



RESEARCH ARTICLE

National Conference on Innovation in Science, Engineering and Management (NCISEM-2022)
Date of Conference 11-12 March 2022

AN EXPERIMENTAL INVESTIGATION ON UTILIZATION OF ALCCOFINE ON CONCRETE

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Manuscript Info

Key words:-

Alccofine, Cement, Concrete, High Performance Concrete, Supplementary Cementitious Material (SCM), High Strength Concrete, Alccofine 1203, Compression Test, Tensile Test

Abstract

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. Alccofine 1203 is a specially processed product based on high glass content with high reactivity obtained through the process of controlled granulation. Concrete attains high strength at a very early age, due to the presence of alccofine material. M20 grade of concrete is intended to study the Durability and Cementing Efficiency of Alccofine in concretes by replacing the cement with Alccofine of various percentages such as 0%, 6%, 12% to 18%, 24% 30%. In this paper review on effect of recently developed Alccofine for sustainable development of concrete industry is studied.

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Introduction:-

Infrastructure development is a key driver for increasing Indian economy. Due to increase in urbanization rapid growth in different sectors of infrastructure industry is increasing with the increase in involvement of foreign investments in this field. In India construction is the second largest activity with contribute to economy after agriculture therefore it is crucial that infrastructure development should occurs in eco-friendly and sustainable manner.

High-performance concrete is being paid more and more attention. Sustainable and environmentally friendly high-performance concrete is a demand in our new generation. the most important ingredient used in the production of concrete is cement which is one of the primary producers of CO₂ and contributes to greenhouse gas. Climate change and global warming are current and major concerns for humanity. Due to scarcity of natural resources or growing concern over greenhousegases or both, time will come when production of cement will have to be curtailed or cannot be increased to have the ecological balance.

Therefore, it is essential to find solutions for sustainable productionof eco-friendly concrete. Alccofine is one such material that can be used as partial replacement of cement. Alccofine is a new generation, micro fine material whose particle size is much finer than other hydraulic materials like fly ash, cement, silica fume, etc. which is manufactured in India. Alccofine 1203 is a specially processed product based on slag of high glass

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content with high reactivity obtained through the process of controlled granulation.

The addition of Alccofine improve the packing density of paste component. This result in lowering water demand and hence improving strength and durability parameters of concrete at all ages Alccofine 1203 can be ideally used as:

1. Lower the water/binding ratio
2. Use of more cost-effective admixture dosage
3. A combination of above

Literature Review:-

S. Kavitha and T. Felix Kala (2016), The use of alccofine within the SCC as the strength enhancer. The results of their investigation proved that alccofine can be used as a strength enhancer within the SCC.

D. Sharma, S. Sharma and Ajay G (2016) conducted experimental investigation about the strength improvement of concrete using foundry slag as an alternative for conventional fine aggregate and alccofine as substitute for cement. They concluded that reasonably high strength concrete can be achieved by means of substituting fine aggregate with 10% to 45% of foundry slag and replacement of cement with 15% of alccofine.

Manisha M. Magdum, Dr. V. V. Karjinni (2016) has explained the contribution of mineral admixture alccofine to the mechanical properties of hybrid fiber reinforced concrete with strength and workability is investigated. It reduces thermal, shrinkage cracks and increases strength as compared to conventional concrete. The primary objective of this study was to evaluate the action of hybrid fibers at different volume fractions to obtain a good post-peak behaviors of high-strength concrete. It deduces that the compressive strength was found to be increased with an increase in the percentage of mineral admixture alccofine 1203 and noted maximum in case of 10%. And flexural strength was found maximum when we used 1.5% of fiber volume fraction (80% steel fiber and 20% polypropylene fiber) by weight of cement [9-11].

R. Rathan Raj P. R. Kalyan Chakravarthy, [3] (2017), has investigated the main objective of this work. It focuses on the compressive strength of concrete with partial replacement of cement with alccofine. The project focuses on the experimental investigation of concrete by replacing cement with alccofine on varying percentage. 0%, 4%, 8%, 16%, 17%, 20%, 25%, 50%, 75% and 100% for 7 and 28 days. The design mix carried out throughout the experiment was M25. The increase in the percentage of compressive strength for 7 days and 28 days curing was found to be maximum at 16% replacement. P.R. Chakravarthy found that for M25 concrete maximum compressive strength was observed at 16% alccofine for both 7 and 28 days.

V N Shashi Kumar (Assistant Professor) publish 2021, to find a best alternative material for cement. The fresh and hardened properties of concrete with Alccofine as cement was found and the results compared with normal conventional concrete without any replacement.

B. Kavya, K. Rohith, (2017), the mechanical properties of Alccofine have been studied. It is observed from the result that the alccofine material increases the strength.

Alccofine:

Characteristics and Properties-

Alccofine 1203 has got the unique chemical composition mainly of Cao (31-33%) and SiO₂ (33-35%). Physically the product is unique with regard to its particle size distribution.

Table 1:- Chemical and Physical composition.

S. No.	Chemical Analysis	Mass(%)	Physical Analysis	Range
1.	CaO	32-34	Bulk Density	600-700 kg/m ³
2.	Al ₂ O ₃	18-20	Surface Area	12000

				cm ² /gm
3.	Fe ₂ O ₃	1.8-2	ParticleShape	Irregular
4.	3 SO	0.3- 0.7	ParticleSize, d ₁₀	<2μ
5.	MgO	8-10	ParticleSize, d ₅₀	<5 μ
6.	2 SiO	33-35	ParticleSize, d ₅₀	<9 μ

Materials Used:-

Main constituents of the concrete which cement, fine aggregate, coarse aggregate, Alccofine 1203 along with Polypropylene glass fibers have been procured from outside. The materials used in the present program are shown below:

Cement

Ordinary Portland Cement of 53 grade of ultra-tech brand conforming to ISI standards has been procured, and following tests have been carried out according to IS: 8112 – 1989

Table 2:- Physical properties of 53 grade OPC.

Chemical Analysis	Mass %
CaO	33
Al ₂ O ₃	22.1
Fe ₂ O ₃	2.1
SO ₃	0.3
MgO	7.5
SiO ₂	35



Fig 4.1:- OPC-53 grade cement.

Sr.No.	Properties of aggregates	Test results of Fine aggregates
1.	Loose Density	1235kg/m ³
2.	Rounded Density	1325kg/m ³

Water

Sr.No.	Physical Property	Test Results of OPC (53 grade)
1.	Initial Setting time	30 min
2.	Final Setting time	600 min

3.	Fineness	6%
4.	Specific Gravity	2.03
5.	Consistency	33%
6.	Soundness	0.5mm

Table 4:- Tests on Coarse Aggregate (CA).

Potable water has been used in this experimental program for mixing and curing.

Mix Design Of M20 Grade Concrete

In the present investigation M 20 grade of concrete has been considered. The mix of concrete is designed as per the guidelines given in IS 456:2000 and IS 10262-2007,

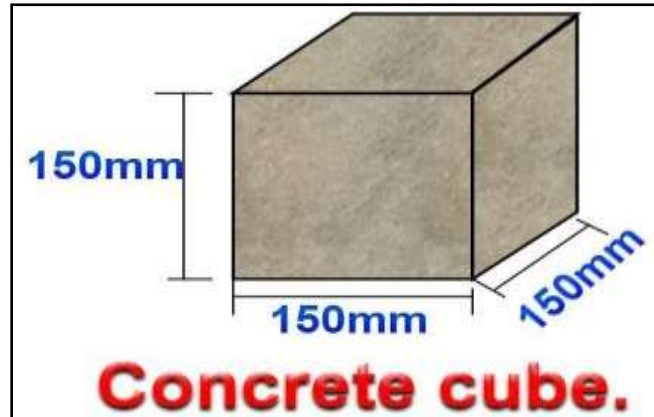


Fig 4.2:- Alccofine 1203 Bag.

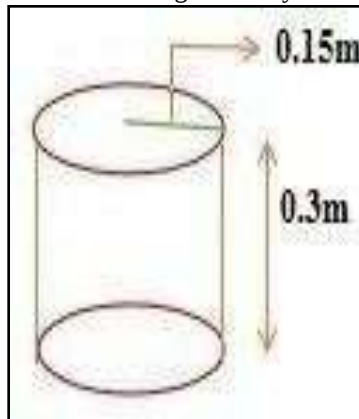
Alccofine 1203

As can be seen in the chemical composition and physical characteristics listed below, ALCCOFINE 1203 has got the unique chemical composition mainly of CaO 30-34% and SiO₂ 30-36%. Physically the product is unique with regards to its particle size distribution as shown.

Fine Aggregate

The locally available natural river sand conforming to grading zone-II IS 383-19100 has been used as Fine aggregate. Following tests have been carried out as per the procedure given in IS 383(1970)



Fig3:- Schematic Diagram of Cylinder Setup.

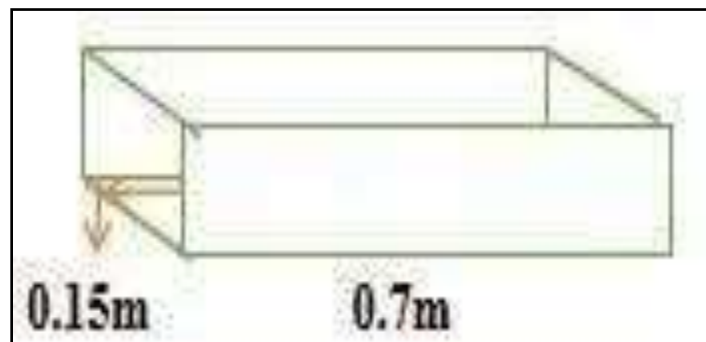
subsequently mixes were prepared with a partial replacement of cement by Alccofine- 1203 of 0%, 6%, 12% & 18%. 24% 30% by weight of cement for Cubes, Cylinders and beams

Table 3:- Tests on Fine Aggregate (FA).

Sr.No	Properties of aggregates	Test results of Fine aggregates
1.	Bulk Density	0
2.	Fineness Modulus	2.4-3
3.	Specific Gravity	2.2-9

Coarse Aggregate

Machine crushed granite conforming to IS 383-19100[23] consisting 20mm maximum size of aggregates has been obtained from the local quarry. It has been tested for physical and mechanical properties such as specific gravity, sieve analysis and the results have been shown in the Table 4.

**Fig 4:-** Schematic diagram of Beam setup.

Preparation Of Test

Concrete cubes specimens of 150 mm x 150 mm x 150mm size, Concrete cylinder specimens of 150mm x 300mm and concrete beam specimens of 150 mm x 150 mm x 700 mm size were casted to evaluate the variation in compressive strength, split tensile strength and flexural strength respectively.

After casting, the concrete specimens were kept in the moulds for 24 hours. The specimens were then demoulded and moist cured in a curing tank till the age of 28 days

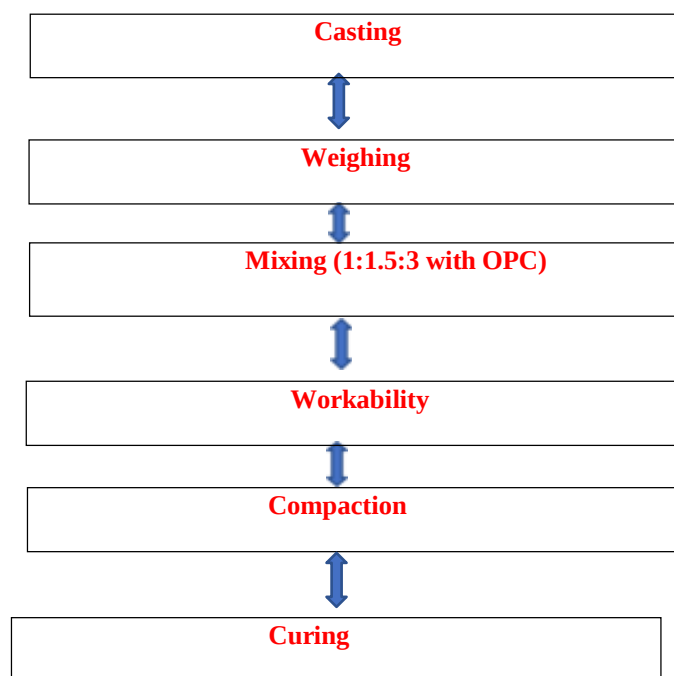


Fig No 5:- Preparation of Concrete Test.

Conclusion:-

On the basis of the literature review, we concluded that a partial replacement of cement with alccofine results in good workability, strength properties, and durability. The compressive and tensile strength of the concrete gets increased when the cement is partially replaced with alccofine and gradually decreases by increasing in the percentage of alccofine. The fresh and hardened properties of concrete with Alccofine as cement was found and the results compared with normal conventional concrete without any replacement. Alccofine showed good results and strength than compared with fly ash in long-term Strength Properties. The maximum strength was attained by partially replacing cement by 10% alccofine and 30% glass powder and check strength.

References:-

1. Davinder Sharma, Sanjay Sharma, Ajay Goyal, "Utilization of Waste Foundry Slag and Alccofine for Developing High Strength Concrete," Vol. 11, Int. J. Electro chem. Sci., 2016.
2. 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.
3. K. Gayathri, Dr. K. Ravichandran, Dr. J. Saravanan, "Durability and Cementing Efficiency of Alccofine in Concretes," Vol. 5 Issue 05, IJERT, May-2016.
4. R. Rathan Raj, "Analysis on compressive strength of concrete with partial replacement of cement with Alccofine," VOL. 12, NO. 8, ARPN Journal of Engineering and Applied Sciences, APRIL 2017.
5. 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
6. 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.
7. 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.
8. M. Vijaya Sekhar Reddy, K. Ashalatha and K. Surendra, "Studies on eco-friendly concrete by partial replacement of cement with Alccofine and fine Fly ash", ARPN Journal of Engineering and Applied Sciences, Vol.11, Issue 5, 2016, Page no. 3445-3448.
9. **M S Shetty**, Concrete Technology, 5th ed., S. Chand & Co. Ltd, 2002.
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