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A Review On Effect Of Fly Ash And Sugarcane Bagasse Ash On Properties Of Concrete

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Abstract: Fly ash concrete has economical and environmental advantages. It also makes concrete sustainable.Fly ash a waste generated by thermal power plants is as such a big environmental concern. In India presently less than 50% of fly ash produced is consumed. . Infrastructural Development is at its peak all over the world and is a symbol of growth for any country. Sugar ane bagasse ash (SCBA) is generated as a combustion by-product from boilers of sugar and alcohol factories. Composed mainly of silica, this by-product can be used as a mineral admixture in mortar and concrete. Several studies have shown that the use of SCBA as partial Portland cement replacement can improve some properties of cementitious materials. In this work sugarcane bagasse ash takaen from MANAS (purti) Sugar Factory, jamni (wardha). The results indicate that SCBA may be classified as a pozzolanic material, but that its activity depends significantly on its particle size and fineness.

KEYWORDS: Fly ash, sugarcane bagasse ash, Pozzolanic activity, cement.

Introduction

In the present era of growth and development, progress is taking place in all the fields. But, in the light of progress, man is ignoring nature and harming it. Construction area, with the use of virgin materials like cement, is also posing the threat of global warming and environmental degradation. The challenge in front of civil engineering community is to provide sufficient, economical and comfortable infrastructure without causing any hardship for environment. Fly ash is a residual material of energy production using coal, which has been found to have numerous advantage for use in concrete.some of the advantage include improved workability, reduced permeability, increased ultimate strength, reduced bleeding, better surface and reduced heat of hydration. Several types of fly ash are produced depending on the coal and coal combustion Process. The use of fly ash in concrete has been encouraged all over the world. sugarcane bagasse ash which shows pozzolanic properties. A few studies have been carried out on the ashes

obtained directly from the industries to study pozzolonic activity and their suitability as binders, partially replacing cement. Therefore it might possible to use sugarcane bagasse ash (SCBA) as cement replacement material to improve quality and reduce the cost of construction.

LITERATURE REVIEW

Chatterjee,(2011) reported that about 50 % of fly ash generated is utilised with present efforts. He also reported that, one may achieve up to 70% replacement of cement with fly ash when high strength cement and very high reactive fly ash is used along with the sulphonated naphthalene formaldehyde superplasticizer. He reported improvement in fly ash property could be achieved by grinding and getting particles in submicrocrystalline range.

Bhanumathidas, &Kalidas, (2002) with their research on Indian fly ashes reported that the increase in ground fineness by 52% could increase the strength by 13%. Whereas, with the increase in native fineness by 64% the strength was reported to increase by 77%. Looking in to the results it was proposed that no considerable improvement of reactivity could be achieved on grinding a coarse fly ash. Authors also uphold that the study on lime reactivity strength had more relevance when fly ash is used in association with lime but preferred pozzolanic activity index in case of blending with cement.

Subramaniam, Gromotka, Shah, Obla& Hill, (2005) investigated the influence of ultrafine fly ash on the early age property development, shrinkage and shrinkage cracking potential of concrete. In addition, the performance of ultrafine fly ash as cement replacement was compared with that of silica fume. The mechanisms responsible for an increase of the early age stress due to restrained shrinkage were assessed; free shrinkage and elastic modulus were measured from an early age. In addition, the materials resistance to tensile fracture and increase in strength were also determined as a function of age. Comparing all the test results authors indicated the benefits of using ultrafine fly ash in reducing shrinkage strains and decreasing the potential for restrained shrinkage cracking.

Hwang, Noguchi &Tomosawa, (2004) based on their experimental results concerning the compressive strength development of concrete containing fly ash, the authors concluded that the pores in concrete reduce by addition of fly ash as replacement of sand.

(Siddique, 2003) carried out experimental investigation to evaluate mechanical properties of concrete mixes in which fine aggregate (sand) was partially replaced with class F fly ash. Fine aggregate was replaced with five percentages (10%, 20%, 30%, 40% and 50 %) of class F fly ash by weight. The test result showed that the compressive strength of fly ash concrete mixes with 10% to 50% fine aggregate replacement with fly ash were higher than control mix at all ages. Also the compressive strength of concrete mixes was increasing with increase in fly ash percentages. This increase in strength due to replacement of fine aggregate with fly ash was attributed to pozzolanic action of fly ash. The splitting tensile strength also increased with increase

in percentage of fly ash as replacement of fine aggregate. The tests on flexural strength and modulus of elasticity also showed improvement in the results as compared to control concrete**.**

Namagg&Atadero, (2009) described early stages of a project to study the use of large volumes of high lime fly ash in concrete. Authors used fly ash for partial replacement of cement and fine aggregates. Replacement percent from 0% to 50% was tested in their study. They reported that concrete with 25% to 35% fly ash provided the most optimal results for its compressive strength. They concluded that this was due to the pozzolanic action of high lime fly ash.

(Jones & McCarthy, 2005) made an extensive laboratory based investigation in to unprocessed low lime fly ash in foamed concrete, as a replacement for sand. For a given plastic density, the spread obtained on fly ash concretes were up to 2.5 times greater than those noted on sand mixes. The early age strengths were found to be similar for both sand and fly ash concrete, the 28-day values varied significantly with density. The strength of fly ash concrete was more than 3 times higher than sand concrete. More significantly while the strength of sand mixes remained fairly constant beyond 28 days, those of fly ash foamed concrete at 56 and 180 days were up to 1.7 to 2.5 times higher than 28 days values respectively.

M.Vijaya Sekhar Reddy, I.V.Ramana Reddy, December 2012 studied the behaviour of High Performance Concrete (HPC) which is being the most used type of concrete in the construction industry. They replaced cement with Supplementary cementing materials (SCM) like fly ash, silica fume and metakaolin. The mix design adopted was M60, cubes were casted and cured for 90 days in 5% HCl(PH=2), NaOH, MgSo4 and Na2So4 They concluded that there was a considerable increase in service life of the concrete structures and reduction in heat of hydration by using the supplementary cementing materials in concrete. They observed the maximum and minimum percentage of reduction in strength of concrete when concrete was with fly ash were 12.64% and 1.92%.

Mr. R. Srinivasan et al., has investigated on "Experimental Study on Bagasse Ash in Concrete". They had observed that Sugar Cane bagasse is fibrous waste-Product of sugar refining industry, and causing serious environmental problem which mainly contain aluminium ion and silica. Hear bagasse ash has been chemically and physically characterized, and partially replaced in the ratio of 0%, 5%, 15%, 25% by weight of cement in concrete. Fresh concrete tests like compaction factor test and slump cone test were undertaken, was well as hardened concrete test like compressive strength , split tensile strength, flexural strength and modulus of elasticity at the age of seven and 28 days was don. The results show that the SCBA in blended concrete had significantly higher compressive strength, tensile strength, and flexural strength compare to that of the concrete without SCBA. It is found that cement could be advantageously replaced with SCBA up to maximum limit of 10%. Partial replacemenof cement by SCBA increases workability of fresh 24 concrete; therefore use of superplasticizer is not substantial. The density of concrete decreases with increase in SCBA content.

Mrs.U.R.Kawade, Mr.V.R.Rathi, Miss Vaishali D. Girge (July 2013) The results show that the SCBA concrete had significantly higher compressive strength compare to that of the concrete without SCBA. It is found that the cement could be advantageously replaced with SCBA up to maximum limit of 15%. Although, the optimal level of SCBA content was achieved with 15.0% replacement. Partial replacement of cement by SCBA increases workability of fresh concrete; therefore use of super plasticizer is not essential.

MATERIALS

Cement :

The most popular construction material till date is cement in the form of concrete. The use of cement in construction is very old. Cement has proved its efficiency in terms of its sufficient strength, economic cost, less time of construction and finally good durability. Moreover, the growth of a country is adjudged through its infrastructural facilities. Hence, construction industry has always been in boom and has seen rapid development in recent past. Cement Concrete with large volumes of fly ash needs to be used in construction activities for the benefits discussed later in this paper.

Fly ash:

Fly ash is the fine residue produced from the combustion of pulverized coal in electric and steam generating plants. In India, thermal power plants are the main source for producing electricity. Though attempts are being made to find solutions for cleaner production of electricity, but still there is a long way to go and we may depend on traditional coal burning thermal power plants for quite some more time (50-100 years). As a rough estimate, approximately 115 million tons of fly ash are being produced annually from thermal power plantsin India. However, only 40 million tons of flyash are used annually in various engineering applications. The use of small percentages of fly ash in a variety of civil engineering works is being carried outmainly for economical reasons. Fly ash, being available, at negligible or no cost is taking place of cement, a costly construction raw material with the aim - one, to solve the problem of disposal of fly ash in environment and two, to get some financial benefit. However, researchers abroad, especially in developed countries, have proved that fly ash in high volumes can safely be used in concrete and results in better pump abilityand long term durability. The use of fly ash in concrete has increased in last 20 years considerably.

Sugarcane Bagasse Ash:

Sugarcane bagasse consist of approximately 50% of cellulose, 25% of hemicelluloses of ligin. Each ton of sugarcane generates approximately 26% of bagasse (at a moisture content of 50%) and 0.62% of residual ash. The residue after combustion presents a chemical composition dominates by silicon dioxide (sio2). In spite of being a material of hard degradation and that presents few nutrients, the ash is used on the farms as a fertilizer in the sugarcane harvests. In this sugarcane bagasse ash was collected during the cleaning operation of a boiler in the sugar factory, located in the city jamni (wardha).

CONCLUSION

From the above experimental works following conclusions could be drawn:

- Addition of SCBA is found to decrease the workability.The mix having fly ash content have workability comparable with the control mix.
- The mechanical properties such as compressive strength, flexural strength, modulus of elasticity, split tensile strength, impact resistance gets improved due to the addition of 5% SCBA with optimum dosage of 10% fly ash.
- Replacement of SCBA up to 5% showed higher early age strength than Normal concrete.
- SCBA 5% and FA 10% showed higher strength compared to Normal Concrete and control mix at all ages.
- The resistance to sulphate attack, chloride attack gets improved in SCBA 5% and FA 10%.

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