



RESEARCH ARTICLE

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AN EXPERIMENTAL INVESTIGATION ON CONCRETE BY USING ALCCOFINE

Ms. Rutuja Baraskar¹, Mr. Abhishek Thakare¹, Ms. Tanushree Zade¹ and Prof. Ms. R. K. Kakpure²

1. UG Student, Department of Civil Engineering, Bapurao Deshmukh college of Engineering, Sewagram, India.
2. Assistant Professor, Department of Civil Engineering, Bapurao Deshmukh college of Engineering, Sewagram, India.

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Abstract

We know that Supplementary cementitious material (SCM) is becoming popular in the construction industry as these materials are bringing technical revolution in the field of civil engineering. Alccofine is a modern and new generation micro fine concrete material for mostly used in for high strength concrete which is important in respect of workability as well as strength. The purpose and aim of this project are to highlight the importance of Alccofine as Supplementary cementitious materials in construction industries. For the reason that demands in the construction industry, the necessity of high-performance concrete is also increased. Alccofine 1203 a mineral admixture in concrete when it is added in cement concrete for the hardened state the workability and strength of concrete is increase. Partial replacement with ordinary Portland cement which varies from 0%, 6%, and 12% to 18%, 24% 30% For M20 mix cement partially replaced with Alccofine 1203. All mix of concrete was examined for slump test of fresh concrete, tensile test and by compressive strength for 7days and 28 days. Total number of specimens for cubes which were casted for testing to study the influence of alccofine1203 on concrete and cement.

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Introduction:-

As we know that in construction industry, concrete is regarded as one of the good and best construction materials in the present scenario which ultimately make Portland cement currently the most widely used material in the construction industry. For manufacturing of 1 ton of Cement approximately 1 Ton of CO₂ is released as per the environmental base reports which are not good and harmful from environmental point of view. Due to which number of studies have been done to find suitable cement replacements or alternatives.

Alccofine is one of 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

Corresponding Author:- Ms. Rutuja Baraskar

Address:- UG Student, Department of Civil Engineering, Bapurao Deshmukh college of Engineering, Sewagram, India.

Owing to its unique chemistry and ultra-fine particle size, Alccofine 1203 provides reduced water demand for a given workability as per requirement of concrete performance. Alccofine 1203 and Alccofine 1101 are two types of Alccofine with low calcium silicate and high calciumsilicate respectively.

Alccofine1203 is slag based supplementary cementitious material having ultra-fineness with optimized particle size distribution. It also helps in reduction in segregation and reduction in heat of hydration of the mix. Alccofine 1203 used to improve compressive strength or as asuper workability to improve flow.

Alccofine1203 is known to produce a high – strengthconcrete and is used in two different ways as a cementpartially replacement, to reduce the cement content and as anadditive to improve concrete properties.

Alccofine can also be utilized as a good water redundant to improve the strength parameters and other properties of concrete. Therefore, utilization of Alccofine provides better results to mechanical properties of concrete. Alccofine1203 is a specially processed product based on the slag of high glass content with high reactivity obtainedthrough the process of controlled granulation. It is latent hydraulic property and pozzolanic reactivity which results inenhanced hydration process. The addition of Alccofineimprove the packing density of paste component. This resultin lowering water demand and hence improving strength anddurability parameters of concrete at all ages Alccofine 1203can 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:-

B. Kavya, K. Rohith, s Published 2017, in that paper the mechanical properties of Alccofine have been considered. Alccofine 1203 is a specially processed product based on high glass content with high durability obtained through the activity of controlled granulation. Concrete attains high strength at a very early age, due to the existence of alccofinematerial. The mechanical properties studied here arecompressive strength on concrete cubes at 7 & 28 days of curing and split tensile. It is note from the result that the alccofine material increases the strength to a large extent at 15% replacement level of cement.

P. R. Kalyan Chakravarthy, R. Rathan Raj (2017), in that paper the main goal of this work focuses on the compressive strength of concrete with partial replacement of cement with Alccofine. The project focuses on the experimental investigation on concrete by replacing cement with Alccofine on partially replaced with percentage. 0%, 4%, 8%, 16%, 17%, 20%, 25%, 50%, 75% and 100% for 7 and 28 days.

V N Shashi Kumar (Assistant Professor) (2021) had been published this paper, so many examine and researchers are focusing to find the best alternative material for cement. In Concrete cement acts as a binding material because it has both cohesive and adhesive properties. In this work, we replaced Alccofine as cement in the range from 10 percent to 40 Percentage. The fresh and hardened properties of concretewith Alccofine as cement was found and the results compared with normal conventional concrete without any replacement.

D.Sharma, S.Sharma and Ajay. G (2016), has been studiedexperimental investigation about the increased strength improvement of concrete using foundry slag as an alternative for conventional fine aggregate and alccofine as a substitute for cement. They concluded that reasonably high strength concrete can be achieved by means of substituting fineaggregate with10% to 45% of foundry slag and replacementof cement with 15% of alccofine.

M. V. Sekhar Reddy, k. A. Latha and k. Surendra (2016)had done experimental work on partial replacement of cement with fly ash and alccofine for M40 Grade concrete.

The fly ash and alccofine are partially replaced different percentage as example at 5%, 10%, 15%, 20% with cement. The conclusion summarizes that the addition of alccofine indicates an early strength gaining capacity and is eco-friendly to nature. Alccofine showed good results and strength than compared with fly ash in long-term Strength Properties.

M. Y. Patel, Darji, and Purohit (2015) had conducted an experimental investigation on the overall performance of the compression test on the concrete mix at 28 and 56 days. They concluded that concrete with a combination of

alccofine and glass powder gives higher compressive strength. The maximum strength was attained by partially replacing cement by 10% alccofine and 30% glass powder and check strength.

Materials Used:-

Cement

Locally available 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 IS: 8112 – 1989

Properties	Content	Values per IS 12269:1987
Grade	53	53
Fineness of cement	6 %	<10%
Normal consistency	33 %	30% - 35%
Initial setting Time	165 min	>30
Final Setting Time	275 min	<600
Soundness	0.5 mm	<10mm

Table 1:- Physical Properties of Cement.

Chemicals	Content %	Chemicals	Content %
Sio2	21.3	Ca0	63.1
Al2O3	4.5	Na2O	0.1
Fe2O3	4.0	K2O	1.2
MgO	2.4	SO3	2.2

Table 2:- Chemical Composition of Cement.

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).

Property	Values obtained
Specific Gravity	2.68
Fineness Modulus	2.7
Grade Zone	2
Water Absorption	0.20

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

Coarse Aggregate

Machine crushed granite confirming to IS 383-19100[23]

Table 5:- Physical Properties of Alccofine.

SR. No.	Test	Result	Requirements As per IS 16715– 2018
1	Particle size, μm ♣ D10 ♣ D50 ♣ D90 ♣ D95	1.6 4.5 9.2 10.8	- 5 Max - 15 Max
2	Slag Activity Index, % ♣ 7 days ♣ 28 days	UTUT	85 Min 100Min

Water

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

Sr. No	Properties of fine aggregate	Test Results of Fine aggregates
1.	Loose Density	1235kg/m ³
2.	Roaded Density	1325kg/m ³

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

Alccofine

Alccofine is a specially processed product based on slag of high glass content with high reactivity obtained through the process of controlled granulation. Alccofine can also be utilized as a high range water reducer to improve compressive strength or as a super workability aid to improve flow.

Mix Design

Mix design is defined as process of selecting suitable ingredients of concrete and determining their relative proportions with the object of producing concrete of certain minimum strength and durability as economic as possible.

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, 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.

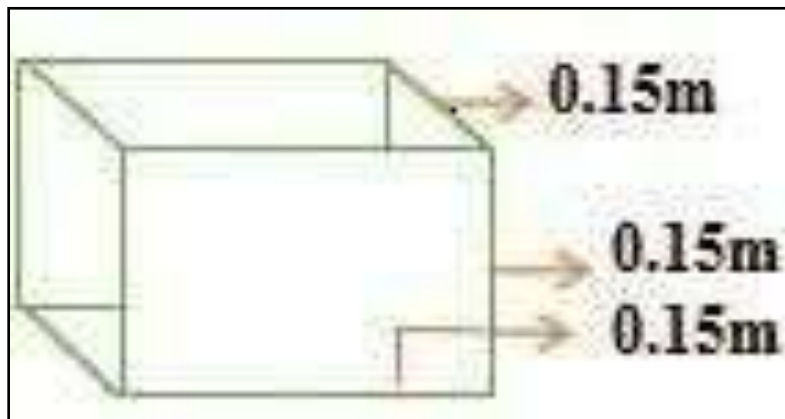


Fig 1:- Schematic diagram of Cube setup.

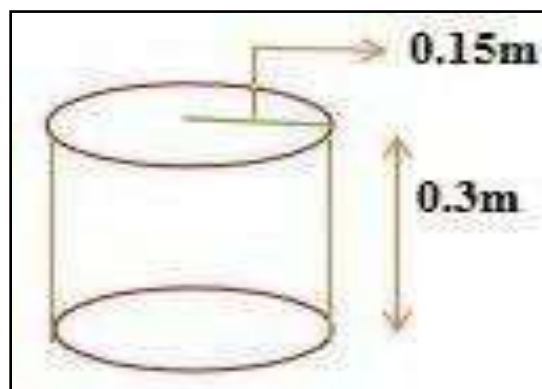


Fig 2:- Schematic Diagram of Cylinder Setup.

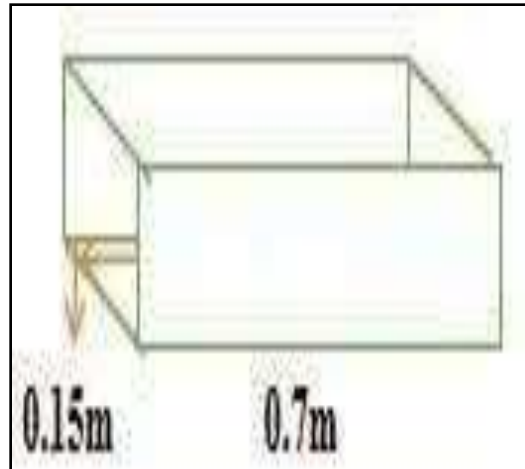


Fig 3:- Schematic diagram of Beam setup.

Preparation of Test

Concrete cubes specimens of 150 mm x 150 mm x 150 mm 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 demolded and moist cured in a curing tank till the age of 28 days.

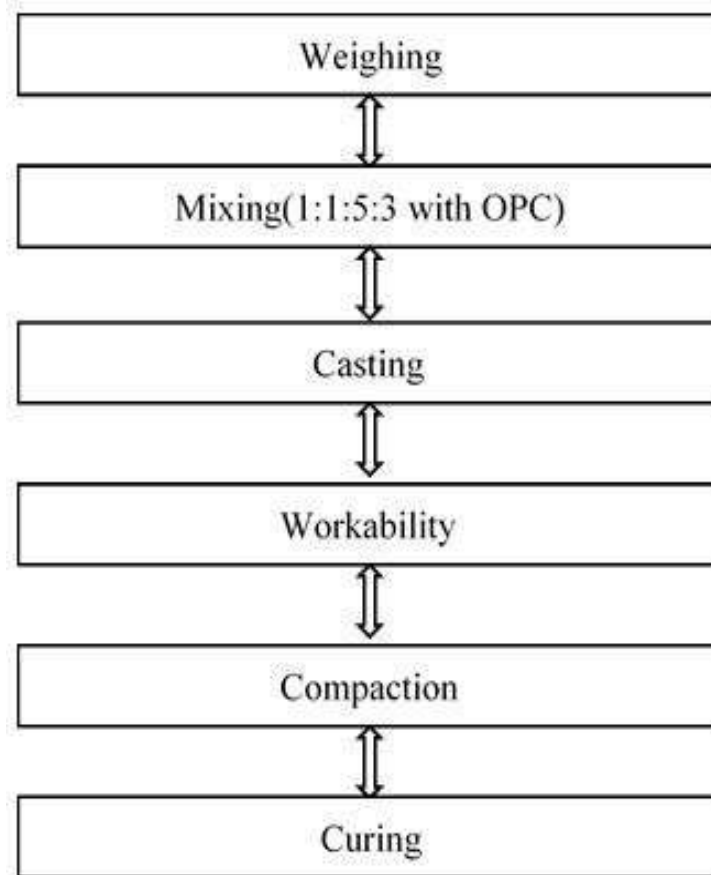


Fig 4:- Preparation of concrete test.

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.

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- [2] **P. R. Kalyana Chakravarthy and R. Rathan Raj** Department of Civil Engineering, VELS Tamil Nadu, India
- [3] **V N Shashi Kumar Assistant Professor**, Department of Civil Engineering, Yoga Nanda Institute of Technology and Science, Tirupati, Andhra Pradesh.
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- [7] **B. Kaviya, 2K. Rohith**, 3 Soniya Kindo, 4 Manoj Kumar J, 5 Divya P Assistant Professor 1 Student 2- 5 Department of Civil Engineering, BIST, BIHER, Bharath University,
- [8] **A Review Nista Lama Ghising¹, Vijay Kumar²** 1 ME Student Department of Civil Engineering, Chandigarh University, Mohali, Punjab, India. 2 Assistant Professor Department of Civil Engineering, Chandigarh University, Mohali, Punjab, India
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