Study on Application of Chemical Accelerator for the Early Age Strength of Concrete using PPC

Ranjeet[1] Mr. R.D. Patel[2]
[1]P.G. Scholar [2]Associate Professor
[1,2]Department of Civil Engineering
[1,2]Madan Mohan Malviya University of Technology, Gorakhpur

Abstract— In this paper we present the experimental investigations on the effect of calcium nitrate on the compressive strength of concrete. Cement concrete cubes of 150mm x 150mm x 150mm were cast using fresh water and calcium nitrate. The constant water cement ratio (w/c) was kept 0.45 by weight for all the mixes prepared. 48 cubes were casted for experiment. They were cured in fresh water. The curing was done for 7, 14, and 28 days, then crushed using the Compressive Strength Test Apparatus at prescribed ages. There was an increase in the compressive strength of concrete for concrete specimens mixed and cured with calcium nitrate.

Key words: PPC, Chemical Accelerator

I. INTRODUCTION

Fast cars, fast travel schedules, fast track construction has become the order of the day. In recent days, technology plays an important role so this technological advancement has been an economic boon for the mankind. The main principle behind this advancement is 'time saved is money saved'. Since then engineers and administrators are making a every possible approach by making every part of construction to contribute into the system in making the construction faster. High Strength concrete is also one of them. The high strength concrete is about 35 years old. The high strength precast products and structural elements in beam were cast in situ using high strength concrete followed by the invention of water reducing admixtures in late 1960s.

But in today's scenario the industry has some very challenging demands for the cement manufacturers, admixture manufacturers. The high strength at early age is very much demanded by the users.

There are many aspects that increase the necessity of early age strength, but as engineers, we need to think about the durability aspects of the structures using these materials.

In this project I am going to add some chemical accelerator for the early age strength of concrete. Therefore I use Calcium Nitrate at various percentage of 0.4%, 0.8%, 1.2%, 1.6%. I have planned to prepare some numbers of cubes and prism and going to test them for its compressive strength and flexural strength at 7,14, 28 days.

The main objective is to determine the optimum content of calcium nitrate for the early age strength of concrete and to analyze the behaviour of calcium nitrate at various percentage for concrete at 7,14 and 28 days.

II. EXPERIMENTAL STUDIES

A. Experimental Procedure:

1) Selection of Mould:

Since we have to check two strength parameters that is compressive strength and flexural strength, so we used two types of moulds.

To measure compressive strength cubical mould of size 150x150x150 mm is used.

To measure flexural strength prism mould of dimensions 700x150x150 mm is used.

2) Casting of Specimen:

To test the variation in compressive strength with the variation of Calcium Nitrate content in design mix, six cubical specimens each are made with Calcium Nitrate contents 0.4%, 0.8%, 1.2%, 1.6%.

To test the variation in flexural strength with the variation of Calcium Nitrate content in design mix, three prism specimens each are made with Calcium Nitrate contents 0.4%, 0.8%, 1.2%, 1.6%.

Then after, I have selected one of the above sample which give the optimum strength and cast the cube and prism.

3) Sampling and Testing:

Sample from fresh concrete shall be taken as per Indian standard code IS-2911 and sample shall be made, cured and tested at specified number of 7, 14 and 28 days.

The strength parameters are based to 28 days strength.

III. RESULTS AND DISCUSSIONS

It was observed that the strength increases at 7days

	Age (days)	**Control concrete**	**Percentage Addition of calcium Nitrate**			
			0.4 %	**0.8 %**	**1.2 %**	**1.6 %**
Average Compressive strength N/mm 2	7	23	25.60	28.80	24.30	23.25
	14	27	27.60	30.80	27.50	27.20
	28	37	37.60	37.90	36.80	36.40

Table 1: The Results of the Compressive Strength Concrete with Calcium Nitrate

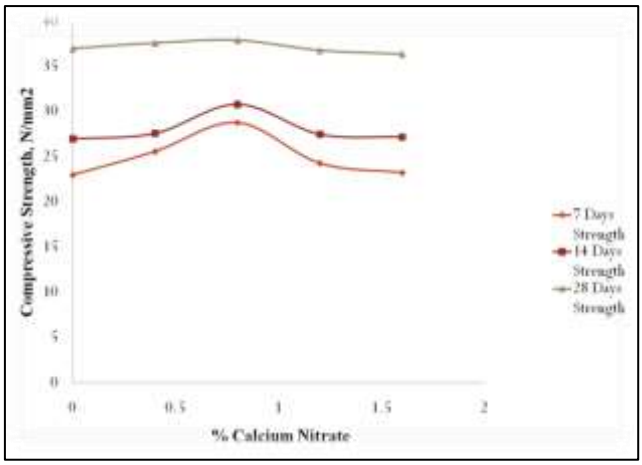

Fig. 1: The Graph Between The Compressive Strength Concrete With Calcium Nitrate

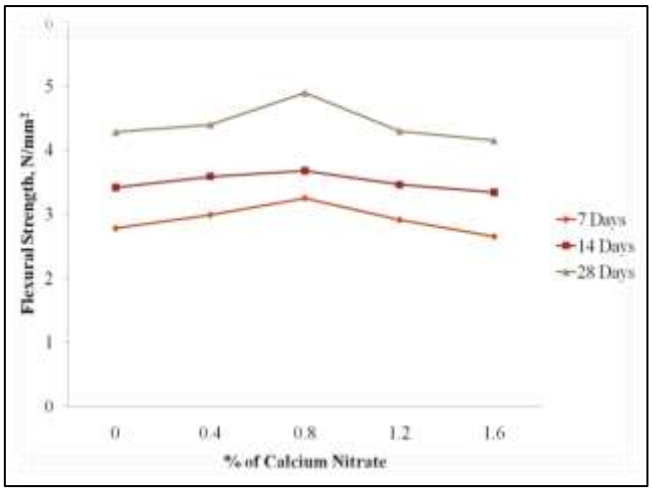

Fig. 2: Graph between flexural strength of rice husk ash

	Age (days)	Control concrete	Percentage Addition of calcium Nitrate			
			0.4%	0.8%	1.2%	1.6%
Average Flexural Strength N/mm²	7	2.78	2.99	3.25	2.91	2.65
	14	3.42	3.59	3.68	3.46	3.34
	28	4.28	4.40	4.90	4.300	4.15

Table 2: Flexural Strength of Concrete using Calcium Nitrate

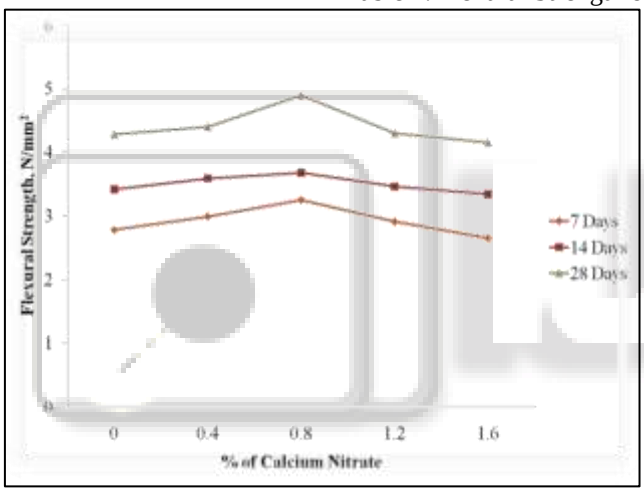

Fig. 2: Graph between flexural strength of rice husk ash

IV. CONCLUSIONS

The following conclusions were made based on the findings of the study:

- Compressive strength of concrete by using 0.8% of Calcium Nitrate gives optimum strength to concrete at 7 days.
- It was observed that the compressive strength of concrete using calcium nitrate is nearly equal to the strength of control cube at 28 days.
- Flexural strength of concrete by using 0.8% of Calcium Nitrate gives optimum strength to concrete at 7 days.
- It was observed that the Flexural strength of concrete using calcium nitrate is nearly equal to the strength of control concrete at 28 days.

REFERENCES

[1] Hussein, A.A.E., Shafiq, N. and Nuruddin, M.F. 2013. A comprehensive experimental study on the performance of fly ash concrete. Int. J. Engg. Adv. Technol. 2(6): 135-142.
[2] Hwang, K.R., Noguchi, T. and Tomosawa, F. 1998. Effects of fine aggregate replacement on the rheology, compressive strength and carbonation properties of fly ash and mortar. ACI Spec. Publ. (178): 401-410.
[3] IS 10262 (1982). Standard code for "Recommended guidelines for concrete mix design".
[4] IS: 1489 (Part 1) 1991. Standard code for "Portland Pozzolana Cement specification part 1 fly ash based".
[5] IS: 4032:1985. Indian Standard code for "Method of chemical analysis of hydraulic cement".
[6] Maslehuddin, M. 1989. Effect of sand replacement on the early-age strength gain and long-term corrosion resisting characteristics of fly ash concrete. ACI Mater. J. 86(1): 58-62.
[7] Mukherjee, S., Mandal, S. and Adhikari, U.B. 2013. Comparative study on physical and mechanical properties of high Slump and zero slump high volume fly ash concrete (HVFAC). Global NEST J. 20(10): 1-7.
[8] Siddique, R. 2003. Effect of fine aggregate replacement with Class F fly ash on the mechanical properties of concrete.

