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# A Comprehensive Study on the Behaviour of Concrete with Partial Replacement of Cement by Alccofine 1203 – A Review

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**Abstract** – In this paper, the effect of alccofine 1203 which is used as a partial replacement for cement is being studied. The main objective of this paper is to study the strength and durability properties of the alccofine concrete. With the increase in the demand of high performance concrete in the construction industry there is need for supplementary cementitious admixtures with mineral and chemical admixtures that can be used to improve the performance of concrete. One such supplementary cementitious material is alccofine 1203.The use of Alccofine 1203 for making high strength concrete makes it more economical and also environmental friendly due to the reduction of cement content in the concrete .It is also studied that the optimum percentage of alccofine replacement with cement is 20% after which it acts as a filler material and increases the workability of the concrete.

**Keywords:** Alccofine 1203; strength; durability; alccofine concrete; partial replacement.

## Introduction

As we know that in construction industry, concrete is regarded as one of the best construction material 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 reports which are not good from environmental point of view. Due to which many studies has been done to find suitable cement replacememts or alternatives. The studies suggested the usage of Fly-Ash, Slag, Rice Husk and Metakaolin as Pozzolanic Materials to partially replace the cement. 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 flyash, cement, silica fume, etc which is manufactured in India. It is a specially processed product based on slag of high glass content with high reactivity through the process of controlled granulation. In alccofine due to the presence of inbuilt CaO content, alccofine triggers both the primary and the pozzolonic reactions resulting in the formation of C-S-H gel which results in the formation of dense pore structure hence, ultimately causes strength gain. The computed blain value based on PSD is around 12000 cm2/gm and is truly fine. It can be used as practical substitute for Silica Fume as per the results obtained by Counto Micro fine products Pvt. Ltd. Owing to its unique chemistry and ultra fine particle size, alccofine 1203 provides reduced water demand for a given workability, even up to 70% replacement level as per requirement of concrete performance. Alccofine 1203 can also be utilized as a high range water reducer to improve compressive strength or as a super workability aid to improve flow.

Alccofine is of two types, alccofine 1100 series and alccofine1200 series. Alccofine 1100 series is used for soil stabilization and grouting purpose while alccofine 1200 series is used as a supplementary cement additive to enhance the properties of both fresh and hardended concrete. In this paper, alccofine 1203 which is of alccofine 1200 series is being studies.

## Literature review

Reddy & Naqash(2019) reported that Water absorption values were less with alccofine in the combination of non-chloride accelerator compared to reference concrete due to micro particle size of alccofine which made the concrete more denser more compacted and also improved the pore structure of the concrete which helped to improve strength as well as reduces the water absorption percentage.

Balamuralikrishnan & Saravanan(2019) reported that the bond strength increases for increase in percentage of Alccofine replacement. The embedded bar is pulled out through UTM, the rod slips are measured, the slip is decreasing with the increase in load as well as in increasing the percentage replacement of Alccofine.

Jangra et al. (2018) reported that the analysis of SEM helped to verify the increased compactness of the structure of the alccofine based GPC through the dense rmatrix and fewer micro cracks, holes, firm achieved higher strength. Also the mechanical and micro-structural properties of fly ash based GPC incorporating alccofine found to be improved.

Chakravarthy & Rathan (2017) reported that on replacing cement with Alccofine on varying percentage of 0%, 4%, 8%, 16%, 17%, 20%, 25%, 50%, 75% and 100% for M25 grade concrete, the maximum compressive strength was achieved at 16% for both 7 days and 28 days. CaO present in alccofine when combines with water under mix, provides high resistance against chemical and acid attacks.

Singh(2017) reported that with the increase in the percentage of Alccofine and Foundry Slag the compressive strength, split tensile strength, flexural strength and the UPV of the concrete mix also increases. Also for the compressive strength, maximum percentage increased for the variation of 0, 3, 6, 9 and 12 % of Alccofine and 0, 5, 10 and 15 % of Foundry slag for 7, 28, 90 days is 26.63, 26.92 and 21.30 % respectively . This increase in the strength is due to the packing effect of alccofine because it has a optimum size particle distribution that helps to fill the gap between the particles of cement and SCM.

Ansari et al. (2015) reported that on partial replacement of cement with alccofine and fly ash for M70 grade concrete, there was an increase of 20% in the compressive strength as compared to normal concrete .It was also found that the relative cost of alccofine is lesser than cement for high strength concrete and also delivers higher strength as compared to normal concrete.

## Conclusions

From the above review report the following conclusions can be drawn –

1. The use of alccofine in the concrete results in early strength gain.
2. The use of alccofine 1203 as partial replacement of cement increases its compressive strength at all ages due to achieving denser concrete.
3. In partial replacement of cement with alccofine ,there is increase in strength with increase in percentage of alccofine ,but after the optimum percentage (20%) the strength gain is stopped but its acts as a filler material and increase workability.
4. The use of alccofine also increases its durability .Resistance to chemical attack /corrosion is improved as ingression becomes difficult.
5. It also improves its flowability and reduces segregation in concrete.

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