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Experimental Investigation on Properties of Concrete with Partial Replacement of Cement by Alccofine

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A B S T R A C T

The main objective of this study is to evaluate the fresh and concrete properties of concrete with and without replacement of Alccofine as cement. Cast in-situ concrete is the most commonly used material worldwide in the multi-storey buildings. In the modern era, many research works are being carried out throughout the world for finding out a suitable cementitious material for the replacement of cement. In this order fly ash, silica fume, GGBS, Metakaoline, micro materials. Quartz powder, etc. are tried out for replacing partially or fully of cement in concrete. A new ultrafine material called Alccofine is tried out for replacing partially in this project. M20 grade of concrete is prepared by replacing the cement with Alccofine (AF) of various percentages such as conventional (0%), 10%, 20%, 30%. Compressive strength was determined after 7, 14 and 28 days of curing. Splitting tensile strength was found after 28 days of curing.. It is observed that 30% of Alccofine replacement with the cement is Yielding good strength as compared to other replacement levels. Also it is determined that the cementing efficiency of Alccofine is good in earlier ages of concrete.

Keywords: Fresh properties, hardened Properties, Cement replacement and Alccofine.

1. Introduction

Creating quality concrete in the present eliminate does not depend solely on achieving strength property. Improving the durability of the concrete and reduce porosity to sustain a longer life span and producing a greener concrete are becoming one of the most common test conducted on the hardened concrete because it is an easy test to Perform and most of the desirable characteristic properties of concrete are qualitatively related to its compressive strength.

The strength of concrete is the most important characteristic as it has strong relationship with quality. Strength as a parameters is used for controlling a well as evaluating other properties of concrete because of its relationship with durability and dimensional stability

Cementitious materials for concrete are fine mineral powders. When this material is mixed with water, they react chemically to form a strong rigid mass that binds aggregate particles together to make concrete. Alccofine is a new generation. Micro fine material of particle size and is much finer than there hydraulic of materials like cement, fly ash, silica etc. being manufactured in India. Alccofine has unique characteristics to enhance performance of Concrete in fresh and hardened stages due to its optimized particle size distribution.

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2. Literature Review

Ultra fine slag is more advanced form of GGBS in which slag is further ground to less than 20 micron. As a result its specific surface area is increased dramatically to 3000-5000m2/kg (Bet Analysis). Particle shape of ultrafine slag is spherical (Scanning electron microscope) which due to ball bearing effect gives increased workability at much reduced water content. Ultra fine slag is produced in India by a joint venture with Ambuja cement Ltd and Alcon developers with a brand name Alccofine. One of the unique properties of Alccofine is its optimized particle size distribution as it is manufactured with special equipments in a controlled manner. Alccofine are available in market as per different percentages of calcium silicate. Alccofine 1203 has low calcium silicate and Alccofine 1101 has high calcium silicate. Alccofine 1203 is generally used as supplementary cementing material due to its fineness and particle size whereas Alccofine 1101 is used for soil stabilization purposes as a grouting material.

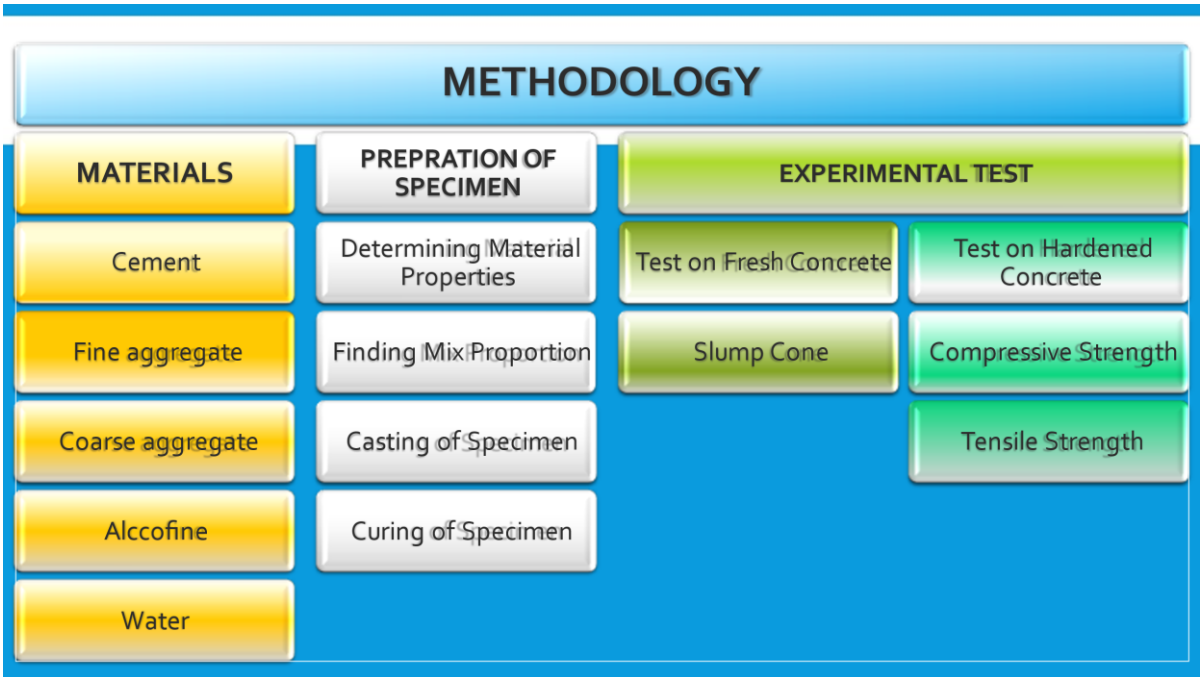
S.P. Upadhyaya and M.A. Jamnu investigated effect on Compressive strength of HighPerformance Concrete (HPC) incorporating Alccofine and Fly Ash and concluded that the addition of Alccofine shows an early strength gaining property and that of Fly ash shows long term strength. The combination of Ordinary Portland cement-fly ash-Alccofine concrete was found to increase the compressive strength of concrete on all ages when compared to concrete made with fly ash and Alccofine alone.

S.B. Suthar and B.K. Parekh studied the strength development of high strength concrete containing alccofine and fly-Ash in which the compressive strength was determined at 56 days of curing. The results indicated that the concrete made with varying proportions generally show excellent fresh and hardened properties since the combination is somewhat synergistic. The addition of Alccofine shows an early strength gaining property and that of fly ash shows long term strength. The ternary system that is ordinary Portland cement-fly ash-alccofine concrete was found to increase the compressive strength of concrete on all age when compared to concrete made with fly ash and Alccofine alone.

A. Pathik et al reported that replacing 10% cement by Alccofine improves workability, workability retention and permits additional strength gains. Alccofine strength gains are at both early and later ages. This makes it a preferred material for use in high performance concrete.

Ansari et al. studied M70 grade of concrete using fly ash and alccofine. The compressive strength of concrete of OPC concrete and with Alccofine and fly ash is compared and it has been found that the strength of concrete got increased by 20% with partial replacement of cement by Alccofine. The author concluded that the compressive strength of concrete increases with increase Alccofine and fly ash content in HPC up to 15 –20%

3.METHODOLOGY



4.MATERIALS PROPERTIES

4.1MATERIALS

The following section discuss constituent materials is used for manufacturing M20 grade of concrete. Physical and Chemcial properties of the constituent materials at presented in this section.

4.2 CEMENT

Ordinary Portland properties 53 grade was used to corresponding IS 12269 (1987). The chemical properties of the cement as obtained by the manufacture are presented in the

Table 3.1 specific gravity of cement was to be found 3.12.

S.NO	PROPERTIES	VALUE	IS SPECIFICATION
1	Specific gravity	3.16	IS 4031
2	Normal Consistecy	32%	IS 4031
3	Intial Setting time	33min	IS 4031
4	Fineness	99.97%	IS 4031

4.3 FINE AGGREGATE

In this study used River sand confirming to zone II fine aggregate. The physical properties of fine aggregate are shown in Table

Table 3.3 Physical properties of fine aggregate

S. NO	PROPERTY	RESULT	IS SPECIFICATIONS
1	Specific Gravity	2.63	IS 383-1970
2	Water absorption	0.5%	IS 383-1970
3	Sieve analysis	Zone II	IS 383-1970

4.4 COARSE AGGREGATE

Crushed granite stones of size 20mm and 10mm are used as coarse aggregate (IS 383:1970). The physical properties if coarse aggregate are shown in Table 3.4

Table 3.4 The physical properties if coarse aggregate

S.NO	PROPERTY	VALUE	IS SPECIFICATIONS
1	Specific gravity	2.63	IS 238-1963
2	water absorption	0.1%	IS 238-1963

4.5 WATER

Generally, water that is suitable for drinking is sufficient for use in concrete. The range ph value of construction water between 6.5 to 8.5 give the durability of structure, by decrease the corrosion of steel.

4.6 ALCCOFINE

Alccofine 1203 is a new product based on slag of high content with low calcium silicate. Alccofine 1203 is an ultrafine cementitious materials reduce water demand up to 30% replacement for a given workability of concrete structures. The particle size of alccofine 1203 is lesser then the cement. Fly ash and silica fume.

5.TEST METHODS

This section describes the test methods that are used for testing fresh and hardened properties of concrete.

5.1 SLUMP TEST

Slump test is the most commonly used method of measuring consistency of concrete which can be employed either in laboratory or at site of work. The Slump Cone apparatus for conducting the slump test essentially consists a metallic mould in the form of a frustum of a cone having the internal dimensions as Bottom diameter: 20cm, Top diameter:10cm, Height:30cm procedure as per IS 1199:19559 Methods of Sampling and Analysis of Concrete

The internal surface of the mould has been thoroughly cleaned and freed for superfluous moisture and any set concrete before commencing the test. The mould was placed on a smooth, horizontal, rigid and non-absorbent surface. The mould. Each layer was tamped with twenty-five strokes of the rounded end of the tamping rod. The stokes distributes in a uniform manner over the cross-section of the mould and for the second and subsequent layers shall penetrate into the underlaying layer.

5.2COMPRESSIVE STRENGTH TEST

Compressive strength test was conducted on the cubical specimens for all the mixes after 7 and 28days of curing. Three cubical specimen of 150mmX150mm were cast and tested for each age and each mix. The

an be calculated by ratio of the maximum load applied to the specimen to the cross-sectional area of the specimen.

5.3 SPLITTING TENSILE STRENGTH TEST

Splitting tensile strength (STS) test was conducted on the specimens for all the mixes after 28days of curing. Three

cylindrical specimens of size 150mmX 300mm were cat and tested for each age and each mix. The load was applied gradually till the failure of the cement occurs. The maximum load applied was then noted. Length and cross-sections of the specimen was measured. The splitting tensile strength (fct) was calculated as followscylindrical specimens of size 150mmX 300mm were cat and tested for each age and each mix. The load was applied gradually till the failure of the cement occurs. The maximum load applied was then noted. Length and cross-sections of the specimen was measured. The splitting tensile strength (fct) was calculated as follows

6. EXPERIMENTAL STUDY

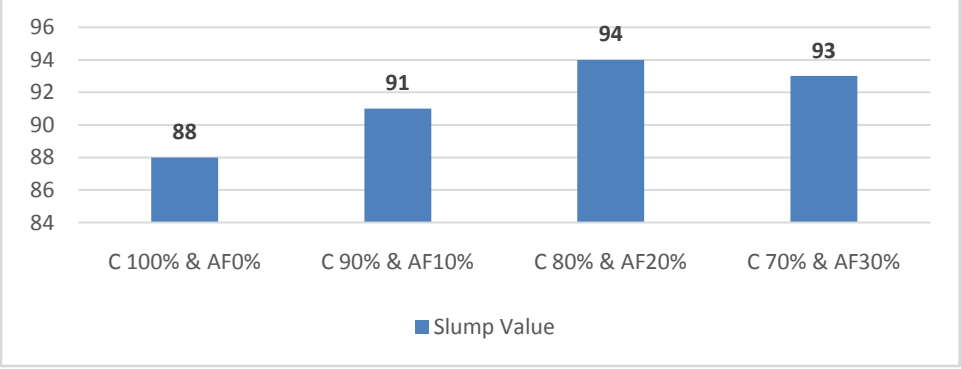
This chapter mainly focused on the effect of mineral admixtures alccofine on the fresh and hardened properties of M20 grade of concrete. In the study, alccofine (AF) was used at various replacement levels (0%, 10%, 20%, 30%).

6.1 RESULTS AND DISCUSSION

SLUMP TEST

This section describes the slump tesgt of concrete mixes. Slump test results of all mixes are tabulated

MIXES	SLUMP (mm)
C 100% & AF0%	88
C 90% & AF10%	91
C 80% & AF20%	94
C 70% & AF30%	93



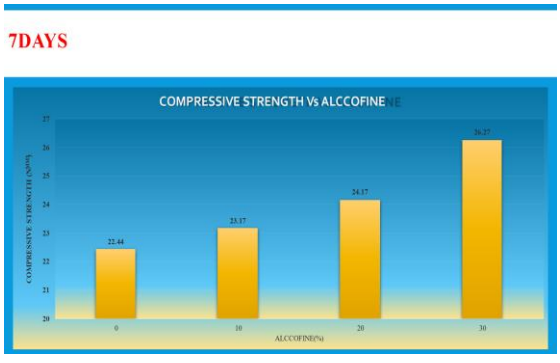
COMPRESSIVE STRENGTH:

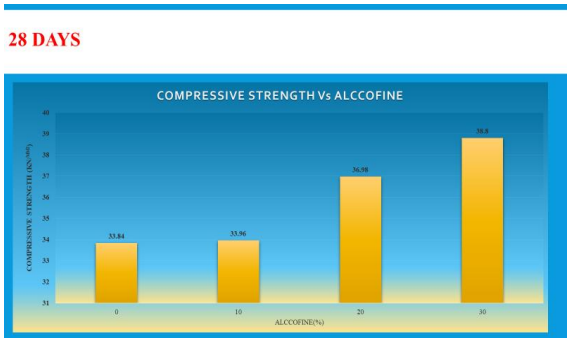
The section describes the compressive strength of concrete mixes after 7 and 28 days of curing. The compressive strength values are tabulated in Table.

Table: compressive strength of concrete

Mixes	Compressive strength (MPa)	
	7days	28days
C100% & AF0%	22.44	33.84
C90% & AF10%	23.17	33.96
C80% & AF20%	24.17	36.89
C70% & AF 30%	26.27	38.80

It is observed that the mix C70% & AF30% has got higher compressive strength values at all ages when compared to other mixes. The increased AF replacement increased the compressive strength. The addition of AF is contributing to the additional strength and partially compensating the strength loss due to reduction of cement percentage

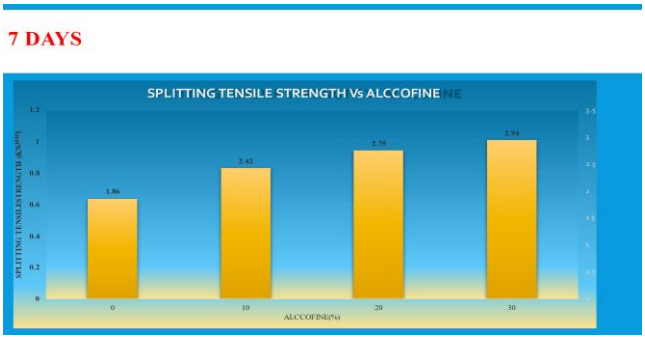




4.3.3 Splitting tensile strength

This section describes the splitting tensile strength of concrete mixes after 28 days of curing. The splitting tensile strength values are tabulated in Table 4.4. Table 4.4 Splittingtensile strength of concrete mixes

Mixes	Splitting tensile strength	
	7days	28days
C100% & AF0%	1.86	3.12
C90% & AF10%	2.42	3.42
C80% & AF20%	2.75	3.52
C70% & AF 30%	2.94	11



5.1. CONCLUSIONS

Based on the test results, the following conclusions are drawn:

1. The increase in percentage of replacement of accofine as cement will increased the workability. Concrete with 30 percentage Alccofine and 70 perfcentage cement gives maximum workability comparing other mixeds.

2. The compressive strength of concrete with partial replacement of Alccofine as cement increases with increase of percentage of Alccofine replacement. Concrete with 30 percentage Alccofine and 70 perfcentage cement gives maximum workability comparing other mixeds.

3. Similarly, The Split tensile strength of concrete with partial replacement of Alccofine as cement increases with increase of percentage of Alccofine replacement. Concrete with 30 percentage Alccofine and 70 perfcentage cement gives maximum workability comparing other mixeds.

4. Alcoffine in concrete It improves the strength and durability properties of concrete. Also Alccofine helps to improves package density of paste.

REFERENCES

- IS 10262. Concrete Mix Proportioning-Guidelines. Bureau of Indian Standards, New Delhi. 2009.
- IS 456. Plain and reinforced concrete code for practice. Bureau of Indian Standards, New Delhi. 2000.
- IS 383. Specification for coarse and fine aggregates from natural sources for concrete. Bureau of Indian Standards, New Delhi. 1970.
- IS 516. Methods of tests for strength of concrete. Bureau of Indian Standards, New Delhi. 1991.
- IS 5816. Splitting tensile strength of concrete method of test. Bureau of Indian Standards, New Delhi. 1999.
- Upadhyay, S.P. and Jamnu, M.A. (2014). "Effect on compressive strength of high performance concrete incorporating alccofine and fly Ash", *International Journal of Innovative Research and Development*, 3(2).
- Suthar, S.B., Shah, B.K. (2013). "Study on Strength Development of High Strength Concrete Containing Alccofine and Fly-Ash", *Indian journal ofresearch*, 2(3).
- Pathik A., Rao., Vyasa.A.N., Pai B V B., Dordi C., (2010). "Micro Technology for High Performance Concrete", *Roving National Seminar On Concrete Sustainability Through Innovation Materials And Techniques*, pp.64-69
- Avuthu Narender Reddy and T. Meena, "An experimental study on effect of Colloidal Nano-Silica on tetranary blended concrete," Vol. 7, No.

2, Advances in Concrete Construction, 2019, pp.107-115.

- Siddharth P Upadhyay, Prof. M.A.Jamnu, "Effect on compressive strength of high performance concrete incorporating Alccofine and fly ash," Volume 2, Issue 2, JIARM, March 2014.
- Balamuralikrishnan R, Saravanan J, "Effect of Alccofine and GGBS Addition on the Durability of Concrete," Vol. 5, No. 6, Civil Engineering Journal, June, 2019.
- K. Gayathri, Dr. K. Ravichandran, Dr. J. Saravanan, "Durability and Cementing Efficiency of Alccofine in Concretes," Vol. 5 Issue 05, IJERT, May-2016.
- 6. Avuthu Narender Reddy, T. Meena, "An Experimental Study to Find the Optimum Dosage of Admixtures in Blended Concrete," Volume-7, Issue-6, IJRTE, March 2019
- P. R. Kalyana Chakravarthy and R. Rathan Raj, "Analysis on compressive strength of concrete with partial replacement of cement with Alccofine," VOL. 12, NO.
- ARPN Journal of Engineering and Applied Sciences, APRIL 2017. 8. Manisha M. Magdum, Dr. V. V. Karjinni, "Influence of Mineral Admixture (Alccofine-1203) On the Properties of Hybrid Fiber Reinforced Concrete," Volume-5, Issue-10, AJER, 2016, pp-72-75.
- A. Sumathi , K. Gowdham , K. Saravana Raja Mohan, "Strength and durability studies on Alccofine concrete with micro steel fibres," Romanian Journal of Materials 2018, 48 (1), pp.58 – 63.
- Dr Deepa A Sinha, Dr A K Verma, "An Experimental Investigation on the Effect of Addition of Ternary Blend on the Mix Design Characteristics of High Strength Concrete using Steel Fibre," IOP Conf. Series: Materials Science and Engineering 225 (2017).
- 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, IJRET, Dec-2013.
- Saurav, Ashok Kumar Gupta, "Experimental study of strength relationship of concrete cube and concrete cylinder using ultrafine slag Alccofine," Volume 5, Issue 5, International Journal of Scientific & Engineering Research, May-2014.
- Fouzia Shaheen, Mohammed SamiuddinFazil, "Effect of metakaolin and Alccofine on strength of concrete," Vol.5, No.4, IRACST – Engineering Science and Technology: An International Journal (ESTIJ), August 2015.