EFFECT OF ELEVATED TEMPERATURE ON CONCRETE WITH PARTIAL REPLACEMENT OF CEMENT BY RHA

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Abstract — **The purpose of this paper is to investigate the strength of cement concrete in the presence of RHA (Rise Husk Ash). The strength and durability of concrete with different replacement level (0%, 5%, 10%, 15%) of Ordinary Portland Cement (OPC) by RHA with different elevated temperature level i.e. 200^0c up to 1200^0c with the interval of 200^0c is investigate here. RHA was manufactured from an uncontrolled burning process. Test sample were prepared from standard material collected from different sites. The sample were kept in curing pot for 28 days in controlled environmental condition. The result shows that addition of RHA as shows batter result from 10% replacement of RHA.**

Keywords—rise Husk Ash; Strength; concrete.

1. INTRODUCTION

During a fire, concrete material in structures is likely exposed to high temperatures. During these exposures the mechanical properties such as strength, modulus of elasticity and volume stability of concrete are significantly reduced resulting in undesirable structural failures. The chemical and physical composition of the concrete change considerably when exposed to high temperature with the use of different aggregates, the strength degradations of concretes are not the same under high temperatures which is due to different mineral structure of the aggregates. The selection of the type of the aggregate for the concrete also plays an important role and the aggregate should be able to sustain high temperature without much affecting the mechanical properties of concrete

2. LITERATURE REVIEW

(A)

NAME OF PAPER: - Performance of concrete with different ingredients at elevated temperature – An experimental study.

AUTHOR: - Dr. Shailesh Chaudhary, Dr. Ravi Saxena.

YEAR: - 2014

ABSTRACT :- In the present work, the residual strengths of cement concrete cubes and weight losses were evaluated in cold state after exposing them to elevated temperature for 1, 1.5 and 2.0 hours. The cubes were heated for 200°C, 400°C, 600°C, 800°C. The effect of elevated temperature is recorded for different types of mixes with different ingredients like cement, sand, coarse aggregate, etc.

CONCLUSION: - The effect of aggregate size was found at elevated temperature. Mix having coarse aggregate only of 20 mm size performed better than mix having graded 20 mm and 10 mm

coarse aggregate. Residual strength was almost same for graded coarse aggregate for temperature 200°C to 800°C for 60 min heating duration

(B)

NAME OF PAPER: - behavior of cement concrete at high temperature.

AUTHOR: - HAGER

YEAR: - 2013

ABSTRACT :- The effect of high temperature on concrete covers changes taking place in cement paste, aggregate , as well as the interaction of these two constituents, that result in changes of physical and mechanical characteristics of concrete including color changes thermal strain, thermal strains under load .

CONCLUSION: - It has been shown that the color changes of heated concrete might be the first indication of the potential deterioration of concrete due to heating. The most common way to evaluate this deterioration is to expose the material to a high temperature.

(C)

NAME OF PAPER: - Impact of Rice Husk Ash in concrete mix design.

AUTHOR: - Dr. Shubha Khatri

YEAR: - 2014

ABSTRACT: - This paper shows the impact of Rice Husk on concrete structures by conducting an experimental study in the laboratory to improve the cubic strength on concrete structure. Rice Husk Ash as a partial replacement of cement is added in the concrete mix design and a detailed parametric study for 5% and 15% Rice Husk has been carried out on compressive strength of concrete cubes for M20 mix at 7 and 28 days. The result shows that the compressive strength of concrete has been improved by adding Rice.

CONCLUSION: - The influence of RHA on cubic strength has been found to be sensitive with 5% and with 15% RHA as a partial replacement of cement. The comparison study has also ben carried out to show the effectiveness of 5% and 15% RHA it has been observed that at 15% RHA compressive strength of concrete cubes increased about 13.38% at 7 days and about 19.78% at 28 days with respective 5% RHA.

(D)

NAME OF PAPER :- Review on concrete subjected to elevated temperature.

AUTHOR :- Maya T M , Nivin Philip , Dr. Job Thomas .

YEAR :- 2014

ABSTRACT :- The main objective of this paper is to assess the effect of elevated temperature on concrete. Studies are mainly based upon the comparison of the mechanical properties of concrete subjected to temperature and tested at ambient temperature. The test result shows that there was a significant loss of weight and mechanical properties after temperature exposure also relative strength of concrete decrease as the exposure temperature increased.

CONCLUSION: - most of the authors concluded that due to temperature exposures there will be a drastic reduction in mechanical properties of concrete. The study about the influence of aggregate on thermal behavior showed that permeability of aggregate plays an important role in the thermal stability .

(E)

NAME OF PAPER:- A study on use of Rice Husk Ash in concrete.

AUTHOR:- P. Padma Rao , A. Pradhan Kumar, B. Bhaskar Singh.

YEAR:- 2014

ABSTRACT :- In this paper shows that use of Rice Husk Ash as an admixture replace cement with Fly Ash(Portland Pozzolana Cement) in concrete, and an attempt has been made to investigate the strength parameter of concrete (compressive and flexural). Five different replacement levels namely 5% , 7.5% , 10% , 12.5% and 15% are chosen for study concern to replacement method. Large range of curing period

starting from 3 days , 7 days , 28 days and 56 days re considered in the present study.

CONCLUSION:- 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 a significant increase in compressive strength from 7 days to 28 days followed by gradual increases from 28 days to 56 days.

3. Materials and tests

3.1 Rice Husk Ash

Rice husk ash used was obtained from Ellora Paper Plant located in Tumsar Bhandara .The Specific gravity of rice husk ash is 2.10 and bulk density is 0.781 g/cc RHA, produced after burning of Rice husk (RH) has high reactivity and pozzolanic property. Indian Standard code of practice for plain and reinforced concrete, IS 456-2000, recommends use of RHA in concrete but does not specify quantities. Chemical compositions of RHA are affected due to burning process and temperature. Silica content in the ash increases with higher the burning temperature. As per study by Houston, D. F. (1972) RHA produced by burning rice husk between 600 and 700°C temperatures for 2 hours, contains 90-95% SiO_2, 1-3% K2O and < 5% unburnt carbon. Under controlled burning condition in industrial furnace, Studies have shown that RHA resulting from the burning of rice husks at control temperatures have physical and waste property.

1) Normal Consistency = 17 %
2) Initial and Final Setting time = 195 min. and 265 min.
3) Compressive Strength = 11 N/mm^2
4) Specific Gravity = 2.09

3.2Cement

The cement used was Ordinary Portland cement (43 Grade) with a specific gravity of 3.15. Initial and final setting time of the cement was 50 min and 365 min, respectively OPC 43 grade cement is used for this whole experimental study. The physical test results on OPC are as follows. 1) Normal consistency = 22% 2) Initial Setting time = 30 min. 3) Final Setting Time = 10 hrs. 4) Specific Gravity = 3.15

3.4 Test on Concrete

An M25 mix is designed as per guidelines in IS 10262, 1982 based on the preliminary studies conducted in the constituent materials. Tests on fresh concrete are obtained as follows. 1) Slump Test=65mm 2)Compaction factor =0.95

3.5 Mixture Proportioning

The mixture proportioning was done according the Indian Standard Recommended Method IS 10262-1982.The target mean strength was 32.1 Mpa for the OPC control mixture, the total binder content was 435.45 kg/m ,fine aggregate is taken 476kg/m and if any, the influence of plasticizer on the properties of hardened concrete. coarse aggregate is taken 1242.62kg/m the water to binder ratio was kept constant as 0.44, The total mixing time was 5 minutes, the samples were then casted and left for 24 hrs before demoulding They were then placed in the curing tank until the day of testing Cement, sand, Fly ash, Rice husk ash and fine and coarse aggregate were properly mixed together in accordance with British Standard Code of Practice (BS 8110)19 in the ratio 1:1.1:2.85 by weight before water was added and was properly mixed together to achieve homogenous material. Water absorption capacity and moisture content were taken into consideration and appropriately subtracted from the water/cement ratio used for mixing reported the blending of rice husk ash (RHA) in cement is recommended in most international building codes now. Hence, cement was replaced in 30% with rice husk ash and fly ash and 150 × 150 × 150mm3, Beam and Cylinder moulds were used for casting. Compaction of

concrete in three layers with 25 strokes of 16 mm rod was carried out for each layer. The concrete was left in the mould and allowed to set for 24 hours before the cubes were de moulded and placed in curing tank. The concrete cubes were cured in the tank for 28days.

4 Testing methods

Mix			Strength At Elevated Temperature		
Sr.no.	% of RHA	% of cement	0^0	200^0	400^0
1	0%	100%	32.28	33.35	32.57
2	5%	95%	33.34	29.20	27.68
3	10%	90%	34.46	31.20	28.26
4	15%	85%	28.96	26.28	25.04

Testing is done as per following IS code. The testing done for compressive strength of cubes were measured 28 days as per IS : 516 – 1959.

5. CONCLUSIONS

Based on the results presented above, the following conclusions can be drawn:

1. The workability of concrete had been found to be decrease with increase RHA in concrete
2. As the rice husk is burned out at 600º to 800º c. It is observed that the 80 % silica was produced due to this it gives a excellent thermal insulation.
3. Through Rice husk ash is harmful for human being and the cost of rice husk ash is zero and thus we preferred RHA use in concrete as compare to silica fumes and it is also economical.
4. Rice Husk Ash can be used with admixtures, plasticizers, and super plasticizers, for increasing the workability and strength of concrete with partial replacement of cement.
5. The mechanical properties in terms of flexural and tensile strength have been significantly improved with the addition of RHA.
6. The maximum 28 days flexural strength was obtained again with 10% rice husk ash mix.
7. Compressive strength increases with the increase in the percentage of Fly ash and Rice Husk Ash up to replacement (10% RHA) of Cement in Concrete for different mix proportions.

6 REFERENCES

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