

# Effects of Varying Molarity in Fly Ash Based Concrete

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**Abstract** – To use waste materials as alternatives in construction industry is an innovative thought. Now a day's many wastes are used in construction industry like in cement production, for manufacturing of concrete and also for manufacturing of bricks. In all types of thermal power plants large amount of fly ash is liberated. Which causes air pollution. So to minimize the quantity of generated waste material we are using it in construction. In this paper fly ash from different sources are taken to prepare the concrete. And in this cement is 100% replaced and for creating the bond in it NaOH and Na<sub>2</sub>SiO<sub>3</sub> solution is used. Which form geopolymerisation process and acts as a replacement of cement in the mix.

In the present work, OPC is totally replaced, But cement is working as a binder in the concrete mix. The main task is now to form another binder in the mix, as there is 0% cement. Hence, NaOH (Sodium hydroxide), Na<sub>2</sub>SiO<sub>3</sub> (Sodium silicate in the form of flakes), super plasticizer (Sulphonated naphthalene polymer based super plasticizer) is used in the distilled water. By using NaOH & Na<sub>2</sub>SiO<sub>3</sub> in distilled mix in the concrete, polymerization process takes place which form gel in the mix and which works as a binder in it, after making concrete specimens of 8M (Molarity) & 12M (Molarity) with the different fly ashes, specimens are treated with ambient (temperature) curing at 7 days and 28 days. And at the age of 7 and 28 days strength is tested (Compressive and Flexural strength)

After the (specimens) test results, it is concluded that NTPC Sipat fly ash based specimen gives more satisfactory results of compressive and flexural strength as compared to GMR Tilda fly ash based specimen. And also at 12 Molarity concentration of NaOH solution compressive and flexural strength increases as compared to 8 Molarity. Hence it is said that while increasing the concentration of NaOH solution in terms of Molarities (8M to 12M), strength of the specimens increases.

**Key Words:** Molarity, fly ash based concrete, Ready Mix Concrete, Ordinary Portland Cement, ambient curing.

## I. INTRODUCTION

In this work total 36 specimens are casted in which concrete is made with different sources of fly ash and with different molarity. In this two molarities are taken one is 8M and another is 12M. Mix is prepared of M25 & M20 grades of concrete. And calculated the slump value and compressive strength of fly ash

based concrete at 8M and 12M at the age of 7 days and 28 days and all the casted specimens are treated in ambient (temperature) curing condition.

### 1.1 Main ingredients of Fly ash based concrete

- Fly Ash- Taken from two sources
- Fine aggregate- Used for proving the stability to the concrete
- Coarse aggregate- Used for providing density to the fresh concrete.

### 1.2 Materials Required

- NaOH- NaOH solution is used in the distilled water
- Na<sub>2</sub>SiO<sub>3</sub>- Na<sub>2</sub>SiO<sub>3</sub> is used in the form of flakes
- Distilled water- Used for the preparation of alkaline activator.
- Fine aggregates
- Coarse aggregates
- Super Plasticizer

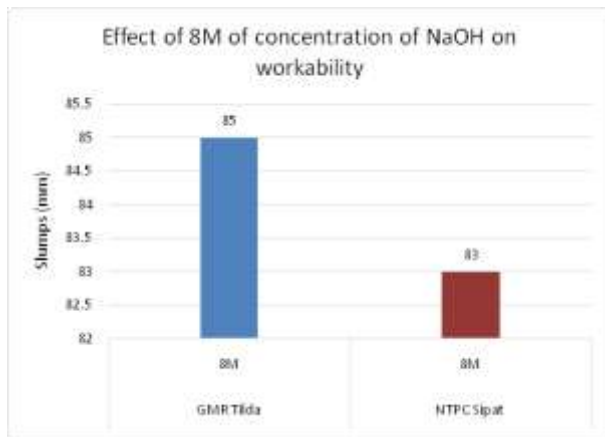
## II. TEST RESULTS

### 2.1 Slump Test

Slump test is done to check whether the concrete is workable or not. So that it should be placed easily in the prepared forms at the working sites otherwise many time due to less workability work hampers, satisfactory result not achieved and also may delays the project also. Here workability is compared at 8Molarity of NaOH and 12M of NaOH

Table 2.1.1: Slump Test Result M25 Grade 8M

Fly Ash	Molarity	Slump (mm)
GMR Tilda	8M	85
NTPC Sipat	8M	83

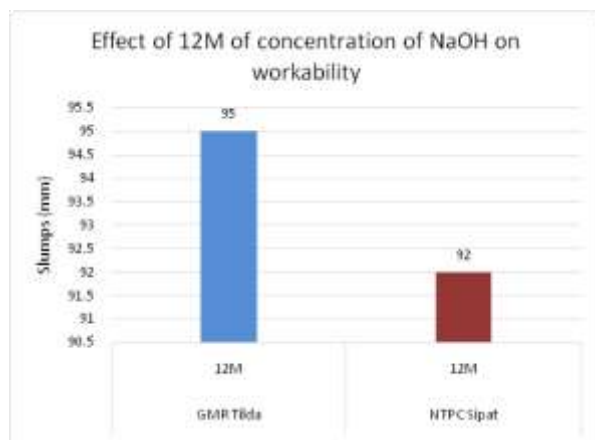


Graph 2.1.1: Effect of 8M NaOH on Workability M25 Grade

Results shows that effect of NaOH concentration. In case of 8M the workability of the GMR Tilda fly ash based concrete gives higher value of slump as compared to the NTPC Sipat fly ash based concrete at M25 grade of concrete.

Table- 2.1.2: slump test M25 grade 12M

Fly Ash	Molarity	Slump (mm)
GMR Tilda	12M	95
NTPC Sipat	12M	92

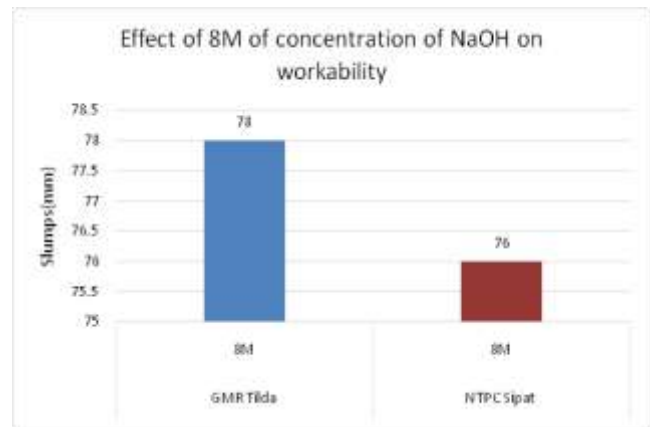


Graph 2.1.2: Effect of 12M of NaOH on Workability M25

Results shows the effects of concentration of NaOH solution, at 12M GMR Tilda based fly ash concrete gives higher workability then NTPC Sipat based fly ash at M25 grade of concrete.

Table- 2.1.3: slump test M20 grade 8M

Fly Ash	Molarity	Slump (mm)
GMR Tilda	8M	78
NTPC Sipat	8M	76

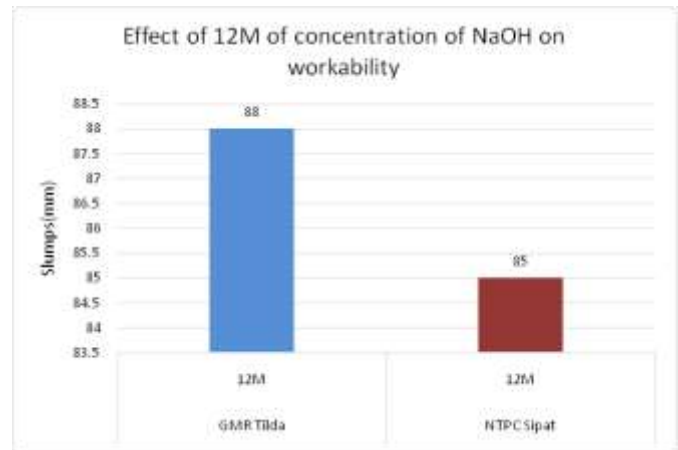


Graph 2.1.3: Effect of 8M NaOH on Workability M20 Grade

Results shows that effect of NaOH concentration. In case of 8M the workability of the GMR Tilda fly ash based concrete gives higher value of slump as compared to the NTPC Sipat fly ash based concrete at M20 grade of concrete.

Table-2.1.4: slump test M20 grade 12M

Fly Ash	Molarity	Slump (mm)
GMR Tilda	12M	88
NTPC Sipat	12M	85



Graph 2.1.4: Effect of 12M of NaOH on Workability M20

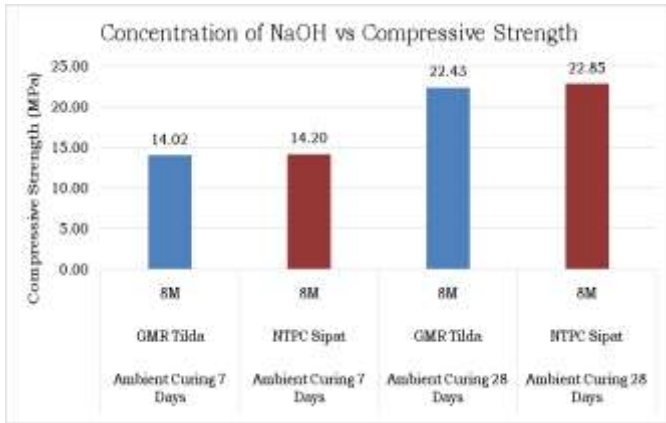
Results shows that effect of NaOH concentration. In case of 8M the workability of the GMR Tilda fly ash based concrete gives higher value of slump as compared to the NTPC Sipat fly ash based concrete at M20 grade of concrete.

### 2.3 Compressive Strength Test

Table 2.3.1: Compressive Strength Test Result M25

S N	Curing type	Days	Fly Ash	Molarity M	Load N	F M Pa
1	Ambient	7	GMR Tilda	8	315400	14.02

2	Ambient	7	NTPC Sipat	8	319450	14.20
3	Ambient	28	GMR Tilda	8	504731	22.43
4	Ambient	28	NTPC Sipat	8	514232	22.85

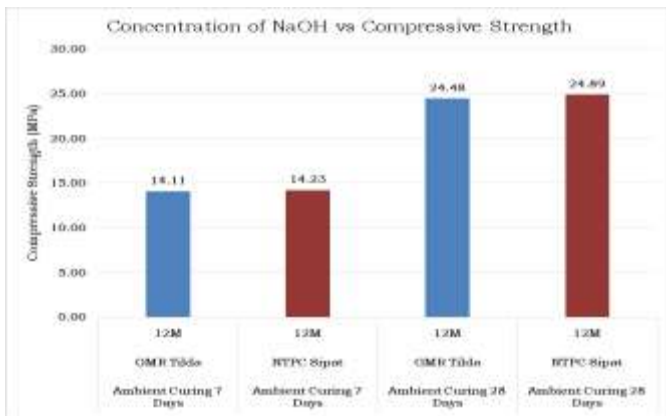


Graph 2.3.1: 8M Concentration of NaOH vs Compressive Strength (M25 Grade)

Results shows that at 8M Concentration NTPC Sipat based fly ash concrete gives greater value as compared to GMR based fly ash concrete. At 28 days and at M25 grade of concrete.

Table 2.3.2: Compressive Strength Test Result M25

S N	Curing type	Days	Fly Ash	Molarity M	Load N	F M Pa
1	Ambient	7	GMR Tilda	12	317390	14.11
2	Ambient	7	NTPC Sipat	12	320100	14.23
3	Ambient	28	GMR Tilda	12	550838	24.48
4	Ambient	28	NTPC Sipat	12	560093	24.89

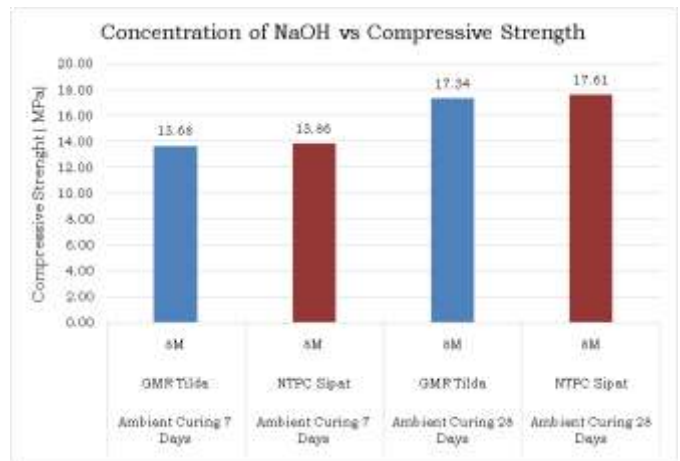


Graph 2.3.2: 12M Concentration of NaOH vs Compressive Strength (M25 Grade)

Results shows that at 12M Concentration NTPC Sipat based fly ash concrete gives greater value as compared to GMR based fly ash concrete. At 28 days and at M25 grade of concrete

Table 2.3.3: Compressive Strength Test Result M20

S N	Curing type	Days	Fly Ash	Molarity M	Load N	F M Pa
1	Ambient	7	GMR Tilda	8	307900	13.68
2	Ambient	7	NTPC Sipat	8	311950	13.86
3	Ambient	28	GMR Tilda	8	390149	17.34
4	Ambient	28	NTPC Sipat	8	396293	17.61

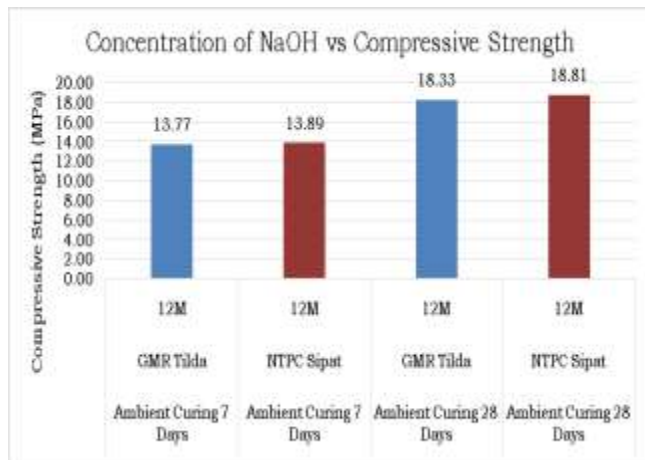


Graph 2.3.3: 8M Concentration of NaOH vs Compressive Strength (M20 Grade)

Results shows that at 8M Concentration NTPC Sipat based fly ash concrete gives greater value as compared to GMR based fly ash concrete. At 28 days and at M20 grade of concrete

Table-2.3.4: Compressive strength M20, 12M

S N	Curing type	Days	Fly Ash	Molarity M	Load N	F M Pa
1	Ambient	7	GMR Tilda	12	309890	13.77
2	Ambient	7	NTPC Sipat	12	312600	13.89
3	Ambient	28	GMR Tilda	12	412347	18.33
4	Ambient	28	NTPC Sipat	12	423234	18.81



Graph 2.3.4: 12M Concentration of NaOH vs Compressive Strength (M20 Grade)

Results shows that at 12M Concentration NTPC Sipat based fly ash concrete gives greater value as compared to GMR based fly ash concrete. At 28 days and at M20 grade of concrete

### III. CONCLUSION

1. Fly ash based concrete obtained from NTPC Sipat thermal power station has less value of workability as compared to the Fly ash based concrete prepared from GMR.
2. Workability of GMR based Fly ash concrete increases while increasing the molarity from 8M to 12M.
3. Overall compressive strength of the NTPC fly ash based concrete is good as compared to the GMR fly ash based concrete
4. Concentration of NaOH increases from 8M to 12M increases the Compressive strength of the NTPC fly ash based concrete
5. Overall flexural strength of the NTPC fly ash based concrete is good as compared to the GMR fly ash based concrete
6. Concentration of NaOH increases from 8M to 12M increases the flexural strength of the NTPC fly ash based concrete
7. It is concluded that in the terms of workability, GMR fly ash based concrete has good value as compared to another one
8. In the terms of compressive strength NTPC based fly ash concrete has good strength at 12M concentration
9. Flexural strength of the NTPC based fly ash concrete has good as compared to GMR based fly ash concrete at 12M concentration
10. NTPC fly ash gives more satisfactory results as compared to GMR based fly ash concrete.

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