works and studies are conducted are workability, weight comparison, compressive strength, tensile and flexural strength of concrete. This paper reported the properties, benefits and uses of RHAC by experimental works. From the experiments and test results on fresh and hardened concrete, it is concluded that it will increase the workability as compared to normal concrete. The use of rice husk ash will increase the corrosion resistance and durability of concrete and it reduces the environmental pollution due to construction.

CONCLUSIONS

Based on study following conclusions are drawn:-

1. Use of super plasticizer is helpful in flowability and segregation control.
2. Strength of self compacting concrete using silica fume increases upto 20% replacement.
3. The use of silica is also beneficial in flowability property.
4. Use of rice husk ash results good effect on compressive strength.
5. Use of these materials are environment friendly.
6. It's also cost effective.
7. Use of GGBS also gives the better on compressive strength.

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