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ANALYSIS OF BEHAVIOUR OF FLY-ASH CEMENT CONCRETE WITH ADDITION OF RICE HUSK ASH

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ABSTRACT - *Cement is widely noted to be most expensive constituents of concrete. The entire construction industry is in search of a suitable and effective waste product that would considerably minimize the use of cements and ultimately reduces the construction cost. Rice husk ash (RHA) which has the pozzolanic properties is a way forward. The possibility of uses RHA as a construction materials need to be investigated. Three grades of ordinary Portland cement (OPC) namely; 33, 43 and 53 as classified by Bureau of Indian Standard (BIS) are commonly used in construction industry. But the usage of cement in concrete causes lot of environmental pollution due to emission of green house gases. So that it is necessary to reduce usage of cement by introducing new supplementary cementitious materials which are the by-products of industries to reduce to relative problem. A comparative study on effect of concrete properties when ordinary Portland cement (OPC) is varying grades is partially replaced by RHA and FA is discussed in this project. Percentage replacement of OPC by RHA and FA are 0%, 10%, 20%, 30% and 40% respectively. The compressive strength test, standard consistency test, initial setting time test, final setting time test and workability test of concrete are mainly studied. The studies suggests that up to 30% mix of fly ash (20%) and rice husk ash (10%) are increased the compressive strength of concrete and decrease the final setting time of cement.*

***Key Words*: Fly Ash(F.A.), Rice Husk Ash(R.H.A.), Ordinary Portland Cement(O.P.C.), Consistency, Initial Setting Time, Final Setting Time, Workability, Compressive Strength,**

1. INTRODUCTION

Traditionally, rice husk has been considered a waste material and has generally been disposed of by dumping or burning, although some has been used as a low-grade fuel. Energy plays a crucial role in growth of developing countries, like India. In context of low availability of non-recoverable energy sources coupled with requirements of large quantities of energy to materials like cement, steel etc., the importance of industrial wastes as building materials cannot be underestimated. In India about 110 million tones of fly ash has been produced by 68 major thermal power stations and are likely to be doubled within next 10 years. It has been a published fact from research that waste materials like fly ash; rice husk ash etc, through their use as construction materials can be converted into meaningful wealth. Also, a partial replacement of cement with fly ash is desirable, and indeed essential due to a variety of technical, economical and ecological reasons. A properly proportional fly ash and rice husk ash in concrete mix improves properties of the concrete that may not be achievable through the use of Portland cement alone. The resulting concrete mix becomes strong, durable and economical and also eco-friendly as it utilizes an ecological hazardous material.

One of the main advantageous of high-volume mineral admixtures in high-strength concrete is reducing the cement content, which has not only economic and environmental benefits but also means reducing heat of hydration and increasing durability properties. As a rule of thumb, the total heat of hydration produced by the pozzolanic reactions involving mineral admixtures is considered to be half as much as the average heat produced by the hydration of Portland cement. To achieve high-strength and workability while reducing creep and shrinkage Chang et al. Using super plasticizers and pozzolona materials in the mix designs of high-performance concrete.

It has been a published fact from reason that waste material like fly ash , rice husk etc, through use as construction materials can be converted in to meaning full wealth. Also a partial replacement of cement by fly ash is desirable and indeed essential due to a variety of technical ecological and economical reason. The properly proportion fly ash and rice husk ash in concrete mix improve properties of the concrete that may not be achievable through the use of Portland cement alone. The resulting concrete mix become strong durable economical and also eco-friendly as it utilized an ecological hazardous materials.

One of the main advantageous of high volume mineral admixture in high strength concrete is reducing the cement content which has not only economic and environmental benefit also mean reducing heat of hydration and increasing durability properties of concrete. Rice husk ash contain high silica content which is more than 90%, it reduces shrinkage cracks and leads to increase the strength of concrete. The many researchers are done research on rice husk ash and they presented their results of modified concrete properties. The rice husk ash is obtained by burning of rice husk ash at temperature between 550oC to 700oC, then the rice husk may forms as cellular micro structure is produced. The rice husk ash has rich silica content of non-crystalline (or)

Water = 21.13litres

6. EXPERIMENTAL PROGRAM:

In this project cementitious material mixed into three pattern of describe in above Table- 4(a). To find out the properties of all mixes and compare the value of all patterns to each other, various testing was done by me. Testing is divided in to two parts. First one is testing of cementitious materials and second one is testing of concrete.

Fig.-6(a): Compressive testing machine

Table-6(a): Consistency, Initial and Final setting time results:

S.N.	Cementitious materials mixes (Cement + fly ash + rice husk ash)	Consistency of cement %	Initial setting time (minutes)	Final setting time (minutes)
01.	A-1	32	45	545
02.	B-1	32	70	645
03.	C-1	31	75	690
04.	D-1	31	85	710
05.	E-1	30	100	785
06.	D-2	35	65	680
07.	D-3	36	95	750
08.	E-2	32	65	715
09.	E-3	36	75	695

Table-6(B): Slump test results

S.N.	Batch	Value of slump (mm)
01.	A-1	71
02.	B-1	73
03.	C-1	77
04.	D-1	78
05.	D-2	72
06.	D-3	71
07.	E-1	80
08.	E-2	77
09.	E-3	68

Table-6(c): Effect of age on compressive strength, w/c = 0.43

S.N.	Batch designation	7 days	28 days	% Increase
01.	A-1	21.37	32.97	54.00
02.	B-1	20.80	30.43	46.00
03.	C-1	19.52	29.28	50.00
04.	D-1	19.28	28.34	47.00
05.	D-2	23.33	37.34	60.05
06.	D-3	22.63	36.80	62.60
07.	E-1	15.98	22.70	33.68
08.	E-2	20.29	30.80	51.78
09.	E-3	21.10	32.45	53.82

7. RESULTS AND DISCUSSIONS

7.1 Standard Consistency, Initial Setting Time and Final Setting Time of Cementitious materials:

7.1.1 Pattern-1

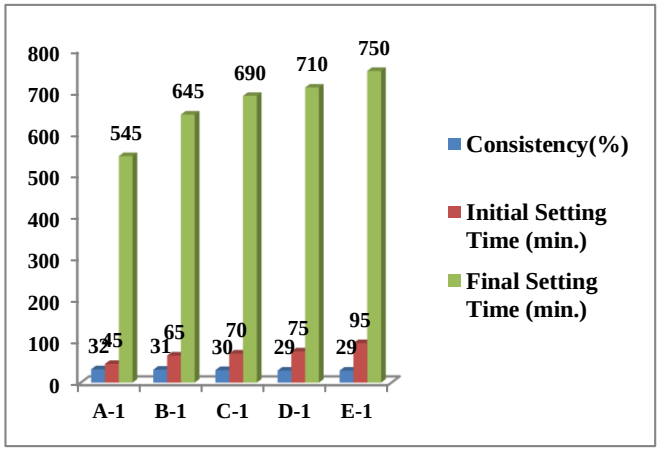

Fig.-7(a): Consistency, initial setting time and final setting time of cementitious materials (P-1)

7.1.2 Pattern-2

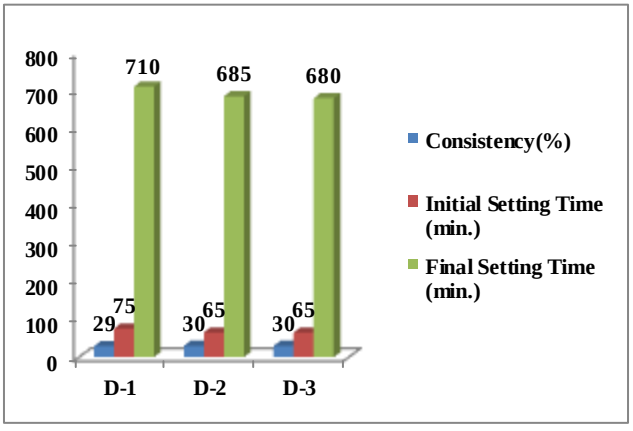

Fig.-7(b): Consistency, initial setting time and final setting time of cementitious materials (P-2)

7.1.3 Pattern-3

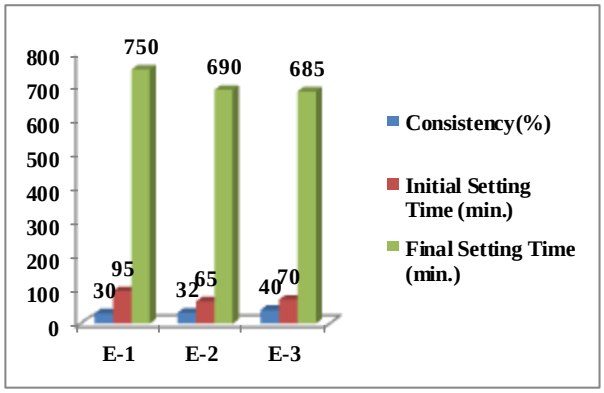

Fig.-7(c): Consistency, initial setting time and final setting time of cementitious materials (P-3)

7.2 Workability test results:

7.2.1 Pattern-1

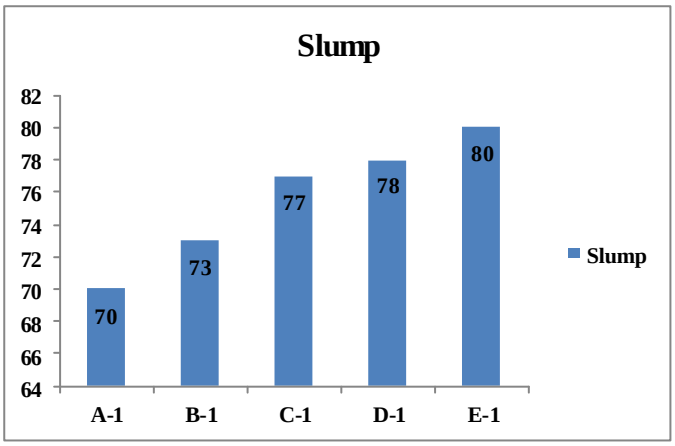

Fig.-7(d): Slump value for w/c ratio 0.43 (P-1)

7.2.2 Pattern-2

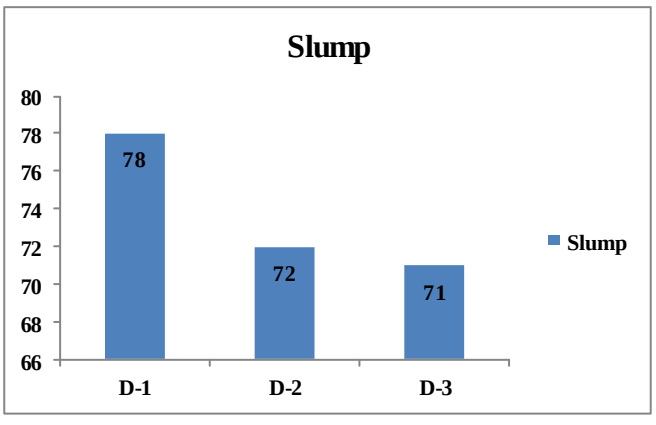

Fig.-7(e): Slump value for w/c ratio 0.43 (P-2)

7.2.3 Pattern-3

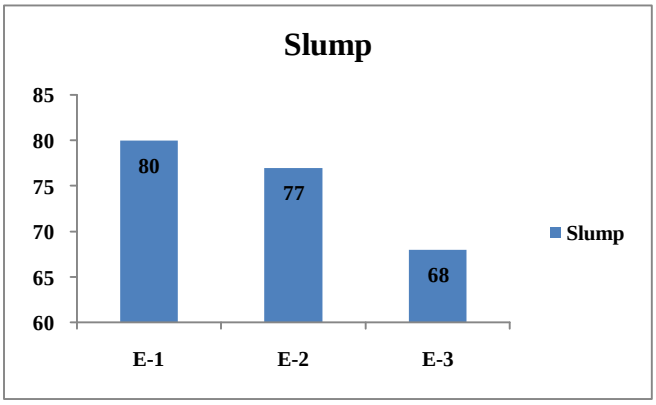

Fig.-7(f): Slump value for w/c ratio 0.43 (P-3)

7.3 Compressive strength result: (for 7and 28 days)

7.3.1 Pattern-1

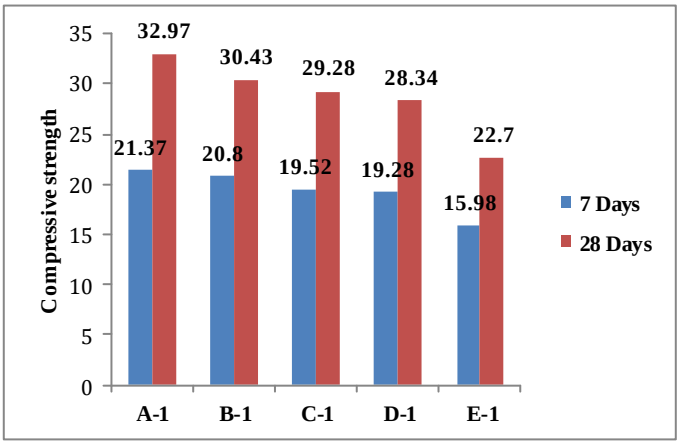

Fig.-7(g): 7 Days and 28 Days Compressive Strength of Pattern 1 for W/C 0.43

7.3.2 Pattern-2

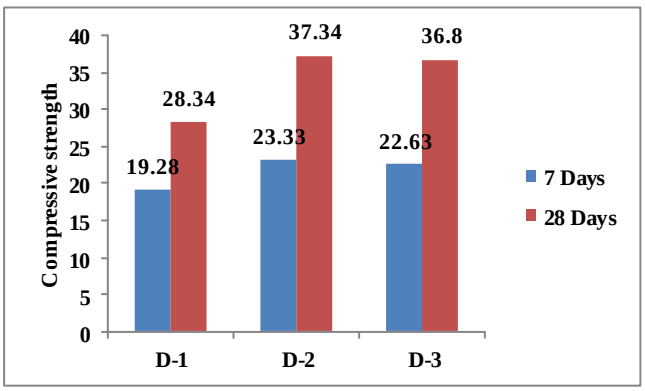

Fig.-7(h): 7 Days and 28 Days Compressive Strength of Pattern 2 for W/C 0.43

7.3.3 Pattern-3

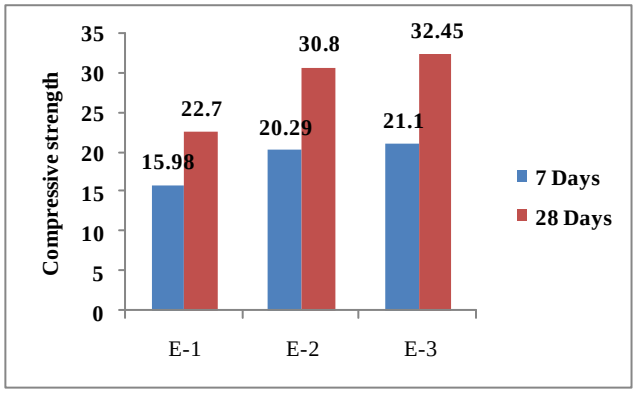

Fig.-7(i): 7 Days and 28 Days Compressive Strength of Pattern 2 for W/C 0.43

7.4 Discussion about results:

7.4.1 Consistency of Cementitious material mix:

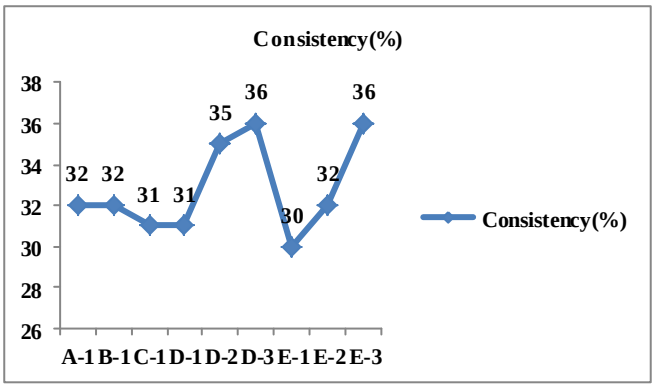

Fig.-7(j) Consistency results of all batches.

7.4.2 Initial and final setting time of cementitious material mix:

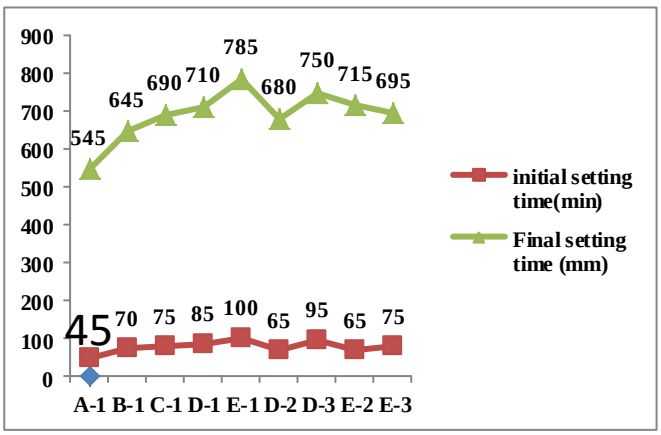

Fig.-7(k): Initial and Final setting Time Results of All Batches

7.4.3 Workability test result of concrete:

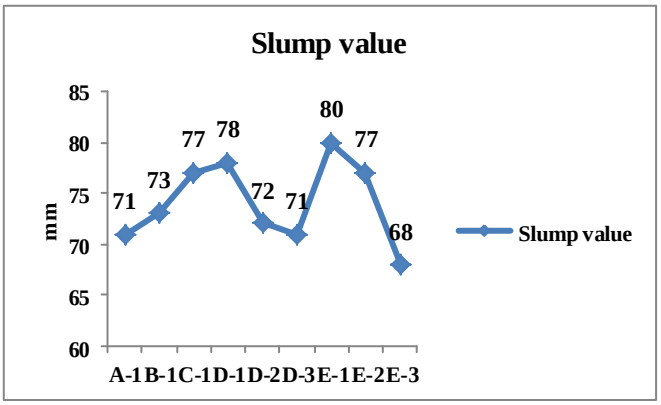

Fig.-7(l): Workability Results of All Batches

7.4.4 Compressive strength results of concrete

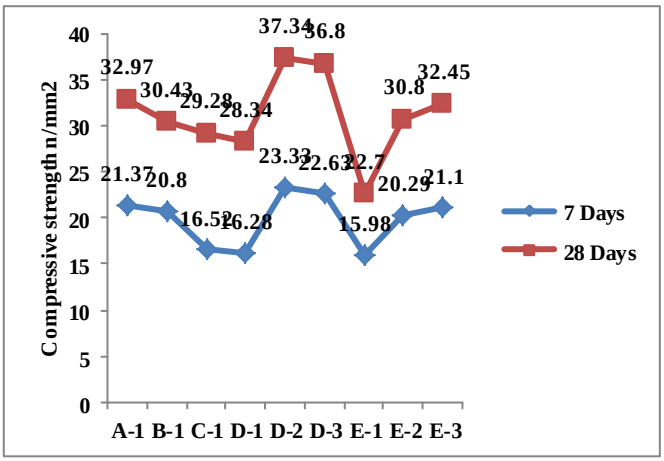

Fig.-7(m): Compressive strength of All Batches

7.4.5 Combined result for effect of age on compressive strength:

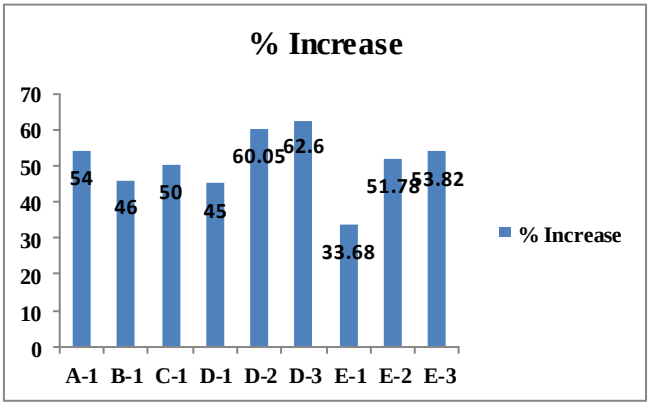

Fig.-7(n): Percentage increase in compressive strength from 7 days to 28 days.

8. CONCLUSIONS

From the experimental results, the conclusion of consistency initial and final setting time of cementitious materials, workability and compressive strength of hardened concrete are concluded as under:
When we replace cement only with fly ash, then the consistency of cement continuously get diminished. But when we add fly ash and rice husk ash in different ratio in the cement than the consistency of cementitious materials increase according to the adding of quantity of rice husk ash.

In the case of setting time of cementitious materials initial and final setting time depend upon the quantity of fly ash, with the addition of rice husk ash in the fly ash cement concrete, initial and final setting time decrease because rice husk ash increase the hydration of cement.

In the case of workability fly ash linearly increase up to batches (A-1), (B-1), (C-1), (D-1) and (E-1) respectively, whereas rice husk ash decrease the workability of remaining batches.

According the results of compressive strength, when only fly ash is present in the concrete as other cementitious materials the rate of compressive strength from 7 days to 28 days slows down but rice husk ash increase the rate of compressive strength from 7 days to 28 days. As the results of the experiments batch (D-2) as 70% cement 20% fly ash and 10% rice husk ash, the compressive strength is highest for 28 days. But the rate of compressive strength of batch (D-3) is speedily increased from 7 days to 28 day

REFERENCES

[1] Shetty, M.S. 2012. Concrete Technology. S. Chand Publication New Delhi.

[2] Nagrale, S.D., Hazare, H. and Modak, P.R. (2012) "Utilization of Rice Husk Ash", International Journal of Engineering Research and Applications (IJERA). Vol. 2, Issue 4, pp. 001-005.

[3] Khan, R., Bhikshma, V. and Prakash, P.J. (2011) "Reduction in Environmental Problems using rice husk ash in concrete", Construction and Building materials 30, pp. 360-365.

[4] Kishore, R., Bhikshma, V. and Prakash, P.J. (2011) "Study on Strength Charecteristics of High Strength Rice Husk Ash Concrete", Procedia Engineering 14, pp. 266-2672.

[5] Naik, T. R., Singh, S. S., & Hossain, M. M. (1994) "Permiability of concrete containing large amount of Fly Ash ", Cement and Concrete Rsearch, 34(5), 913-922.

[6] Owens, P.L. (1979). Fly ash and its using in concrete. Concrete, 13(7).

[7] Ramzanianpour, A., Mahdikhani, M., & Ahmadibeni, G. (2009) "The effect of rice husk ash on mechanical properties and durability of sustainable concrete", International Journal of Civil Engineering, 7(2), 83-91.

[8] Rukzon, S. and Chindaprasirt, P. (2010) " Strength and carbonation Model of Rice Husk Ash Cement Mortar with Different Fineness.' Journal of Matrials in Engineering ASCE22, pp. 253-259."

[9] Siddique, R. (2003) "Effect of fine aggregate replacement with Class F fly ash on the mechanical properties of concrete", Cement and Concrete Research, 33(4), 539-547

[10] Zhang, M.H., Lastra, R. and Malhotra, V.M.(1996) "Rice Husk Ash Paste and Concrete: Some Aspects of Hydration and the microstructure of the Interfacial Zone Between the Aggregate and Paste", Cement and concrete Research, Vol. 26, No. 6, pp. 963-977.

[11] Zhang, M.H., & Malhotra, V. M. (1996) "High-Performance concrete incorporating Rice Husk Ash as a supplementary cementing materials" ACI Materials Journal, 93(6).

[12] IS: 456-2000, Indian standard, "PLAIN AND REINFORCED CONCRETE CODE OF PRACTICE", (Fourth Revision).

[13] IS: 10262-1982, Indian standard, "RECOMMENDED GUIDELINESS FOR CONCRETE MIX DESIGN".

[14] IS: 3812(Part-1)-2013, Indian standard, "PULVERIZED FUEL ASH-SPECIFICATION".

[15] IS: 3812(Part-2)-2013, Indian standard, "PULVERIZED FUEL ASH-SPECIFICATION"(Third rivision).

[16] IS: 269-2013, Indian standard, "ORDINARY PORTLAND CEMENT, 33 GRADE-SPECIFICATION" (Fifth Revision)

[17] IS: 269-2013, Indian standard, "ORDINARY PORTLAND CEMENT, 43 GRADE-SPECIFICATION" (Second Revision)

[18] IS: 12269-2013, Indian standard, "ORDINARY PORTLAND CEMENT, 53 GRADE-SPECIFICATION" (First Revision)