

Experimental Study on Development of Normal Strength Concrete and High Strength Concrete Using Alccofine

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Abstract - Using alccofine1203 enhance early strength in concrete. The experimental work is carried out to evaluate mechanical properties such as compressive strength, split tensile strength and flexural strength for normal strength concrete and high strength concrete. Normal concrete and High strength concrete is made by replacing alccofine by weight of cement various percentage 0% ,9%, 10% , 11% ,12% ,13%, 14%.using constant water cement ratio 0.45and 0.30 for M30 and M70 concrete respectively, super plasticizer are used for required degree of workability. Casting specimen is cured in atmospheric temperature and hardened properties for 7, 14 and 28days

Key Words: Normal strength¹, High strength², Metakolin³, and Alccofine⁴.

1. INTRODUCTION

Concrete is the one of the mainly used material throughout the globe in the various field, which basically consists of cement, sand and crushed quarry stones are locally and naturally available, then sand and crushed stone are use as a filler material in concrete and cement is used for bonding and strength parameter of the concrete. Therefore concrete is used extensively, it has many disadvantage for the production of one tone of concrete nearly one tone of CO₂ is to be released which effect the environment. And also the concrete can withstand compressive loads are effected but it failure for tensile loads as well as in flexure. To enhance the tensile and flexural strength of concrete, number of experimental studies and investigations are to be carried out.

1.1 High Strength concrete

The strength of concrete at least 40 MPa is said to be high strength concrete. While concrete is used in different place such as compression member like piles, pillar column, etc. If the high strength concrete is used in the compression member, it will useful to reduce the dimension of the compression member. As consider high strength concrete has several advantages over the conventional concrete, since the strength of concrete increases which will makes the compression member size will be decrease. Then the structure becomes more economical also, the strength of

high strength concrete is prepared by mixing supplementary cementing material those have a Pozzolanic property it fills in between the cement pores in concrete, it reduce the pores and improves the strength of concrete. Generally mineral admixture is finer then cement

1.2 Metakaolin

Metakaolin is superior clay that's discharge (calcined) below suspiciously controlled conditions to make associated nursing amorphous alumino-silicate therefore reactive in concrete. Like alternative pozzolans such as (fly ash and silica fume are both common pozzolans), metakaolin react with the lime hydroxide (lime) by products made throughout the association. Metakalin is a type of mineral admixture it can be used for increasing the strength of concrete.

1.3 Alccofine1203

Alccofine1203 could be an especially prepared product support scoria of additional glass content with more reactivity acquire through the method of restricted required degree of fines. Appropriate to its distinctive chemistry and very fine particle size, Alccofine1203 decreased water requirement for a required workability, then 70% of substitute margin necessity of concrete performance. Alccofine1203 can also used as high range water decrease to enhance compressive strength or as a super workability assist to improve flow. The advantage of Alccofine1203 Increase the strength for higher and middle range grades of concrete with optimal utilization Economy in higher grades of concrete can be provided .Increase durability of concrete. Enhance impermeability and eliminates or minimizes thermal cracks in concrete. Certain quality in terms of even and regular particle size distribution..it enhance the strength of concrete . Therefore using alccofine in concrete should assure advantage compared to the other supplementary cementitious material like fly ash, GGBS, rice husk and metakaolin etc.

2. MATERIALS USED

2.1 cement

Table-2.1: Tests on cement

Sl. No.	Particulars	Requirement as per IS:8112-1989	Test Results found
1	Fineness of the cement	10 maximum	3%
2	Specific gravity	2.99-3.15	3.13
3	Normal consistency	35 maximum	31%
4	Initial setting time	30 minimum	53min.
5	Final setting time	600maximum	362min
6	Cube compressive strength	Not less than	
	3 days	23N/mm ²	24.5N/mm ²
	7days	33 N/mm ²	36.6N/mm ²
	28days	43 N/mm ²	45.81N/m ²
7	Soundness	>10mm	6mm

2.2 Fine Aggregate

Table- 2.2: Physical Properties of Fine Aggregate

Properties	Result
Specific Gravity	2.44
sFineness modulus	3.03
Water absorption	0.9%

2.3 Coarse Aggregate

Table- 2.3: Physical Properties of Coarse Aggregate

Properties	20mm	12.5mm
Specific Gravity	2.70	2.61
Fineness modulus	7.05	7.83
Water absorption	0.3%	0.6%

2.4 Alccofine1203

Table-2.4: Properties of Alccofine1203

Test	Result	
Particle Size Distribution(micron)	d10	1.8
	d50	4.4
	d90	8.9
Chemical Composition (%)	SiO ₂	32.6
	Al ₂ O ₃	22.5
	Fe ₂ O ₃	1.5
	CaO	33.8
	SO ₃	0.17
	MgO	7.5
Specific Gravity		2.85
Bulk Density (Kg / m ³)		660

2.5 Metakaolin

Table- 2.5: Properties of metakaolin

Tests Conducted	Results obtained
Specific gravity	2.40 – 2.60
Physical form	Powder
Color	Off white, Gray to buff
Specific surface	8-15m ² /gm

2.6 Super-plasticizer

Table 2.6: Properties of Conplast-SP430

Appearance	Specific gravity	Alkali content	Air entrainment
Brown Liquid	1.2 at 200°C	>72.0g Na ₂ O equivalent/liters of admixtures.	>2%

3. EXPERIMENTAL WORK

Experimental work consists for making of M30 and M70 grade concrete. M30 concrete designed as per IS:1062-2009 mix ratio obtained as 1:1.42:2.67:0.45 and M70 concrete is designed made as per ACI method with reference to M.L Gambhir mix ratio obtained as 1:0.99:1.24:0.3:1.5.

3.1 Test Specimen and Test Procedure

Cube casting specimens of dimension 150mm X 150mm X 150mm, cylinder casting specimen of diameter 95mm and length 220mm, and prism casting specimens of size 500mm X 100mm X 100mm were casted. The specimens were cured for 7, 14 and 28days.

4. TESTS ON CONCRETE

4.1 Slump Test

Table-4.1: Slump values for M30 concrete

Serial No	Grade of concrete	Percentage of Alccofine1203	Slump in mm
1	M30	00%	58
2		09%	61
3		10%	65
4		11%	68
5		12%	55
6		13%	52
7		14%	50

4.2 .Vee Bee Test

Table-4.2: Vee Bee values for M30 and M70 concrete

Serial No	Percentage of Alccofine	Vee Bee Time in sec	
		M30	M70
1	00%	22	12
2	09%	21	10
3	10%	20	9
4	11%	17	9
5	12%	23	11
6	13%	25	12
7	14%	25	14

4.3 Compressive Strength

Table-4.3.1: Compressive Strength for M30 concrete

Serial. No.	Percentage of Alccofine	Compressive strength for M30 concrete in (N/mm ²)		
		7 days	14days	28days
1	00%	26.88	30.10	35.42
2	09%	34.88	36.94	41.98
3	10%	36.01	40.89	45.44
4	11%	36.75	42.23	46.41
5	12%	31.68	36.88	41.92
6	13%	30.58	32.24	37.49
7	14%	29.30	32.50	36.52

Table-4.3.2: Compressive Strength for M70 concrete

Serial. No.	Percentage of Alccofine	Compressive strength for M70 concrete in (N/mm ²)		
		7 days	14day s	14days
1	00%	53.81	65.78	75.62
2	09%	52.86	63.15	71.04
3	10%	57.26	68.47	76.08
4	11%	48.53	59.77	68.24
5	12%	47.59	57.13	65.79
6	13%	50.04	55.59	62.75
7	14%	50	53.92	58.55



Fig-4.1: Compressive Strength test

4.4 Split Tensile Strength

Table-4.4.1: Split Tensile Strength for M30 concrete

Serial. No.	Percentage of Alccofine1203	Split Tensile strength for M30 concrete in (N/mm ²)		
		7days	14days	28days
1	00%	2.28	3.00	3.40
2	09%	2.23	3.17	3.49
3	10%	3.23	3.31	3.77
4	11%	3.58	3.72	4.14
5	12%	2.41	2.64	2.94
6	13%	2.91	2.88	3.20
7	14%	2.67	2.80	3.19

Table-4.4.2: Split Tensile Strength for M70 concrete

Serial. No	Percentage of Alccofine1203	Split Tensile strength for M70 concrete in (N/mm ²)		
		7days	14days	28days
1	00%	3.20	3.66	4.16
2	09%	3.38	3.57	4.00
3	10%	4.84	5.18	5.57
4	11%	3.75	4.38	4.99
5	12%	3.97	4.63	5.30
6	13%	3.20	3.76	4.32
7	14%	3.19	3.44	3.97



Fig-4.2: Split tensile test

4.5 Flexural Strength

Table-4.5.1: Flexural Strength for M30 concrete

Serial. No	Percentage of Alccofine1203	Flexural strength for M30 concrete in N/mm ²		
		7days	14days	28days
1	00%	4.24	4.31	4.60
2	09%	4.72	4.84	5.50
3	10%	5.00	4.89	5.55
4	11%	5.30	5.44	5.67
5	12%	4.25	4.59	5.34
6	13%	3.45	4.20	5.01
7	14%	3.20	3.82	4.30

Table-4.5.2: Flexural Strength for M70 concrete

Serial. No	Percentage of Alccofine1203	Flexural strength for M70 concrete in N/mm ²		
		7days	14days	28days
1	00%	6.00	6.26	6.89
2	09%	6.20	6.63	7.40
3	10%	7.06	8.82	9.85
4	11%	6.68	8.54	9.15
5	12%	6.00	7.83	8.15
6	13%	5.90	7.25	7.80
7	14%	5.70	6.28	7.66



Fig-4.3: Flexural test

5. RESULT AND DISCUSSIONS

5.1 Fresh properties

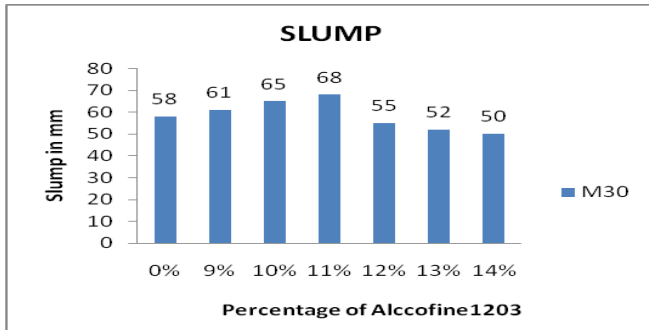


Chart -5.1: Slump test values for M30 Concrete

Slump test is used for identify the workability of fresh concrete .Slump increases, workability of concrete increase. In normal strength concrete maximum slump is obtained at 11% replacement of alccofine by weight of cement.

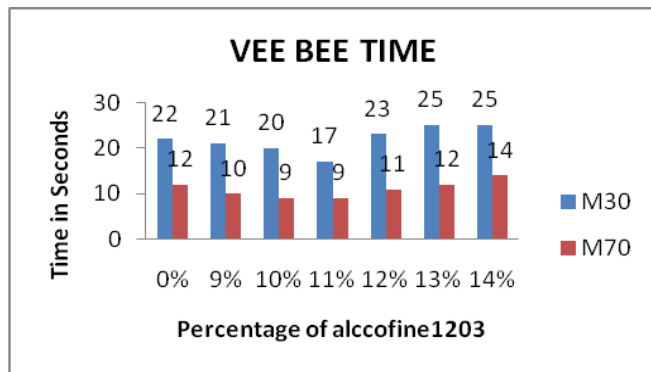


Chart -5.2: Vee bee test values for M30 and M70 Concrete

This is the best test to analyzed workability of fresh concrete in laboratory. In this test workability can measured in terms of time (second), increased time means workability decrease and decreased time means workability is more. Vee Bee time is minimum at 11% in normal strength concrete and 10% in high strength concrete.

5.2 Hardened properties

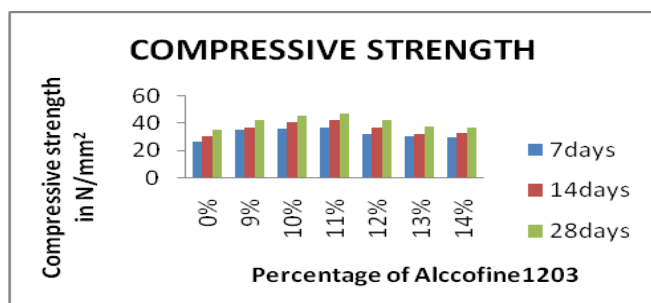


Chart -5.3: Compressive strength values for M30 Concrete

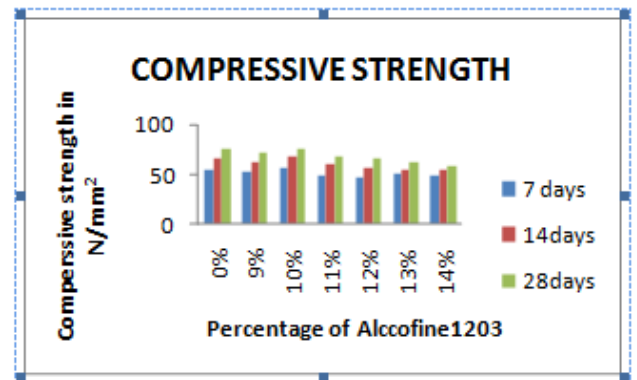


Chart -5.4: Compressive strength values for M70 Concrete

Compressive test is a very significant test to know mechanical property of concrete. This test is conducted for various percentage of Alccofine is replaced to the cement. Optimum percentage of alccofine for normal strength concrete and high strength concrete is 11% and 10% respectively.

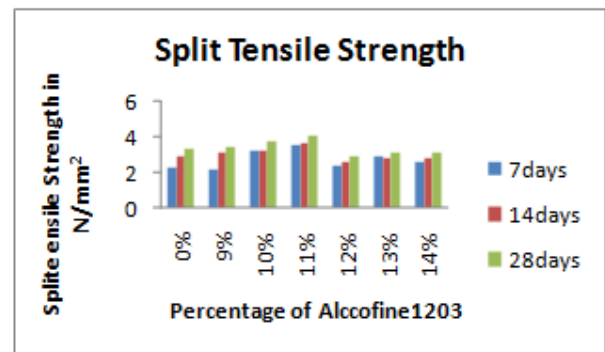


Chart -5.5: Split Tensile Strength values for M30 Concrete

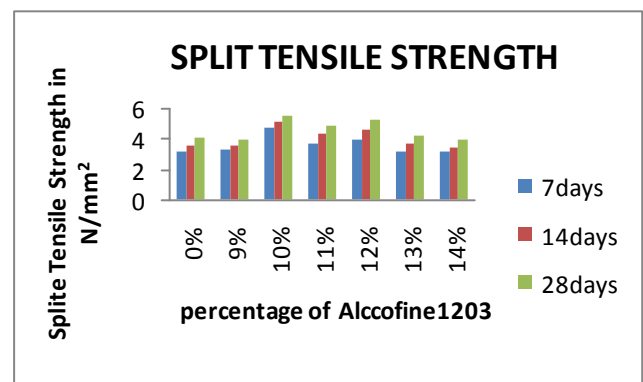


Chart -5.6: Split Tensile Strength values for M30 Concrete

Split tensile strength of concrete criteria is difficult measure directly. That's why, placing cylinder horizontally then applying the compressive load until the cylinder fail. It gives the strength indirectly to cylinder. Optimum strength is obtained at 11% and 10% for normal and high strength concrete respectively.

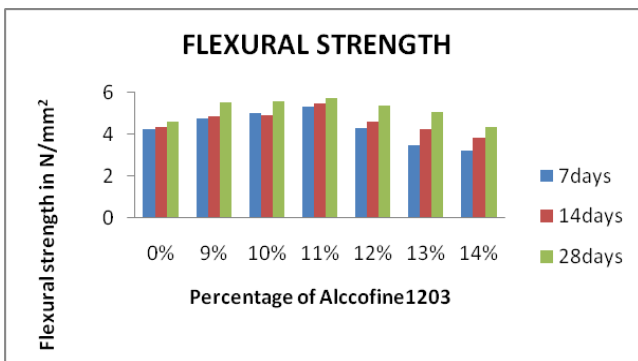


Chart -5.7: Flexural strength values for M30 Concrete

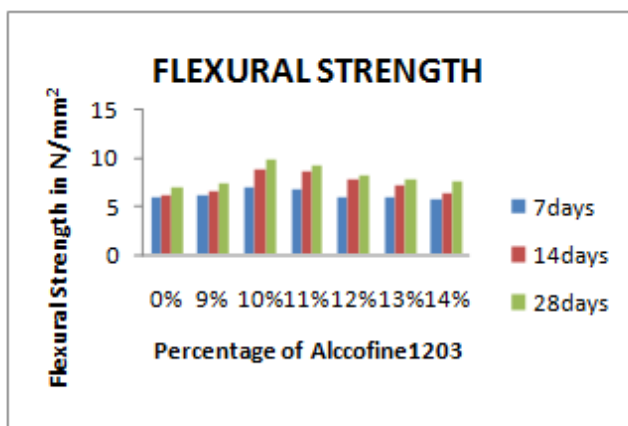


Chart -5.8: Flexural strength values for M70 Concrete

Flexural strength is one of the important criteria for finding the mechanical property of concrete. Flexural strength is maximum at 11% and 10% for normal strength concrete and high strength concrete respectively.

6. CONCLUSIONS

- 1) Experimental work are carried out various percentages of Alccofine replaced to the cement in control mix from 9% - 14% and both the fresh and hardened properties
- 2) for normal strength and high strength compared. Using the alccofine as mineral admixture get early strength in concrete.
- 3) The fresh properties and hardened properties of concrete with alccofine are enhanced compared control mix.
- 4) The hardened properties like Compression strength, split tensile strength and flexural strength of concrete is obtained at 11% and 10% in normal strength concrete and high strength concrete respectively.
- 5) We observed in the above experimental work the alccofine increases the strength of normal strength of the concrete up to 11% for hardened properties then after decreases as increasing the alccofine. But in high strength concrete hardened

properties increases at 10% then decreased for the increased percentage of alccofine.

REFERENCES

- [1] Abhijitsinh Parmar, Dhaval Patel, Dron Chaudhary, "Utilization of Pond Fly Ash as a Partial Replacement in Fine Aggregate with Using Fine Fly Ash and Alccofine in HSC Hards Concrete Properties", ISSN: 2321-9939| January 2009.
- [2] Sanjeev Sharma "Study of ALCCOFINE1203 in High Volume Fly Ash concrete as floor material" 2010.
- [3] Suthar Sunil B, Dr. (Smt.) B. K. Shah, Study on Strength Development of High Strength concrete Containing Alccofine and Fly-Ash Volume : 2 | Issue : 3 | March 2013 ISSN - 2250-1991.
- [4] Jay Patel, Kunal Patel, Gaurav Patel, "Utilization Of Pond Fly Ash As A Partial Replacement In Fine Aggregate With Using Fine Fly Ash And Alccofine In HSC Volume: 02 Issue: 12 | Dec-2013.
- [5] Saurav, Ashok Kumar Gupta, "Experimental study of strength relationship of concrete cube and concrete cylinder using ultrafine slag Alccofine", International Journal of Scientific & Engineering Research, Volume 5, Issue 5, May-2014 ISSN 2229-5518
- [6] Praveen Nayak S, Narashimhan "They compare the properties of concrete made with alccofine, used as supplementary cementing materials" Volume:10 | Issue : 8 | August 2014.
- [7] IS:8112-1989.Specification for 43 grade ordinary Portland cement. Bureau of Indian standards, New Delhi.
- [8] IS: 383-1997. Specification for coarse and fine aggregates from natural sources for concrete. Bureau of Indian standards, New Delhi.
- [9] IS: 1199-1959. Indian standard method of sampling and analysis of concrete.Bureau of Indian standards, New Delhi.
- [10] IS:10262-2009 "Recommended Guidelines For concrete Mix design 1982 Buru of Indian standard.

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