



EXPERIMENTAL STUDY ON ALCCOFINE-1203 CONCRETE AS A PARTIAL REPLACEMENT OF CEMENT IN HIGH STRENGTH CONCRETE

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Abstract: Concrete made up of cement, aggregates, water & additives is the world's most consumed material since it is found to be more versatile ,durable and reliable. Concrete is the second most consumed material after water which required large quantities of Portland cement . The production of Ordinary Portland Cement causes havoc to the environment due to the emission of CO₂ as well mining also results in unrecoverable loss to nature . Cement which we use in the concrete is the most energy intensive material. This Cement production leads to high carbon dioxide emission.1 Ton of CO₂ is produced for every 1 Ton of cement. Hence , it is the need of hour to find the alternative material to this existing most expensive Cement-Concrete. Geopolymer concrete is an innovative construction material which shall be produced by the chemical action of inorganic molecules.In the construction field, supplementary cementitious materials (SCMs) have brought about a technological revolution in the manufacturing of concrete as a partial replacement or addition to conventional binder mass. The alccofine-1203 has ultra-fine particles with a unique chemical composition that improves the hydration process and pozzolanic reaction. Therefore, its incorporation in concrete has resulted in good workability, reduction in segregation, reduction in heat of hydration, and reduction in permeability to concrete, and increased the rate of hydration process and improved the pozzolanic reaction to achieve high strength to concrete at the early curing stage. The presence of calcium (CaO) and silica (SiO₂) in alccofine-1203 improved the mechanical and durability properties of concrete better than the other SCMs. From the literature review, the optimum dosage of alccofine-1203 is obtained between 8% to 12%, and at these percentages, the improvement in mechanical and durability properties of the concrete is highest.

INTRODUCTION

Considering the high consumption of concrete and the increasing necessity for cement production, high attention to the environmental degradation effects of this substance is needed . These effects include 7% of CO₂ emission and the considerable consumption of energy such as electricity and fossil fuels. Hence the provision of alternative products in order to move towards sustainable development is essential. Therefore, the use of an eco-friendly concrete enables the reduction of consumption of ordinary Portland cement (OPC) with activated pozzolanic binders as a replacement, leading to lower emission of CO₂ in the atmosphere .



MATERIALS

1. Ordinary Portland Cement (OPC) :

OPC is a special blended cement useful in general construction work and is especially suitable for applications in environmental conditions. 53 grade cement is used and it is used as a binding material.



2. Coarse aggregate :

The size of the aggregate is more than 4.75mm is called as a coarse aggregate. For this project, we are using 10mm size aggregate. It is used as a concrete material to increase the strength.



3. Fine Aggregate:

The size of the aggregate is less than 4.75mm is called as a fine aggregate. For this project we are using 4.75mm size aggregate. It is used as a concrete material to increase the strength.



4. Potable water:

Water is the key ingredient, which is mixed with cement, forms a paste that binds the aggregate together. The water causes hardening of concrete through a process called hydration.



5. ALCCOFINE-1203:

- ALCCOFINE 1203 is a new generation ,ultrafine product whose raw material is slag of high glass content with high reactivity obtained through the process of controlled granulation.
- The raw materials are composed primarily of low calcium silicates.
- ALCCOFINE 1203 performs in superior manner than all other mineral admixtures in used in concrete.
- Due to its unique chemistry and ultra fine particle size ,ALCCOFINE 1203 provides reduced water demand for a given workability.
- It has similar properties as pozzolanic



TESTS ON MATERIALS USED:

1. Impact test on concrete:

Aggregate Impact Value test determines the aggregate Impact Value (AIV) of aggregates which provides a relative measure of the resistance of an aggregate to sudden shock or impact. Resistance of the aggregates to impact is termed as toughness. Impact Value should not be less than 45% for aggregates used for concrete other than wearing surface and 30% for concrete used in wearing surface.



2. Crushing test on aggregates:

The aggregate crushing value provides a relative measure of resistance to crushing under a gradually applied compressive load. To achieve a high quality of pavement, aggregate possessing low aggregate crushing value should be preferred. The aggregate crushing value for cement concrete pavement shall not exceed 30%. The aggregate crushing value for wearing surfaces shall not exceed 45%.

3. Fineness test on cement:

The fineness of cement has an important bearing on the rate of hydration and hence on the rate of gain of strength and also on the rate of evolution of heat. Finer cement offers a greater surface area for hydration and hence faster the development of strength. According to the IS recommendations, the standard value of fineness of cement should have a fineness that is less than 10%, or the fineness of cement should not be higher than 10%.

4. Specific Gravity:

Specific gravity separates bad particles which are lighter than other particles, from good aggregates. Using specific gravity in cement mix design, we calculate the solid volume of aggregates in concrete mix. Gavel, water and cement are used for this test. The specific gravity of coarse aggregate of 10mm is 2.7.

5. Elongation index test:

If elongated particles are used for pavement base course construction, they may break down easily under heavy loads which will cause damage to the pavement. So, it is necessary to know the elongation index of given aggregate mix. For pavements either bituminous or Non-bituminous, Elongation index of coarse aggregate should not be more than 15%.

6. Flakiness index test:

A flakiness index test is conducted to determine the shape of the aggregates. The presence of flaky or flattened coarse aggregates is undesirable in cement concrete, in making bituminous roads, & in the construction of pavements. The flakiness index is defined as the percentage (by mass) of stones in an aggregate having an Average Least Dimension(ALD) of less than 0.6 times their average dimension.

WATER ABSORPTION TEST RESULTS:

FINAL REPORT FOR 7 DAYS



S.no	% of alccofine	Size in mm	Area in mm ²	Failure load in Kn	Compressive strength
1	0%	150*150*150	22500	360	16
2	10%	150*150*150	22500	470	20.8
3	20%	150*150*150	22500	490	21.7
4	30%	150*150*150	22500	450	20

WATER ABSORPTION TEST FOR 7 DA

% OF ALCCOFINE	DRY WEIGHT(W1) IN Kg	WET WEIGHT(W2) IN Kg	ABSORPTION OF WATER =W2-W1/W1X100(%)
0%	14.050	15.168	7.23
10%	14.010	14.870	6.15
20%	14.000	14.740	5.33
30%	13.780	14.280	3.83

Final report for 14 days

4	30%	150*150*150	22500	450	20
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S.no	% of alccofine	Size in mm	Area in mm ²	Failure load in Kn	Compressive strength
1	0%	150*150*150	22500	360	16
2	10%	150*150*150	22500	470	20.8
3	20%	150*150*150	22500	490	21.7



WATER ABSORPTION TEST FOR 14 DAYS

% OF ALCCOFINE	DRY WEIGHT(W1) IN Kg	WET WEIGHT(W2) IN Kg	ABSORPTION OF WATER =W2-W1/W1X100(%)
0%	14.050	15.300	8.8
10%	14.010	14.950	7.9
20%	14.000	14.880	6.2
30%	13.780	14.300	3.83

FINAL REPORT ON 28 DAYS

S.no	% of alccofine	Size in mm	Area in mm ²	Failure load in Kn	
1	0%	150*150*150	22500	510	22.6
2	10%	150*150*150	22500	640	28.5
3	20%	150*150*150	22500	730	32.4
4	30%	150*150*150	22500	693	30.8

WATER ABSORPTION TEST ON 28 DAYS

% OF ALCCOFINE	DRY WEIGHT(W1) IN Kg	WET WEIGHT(W2) IN Kg	ABSORPTION OF WATER =W2-W1/W1X100(%)
0%	14.050	15.400	9.6
10%	14.010	15.090	7.7
20%	14.000	14.900	6.4
30%	13.780	14.450	4.8

ADVANTAGES

- Improves durability parameters of concrete by refined pore structures, reduces permeability.
- Enhances the resistance of concrete to aggressive environmental agents .
- Maintain the pH of the concrete mix to protect steel reinforcement .
- Improves pump ability of concrete
- The enhanced slump of concrete and extended slump retention without increasing the dosage of the chemical admixture
- Quicker removal of shuttering, quick rotation of forms in the precast industry
- Improve the rate of strength obtained in concrete mixes with high pozzolanic material contents like fly ash, GGBS, etc.



CONCLUSION

In this study, the effect of local Alccofine as supplementary cementing materials and filling materials on the strength and durability of concretes was investigated.

- The compressive strength of the concrete get increased when the cement is partially replaced with alccofine up to 20% and gradually decreases by increasing the percentage of alccofine.
- Optimum level of replacement of cement by alccofine is found to be 20%.
- Highest compressive strength is achieved at 20% replacement of alccofine.

REFERENCES

1. Li, H., Zhang, M., & Zhao, J.

(2019). Experimental study on the mechanical properties of high-strength concrete with industrial waste residue as partial replacement of cement.

Construction and Building

Materials, 225, 215-222.

2. Wang, S., Li, T., & Li, X. (2020).

Study on the performance of high-strength concrete with fly ash and slag as partial replacement of cement. Journal of Cleaner Production, 256, 120398.