International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 10 Issue: 08 | Aug 2023 www.irjet.net p-ISSN: 2395-0072

TO STUDY THE EFFECT OF ACCELERATED CURING ON THE STRENGTH OF THE CONCRETE INCORPORATING PARTIAL FLY ASH

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Abstract – *The way concrete is prepared and its quality is always an important factor for the assessment of the strength of the structure. The type of curing used in this study is normal water curing and accelerated curing by boiling water method. The project of civil engineering is highly influenced by the time constraint because it is directly concerned with the economy aspect of the project. The time consumed during the process of curing can be expedited by increasing the temperature of water used for curing and that directly influences the rate of hydration. This paper explain the behavior of M30 grade of concrete which is cured at normal as well as accelerated with the partial replacement of fly ash with the weight of the cement. The mix prepared is as per IS 10262: 2009. The types of sample that were prepared were nominal mix and binary mix that incorporated fly ash with varying percentage i.e.25%, 30% and 35%. After performing various tests over the sample as 3 sample for each variation is prepared and whose average has been tabulated and compared. The result obtained was after the comparison of the concrete prepared using normal and accelerated curing.*

Keywords- *Accelerated Curing, Boiling Water, Rate of Hydration, Mix Design, Binary Mix, Fly Ash*

1. INTRODUCTION

In the present scenario concrete is the most widely used substance for the development of any city on the planet. As we are more depending on the concrete it has become the most commonly used man-made material on earth. It has proved itself as an important construction materials used extensively in building, bridges, roads and dams. Its uses range from structural applications such as high rise building, kerbed, pipes as well as drain. Over the period of time, as technology improvement in every sector so was of the concrete as we have now develop pre stress and post tensioned stress concrete which have different depending upon the load to be carried by them over.

There has been delay in the application as we have to wait for more than 1 year to let concrete attain his 99% of the strength which is not feasible for any project so to tackle such problem this paper represent the effect of accelerated curing over the concrete.

2. MATERIAL

The materials used in this work are broadly classified as base material, filler material, binders and admixtures. Both inert and reactive materials are used for this study. The various materials used in this work are discussed with their properties and with the test results as follows.

2.1 Cement: Ordinary Portland Cement of 53 grade was used in this study which was provided by Ultratech Cements Ltd.

2.2 Aggregates: There are two types of aggregate being used for the experiment: Fine aggregate and course aggregate. The Fine aggregates used in this research are taken from nearby river tributary of Beas having max size of 4.75mm. Coarse aggregates used are of crushed stone from the nearby crusher such that the stone passing through 20mm IS sieve and retained on 4.75mm IS sieve.

2.3 Fly Ash: It was obtained from thermal power station, dried and used. Class F fly ash is designated in ASTM C 618 and originates from anthracite and bituminous coals. It consists mainly of alumina and silica and has a higher loss of ignition (LOI) than Class C fly ash. The class F fly ash was used in this study, the chemical composition of Class F fly ash (ASTM C618) is given in Table

Property	ASTM C618 requiremets
SiO2+Al2O3+Fe2O3	70% (min)
SO3	5% (max)
Moisture content	3% (max)
Loss of ignition	6% (max)

2. Methodology

For the experiment a nominal mix of grade M30 is prepared with the appropriate proportion of the ingredient such as aggregate, cement, water, admixture etc as per the norms. After that, partial replacement of the cement is done with the fly ash varying percentage of 25%, 30%, 35% of weight of cement and mix is prepared. The compressive strength of the sample is checked by performing various test in lab related to them. Cubes of size 150mmX150mmX150mm are casted to check the compressive strength with normal curing. In this experiment, comparison of the compressive strength of the concrete prepared by with normal curing after 3, 7 and 28 days is done with the compressive strength of the concrete prepared by using the method of accelerated curing which has partial replacement of the cement with that of fly ash by weight of cement having varying percentage of 25%, 30%, and 35% whose result are discussed as:

3. TESTING AND RESULTS

The concrete mix was designed for M30 grade and the mix design was done. Mix design for concrete was made considering the properties of constituents of concrete. Different concrete mixes with varying fly ash content percentage were produced, replacing 25%, 30%, and 35% cement in terms of weight. Cubic specimens of 150 mm size were casted for compressive strength test and tamping was done as per Indian standard. The cubes were casted in stainless steel moulds and wet cured at standard temperature until the time of test. The cubes were cured for 3 days, 7 days and 28 days

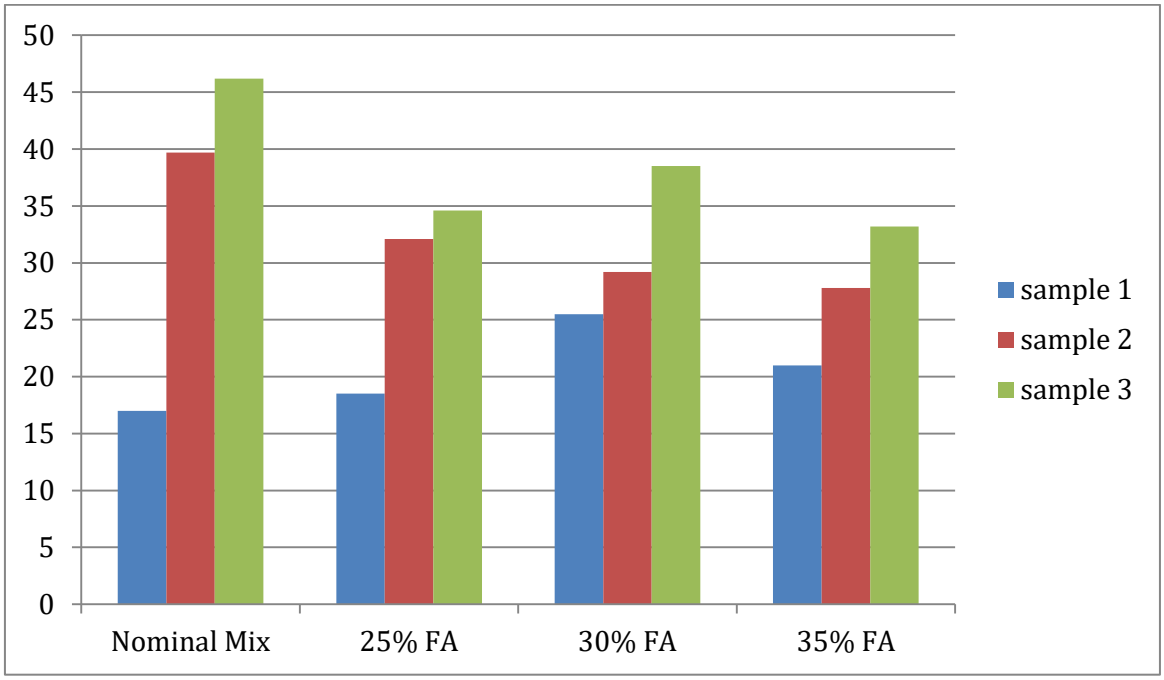
3.1 VARIATION IN STRENGTH AT DIFFERENT REPLACEMENT LEVEL OF FLY ASH

Different concrete mixes with varying fly ash content percentage were produced, replacing 25%, 30%, and 35% cement in terms of weight. Cubic specimens of 150 mm size were casted for compressive strength test and tamping was done as per Indian standard.

3.1.1 NORMAL CURING

The cubes were casted in stainless steel moulds and wet cured at standard temperature until the time of test. The cubes were cured for 3 days, 7 days and 28 days. The result of the following are discussed as:

	Average strength of 3 cube tested		
MIX	Sample 1	Sample 2	Sample 3
Nominal Mix	17	39.7	46.2
25% FA	18.5	32.1	34.6
30% FA	25.5	29.2	38.5
35% FA	21	27.8	33.2



3.1.2 ACCELERATED CURING BY BOILING WATER METHOD (IS 9013:1978)

Accelerated Curing Method is adopted to enhance the rate of gain of strength which depends on the curing of the concrete. Many researchers have discussed their result as there is gain in the strength of concrete which was reached after 28 days in 28 hours of the concrete (As per IS 9013-1978 code which describe the method of making of concrete, curing of concrete and determining compressive strength of accelerated cured concrete test specimens such as cubes, cylinders and beams. Initially Accelerated curing was used in the prefabrication industry wherein high early age strength requirement enables the removal of the formwork within 24 hours thereby reducing the cycle time resulting in cost saving benefits and this could be possible on site as we started using concrete from RMC plants. The method adopted to achieve curing techniques in prefabrication industry is steam curing which is done at atmospheric pressure, warm water curing, boiling water curing and autoclaving.

MIX	Sample 1	Sample 2	Sample 3	Average
Nominal Mix	16.3	20.2	19.0	18.5
25% FA	16.7	23.1	22.0	20.6
30% FA	20.3	20.7	19.2	20.0
35% FA	12.3	14.9	14.6	13.9

Table 2: Results of Accelerated Curing

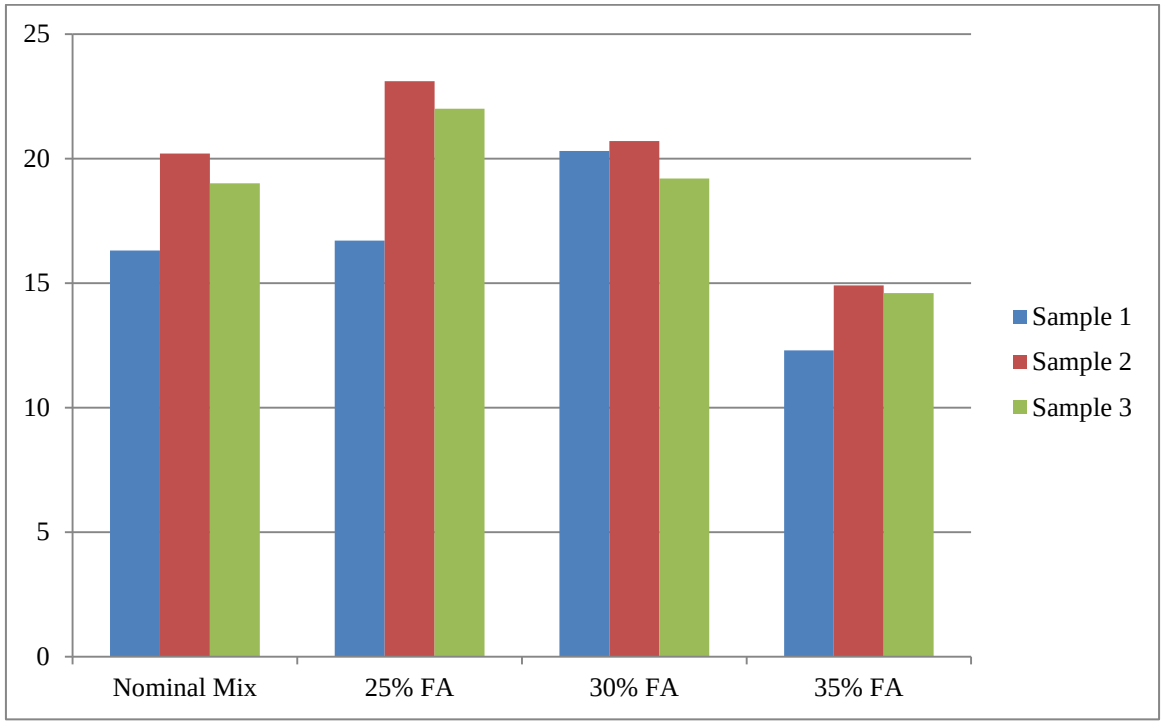


Figure 2 Variation of Accelerated Curing

3. CONCLUSIONS

- The optimum dosage of Fly Ash addition was decided as 30% Fly Ash in Cement for M30 grades of Concrete in normal curing and 25% Fly Ash when cured in ACT.
- The maximum Compressive Strength obtained at optimum Dosage for normal curing is 40.7Mpa and for accelerated curing is 46.0MPa
- It is concluded that nominal mix concrete cubes have shown better results for water curing than accelerated curing samples.
- 28 Days was considered as Optimum Curing period because maximum strengths were obtained at this period for all proportions of mixes.

REFERENCES

1. Yaragal, S., Narayan, K.B., Venkataramana, K., Kulkarni, K., Gowda, H.C., Reddy, G.R. and Sharma, A., 2010. Studies on normal strength concrete cubes subjected to elevated temperatures. *Journal of Structural Fire Engineering*.

2. Jain, Siddharth, And Sp Sharma. "To Study The Strength Characteristics Of Concrete By Replacing Curing Water With Self Curing Compounds."

3. A.S.Thakare, S.P.Pethe, A.A.Sarode and R.S.Shah "Comparison Between Self Cured Concrete and Conventionally Cured Concrete"International Conference on Science and Technology for Sustainable Development (ICSTSD)- 2016

4. Obam, Ogah "Effect of Curing Methods on the Compressive Strength of Concrete"International Journal Of Engineering And computer Science Volume 5 , 7 July 2016,

5. B.Mohan,"Investigation Of Self Compacting Concrete By Using Self Curing Agents"International Journal of Scientific & Engineering Research, Volume 7, Issue 4, April-2016

6. Mr. Ram Lohar, Mr.BhagwatDeokar and Mr.Ambadas Kale " A Study On Internal Curing Of Self Compacting Concrete Using Admixture Peg (400) &Superplasticizers",ICRTERSM, December-2016

7. Mr. ShaileshVetal, Miss. Swapnalikunjir, Mr. Santosh Lande and Miss. Tejaswani Desai," Internal curing of self compacted concrete using polythene glycol" International Journal Of Engineering Research and Technology, Volume 5, March 2016

8. GeetKalra, Pratyksh Vijay and Ebin Joseph "Research Review and Modeling of Concrete Compressive Strength Using Artificial Neural Networks", IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 3 Issue 2, February 2016.

9. Nuruddeen Usman and Muhammad Nura Isa," Curing Methods and Their Effects on The Strength of Concrete" Int. Journal of Engineering Research and Applications, Vol. 5, Issue 7, (Part - 2) July 2015

10. K. Vijai, R. Kumutha and B. G. Vishnuram," Effect of types of curing on strength of geopolymer concrete" International Journal of the Physical Sciences Vol. 5(9), 18 August, 2010

11. Magar, Rajendra B. "Influence of accelerated curing on the compressive strength of concrete incorporating fly ash." (2018).