A REVIEW STUDY ON RICE HUSK ASH AND BLAST FURNACE SLAG BASED ON HIGH STRENGTH CONCRETE

[1] Prof. Shubhangi. T. Umale, [2]Jafri Sadekh Ahmed, [3]Ansari Ab. Qadir, [4]Shaikh Md. Umair Shaikh, [5]Momin Abdullah
[1]Assistant Professor, [2]BE Student, [3]BE Student, [4]BE Student, [5]BE Student
[1]Department of Civil Engineering
[1]Everest College of Engineering & Technology Aurangabad (M.S) India,

Abstract— The cement industry is the major contributor of emission, Rice husk ash one of the supplementary cementitious materials, exhibits high pozzolanic characteristics when properly produced under controlled conditions according to American Society of Civil Engineers. RHA was added as partial replacement of ordinary Portland cement from 10 to 30%.Based on the results; it was found that RHA addition up to 20% in partial replacement of ordinary Portland cement (OPC) lead to increased compressive strength of concrete. Blast furnace slag (BFS) is a by-product from blast furnaces which is used to produce iron. Blast furnace slag has been used as a successful replacement material for Portland cement in concrete materials to improve durability, produce high strength and high performance concrete, and brings environmental and economic benefits.In this project we have to experimental investigation on concrete cube with partially replacement of ordinary Portland cement to with or without RHA and BFS. We will test on specimen at various days of curing such as 3, 7 and 28 days and compare strength of specimen, with and without using admixtures.

Index Terms— RHA, Pozzolanic, OPC, BFS, Admixture,

I. INTRODUCTION:

Concrete is a very strong and versatile mouldable construction material. It consists of cement, sand and aggregate (e.g., gravel or crushed rock) mixed with water. The cement and water form a paste or gel which coats the sand and aggregate. When the cement has chemically reacted with the water (hydrated), it hardens and binds the whole mix together. The initial hardening reaction usually occurs within a few hours. It takes some weeks for concrete to reach full hardness and strength. Concrete can continue to harden and gain strength over many years.

History: Perhaps the earliest known occurrence of cement was twelve million years ago. A deposit of cement was formed after an occurrence of oil shale located adjacent to a bed of limestone burned due to natural causes. These ancient deposits were investigated in the 1960s and 1970s.In the Ancient Egyptian and later Roman eras, it was re-discovered that adding volcanic ash to the mix allowed it to set underwater. German archaeologist Heinrich Schliemann found concrete floors, which were made of lime and pebbles, in the royal palace of Tiryns, Greece, which dates roughly to 1400–1200 BC. Lime mortars were used in Greece, Crete, and Cyprus in 800 BC. The Assyrian Jerwan Aqueduct (688 BC) made use of waterproof concrete. Concrete was used for construction in many ancient structures.

Admixtures: The concrete material is the expensive material and used in all over India, if all-important expensive material is partially replaced with more natural, local and affordable material like Rice Husk Ash (RHA) and Blast furnace Slag (BFS) will not only take care of waste management but will also reduce the problem of high cost of concrete and housing.

Rice Husk: Rice milling generates a byproduct know as husk. This surrounds the paddy grain. During milling of paddy about 78 % of weight is received as rice , broken rice and bran .Rest 22 % of the weight of paddy is received as husk . This husk is used as fuel in the rice mills to generate steam for the parboiling process. This husk contains about 75 % organic volatile matter and the balance 25 % of the weight of this husk is converted into ash during the firing process, is known as rice husk ash (RHA). This RHA in turn contains around 85 % - 90 % amorphous silica. So for every 1000 kg of paddy milled, about 220 kg (22 %) of husk is produced, and when this husk is burnt in the boilers, about 55 kg (25 %) of RHA is generated.

***Blast Furnace Slag*:** Blast furnace slag (BFS) is obtained by quenching molten iron slag (a by-product of iron and steel-making) from a blast furnace in water or steam, to produce a glassy, granular product that is then dried and ground into a fine powder. The main components of blast furnace slag are CaO (30-50%), SiO_2 (28-38%), Al_2O_3 (8-24%), and MgO (1-18%). In general increasing the CaO content of the slag results in raised slag basicity and an increase in compressive strength. The MgO and Al_2O_3 content show the same trend up to respectively 10-12% and 14%, beyond which no further improvement can be obtained. Several compositional ratios or so-called hydraulic indices have been used to correlate slag composition with hydraulic activity; the latter being mostly expressed as the binder compressive strength.

II. OBJECTIVES*:*

The objective of this paper is to verify the expectation of partially replacement of ordinary Portland cement by Rice Husk Ash and Blast Furnace Slag in the concrete in optimum quantity.

- RHA has two roles in concrete manufacture, as a substitute for fine aggregate, reducing the cost and weight of concrete in the production of low cost buildings.
- Therefore, a large number of researchers have been directed toward the utilization of waste materials.
- It increases the durability of concrete.
- Rice Husk Ash (RHA) is an agricultural waste product, and how to dispose of it is a problem to waste managers. Use of RHA reduces this type of problems.
- As it is a waste form in environment there is an increasing importance to preserve the environment in the present day world. RHA from the boiling plants is posing serious environmental threat and ways are being thought of to dispose them.
- Blast Furnace Slag (BFS) is by product of steel, having two types of superplasticizers on the properties of self-compacting concrete.

- Superplasticizer which is present in BFS, polycarboxylate based superplasticizer and naphthalene sulphonate based superplasticizers.
- Cement was partially replaced with 10%, 15%, 20%, and 25% of BFS.
- Based on the test results, it is suggested that much stronger corrosion resistance can be achieved, if higher volume of BFS is added in ordinary Portland cement.

III. LITERATURE SURVEY:

Muhammad Shoaib Ismail and A. M. Waliuddin[1]: In this paper the High strength concrete (HSC) was produced using locally available material. The effect of rice husk ash (RHA) passing at 200mm and 325mm sieves as a10-30% replacement of cement on the strength of HSC was also studied. The RHA was obtained by burning rise husk, an agro waste material which is abundantly available in the developing countries. The total of 200 taste specimens were cast and tested at 3, 7, 28 and 150 days. Compressive and split tensile strengths of the taste specimens were determined. Cube strength over 70 MPa was obtained without any replacement of cement by RHA. Taste results indicated that strength of HSC decreased when cement was partially replaced by RHA for maintaining same level of workability.

Min-Hong Zhang and V. Mohan Malhotra[2]: This paper presents results on the physical and chemical properties of rice husk ash (RHA), and deals with the properties of fresh hardened concrete incorporating the same ash. In addition to the effect of the percentage of RHA and the water cementitious materials ratio on the properties investigated, the properties of RHA concrete were also compared with those of the control Portland cement concrete and silica fume concret. The taste results indicate that the RHA is highly pozzolanic and can be used as a supplementary cementing material to produced high performance concrete.

Mr. Amitkumar I. Gupta, Dr. Abhay S.Wayal[3]: In this paper Conventional building material like cement is both resource and energy intensive material. Procduction of cement also emits CO_2 in atmosphere. In order to decrease this environmental pollution and cost of conventional building materials, alternative material like fly ash, ground granulated blast-furnace slag, matakaolin, rice husk ash and silica fume is used because of their pozzolanic behavior. This paper present an overview of the work carried out on the use of RHA as partial replacement of cement in concrete and its effect on workability, compressive strength and chloride permeability of concrete.

G. A. Habeeb, M. M. Fayyadh[4]: This paper reports an experimental investigation on the influence of rise husk ash average partical size on the mechanical properties and drying shrinkage of the produced RHA blended concrete. Locally produced RHA with three deferent APS. (i.e., 31.3, 18.3 and 11.5, micron, respectively) were used to replace cement by 20% of its weight. Fine RHA exhibited the highest shrinkage value due to the effect of micro fine particle which increases its shrinkage values considerably.

EL-Hadj Kadri and Said Kenai[5]: This paper presents the results of an experimental investigation carried out to study the effect of blast-furnace slag and two types of superplasticizers on the properties of self-compacting concrete (SCC). In control SCC, cement was replaced with 10%, 15%, 20% and 25% of blast-furnace slag. Two types of superplasticizer: polycarboxylate based superplasticizer and naphthalene sulphonate based superplasticizer were used. Tests were conducted for slum flow, the modified slump test, V-funnel, J-Ring, U-Box, and compressive strength. The results showed that polycarboxylate based superplasticizer concrete mixes give more workability and higher compressive strength at all ages, than those with naphthalene sulphonate based superplasticizer. Inclusion of blast-furnace slag by substitution of cement was found to be very beneficial to fresh self-compacting concrete. An improvement of workability was observed upto 20% of slag content with an optimum content of 15%. Workability retention of about 45 min with 15% and 20% of slag content was obtained using a polycarboxylate based superplasticizer; compressive strength decreased with the increase in slag content, as occurs for vibrated concrete, although at later ages the differences were small.

Kyong Yun Yeau and Eun Kyum Kim[6]: This paper present experimental taste result on corrosion resistance of concrete containing ground granulate blast-furnace slag (GGBS) and American Society for Testing Material (ASTM) Type 1 or American society for Testing Material (ASTM) Type V cement. To investigate the problem, a series of tests were performed. Third, accelerated steel corrosion tests were carried out by using the repeated wetting and drying technique, fourth, half –cell potential tests were implemented in accordance with (ASTM) C 876 to evaluate the probability of steel corrosion. Test results showed that the coefficient of permeability of Type 1 cement concrete was lower than that of Type V cement concrete. Based on the test results, it is suggested that must stronger corrosion resistance can be achieved, if higher volume of (GGBS) is added in Type 1 cement rather than Type V cement.

.

IV. CONCLUSION:

The compressive strength of concrete varies with the type of curing and the amount of curing done before the test. Experimentally it is found that 28 days strength is found to be more than 7 days. Experimentally RHA has replaced about 10-30% and it gives higher values of strength in M20 grade at 20% of RHA replacement shows higher values that in M20 grade with 40% of RHA. The compressive strength of concrete containing up to 20% of Rice Husk Ash was higher than that of control Portland cement concrete. But RHA requires higher dosage of super plasticizer and the air entraining admixtures. The Blast Furnace Slag (BFS) has some chemical properties as polycarboxylate with a nepethalene sulphonate based super plasticizer, is to use make self-compacting concrete by increasing its workability.Experimentally, the addition of BFS by substitution to cement was found to be very beneficial at a 15% of slag.BFS has also used as resistance to with permeability, chloride defussion and steel corrosionFrom the literature review it can be concluded that to produces environment friendly and durable concrete product in corporation of RHA and BFS as partial replacement of cement in concrete has gained importance. Further research can be carried out on ultrafine RHA, the use of RHA will help in reducing the CO_2 emission and using of RHA and BFS also reduces the problem of disposal of this waste. Cement plays an important role in manufacturing of concrete and partially replaced by RHA & BFS, these are locally available at low cost material, due to using of these admixture will be decreases cost of construction.

REFRENCES:

[1] Muhammad Shoaib Ismail and A. M. Waliuddin, 1996. “Effect of Rice Husk Ash on High Strength Concrete” Construction and building Materials, 10(7): 521-526.

[2] Metha, P. K. Siliceous ashes and hydraulic cements prepared there from , In Belgium Patent 802909, July 1973; US Patent 4105459 August 1978.

[3] Zhang, M.H. Malhotra, 1996.High-Performance Concrete Incorporating Rice Husk Ashe as a supplementary Cementing Materials Journal, 93(6): 629-636.

[4] Giaccio, G., G. R. de Sensale, R. Zerbino, 2007. Failure mechanism of normal and high-strength concrete with rice-husl ash. Cement & Concrete Composites, 29: 566-574.

[5] Hwee, Y. S. and Rangan, B. V. Studies on commercial SHC. ACI Mater. J. Septeber-October 1990,440-445
[6] Chopra, Utilisation of rice husk for making cement and cement-like binders. In Proc. UNIDO/ESCAP/RCTT Workshop on Rice Husk Ash Cement, Peshawar, Pakistan, 1979, pp. 135-149
[7] Malhotra, V. M., "Mechanical Properties and Freezing and Thawing Resistance of Non-Air-Entrained, Air-Entrained, and Air-Entrained Super-plasticizer Concrete Using ASTM Test C 666, Procedure A and B," Cement, Concrete and Aggregate, VI 4, No.l, Summer 1982, pp. 3-24.
[8] Ha Thanh Le, Sang Thanh Nguyen, and Horst-Michael Ludwig (2014) "A Study on High Performance Fine-Grained Concrete Containing Rice Husk Ash" International Journal of Concrete Structure and Materials, Vol.8, No.4, pp.301-307.
[9] Muthadhi and S. Kothandaraman (2013) "Experimental investigations of Performance Characterstics of Rice Husk Ash Blended Concrete" ASCE Journal of Materials in Civil Engineering, Vol. 25, No. 8
[10] Ernst Worrell, Lynn Price, Nathan Martin, Chris Hendriks and Leticia Ozawa Meida (2001) "Carbon Dioxide Emissions from the Global Cement Industry" Annual Review Of Energy And The Environment, Vol. 26. Pg No.303-329.
[11] Kyong Yun Yeau, Eun Kyum Kim, "An experimental study on corrosion resistance of concrete with ground granulated blast furnance" (2004), Cement and concrete Reseach 35 (2005) 1391-1399.
[12] H.A.F. Dehwah, M. Maslehuddin, S.A.,Austin, Long–term effect of sulphate ions and associated cation type on chloride-induced reinforcement corrosion in Portland cement concretes, Cem. Concr. Compos. 24 (2002) 17-25
[13] Othmane Boukendakdji, El-Hadj Kadri, Said Kenai, "Effect of granulated blast furnance slag and superplasticizer type on the fresh properties and compressive strength of self-compacting concrete" (2011), Cement & Concrete Composites 34 (2012) 583-590.
[14] Domone PL, Chai HW, Jin J. Optimum mix proportioning of self-compacting concrete. In: Dhir RK, Jones MR, editors. Proceeding on international conference on "innovation in concrete structures: design and construction. London: University of Dundee, Thomas Telford.p. 277-85.
[15] Yamada K, Takahashi T, Hanehara S, Matsuhisa M. Effects of the chemical structure on the properties of polycarboxylate-type superplasticizer.Cem Concr Res 2000;30:197-207.
[16] M. S. Shetty (1982) "Concrete Technology" published by S. Chand Publication.