ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Characteristic Study on Concrete by Partially Replacing Cement with Metakaolin and Alccofine and by Adding Conplastsp 430, Compost NC & Sodium Lignosulphonate as Admixtures

Velamarthi Bala Kumar
Department of Civil Engineering, Aurora's Engineering College, Bhongir, Hyderabad, T.S-508116, India.

Mr.Deepak Patil
Department of Civil Engineering, Aurora's Engineering College, Bhongir, Hyderabad, T.S-508116, India.

A.Karthik
Department of Civil Engineering, Aurora's Engineering College, Bhongir, Hyderabad, T.S-508116, India.

ABSTRACT

Now-a-day's enormous development occurred in the field of concrete technology. Many researchers have carried out several studies to investigate the possible utilization of broad range of supplementary cementitious materials as partial replacement of Portland cement. The use of supplementary cementitious materials in the production of concrete can result in major saving of cost and energy. It also helps to improve the strength and durability properties of concrete. The present investigation is carried out to study the effect of metakaolin, Alccofine AND Lignosulphate as partial replacement of cement on compressive strength and flexural strength of concrete. The replacement levels of metakaolinare Selected as 5% and 7.5% and the replacement levels of Alccofine are selected as 5%, 10% and 15% by weight of cement. For Lignosulphate also the same Proportions are being replaced. From the research it is expected that the compressive Strength, split tensile strength and flexural strength would increase with increase in Replacement percentage levels of metakaolin, Alccofine and Lignosulphate.Now days it has become essential to use admixtures and plasticizers in construction in order to enhance the strength, durability and performance of the concrete. With the suitable replacement percentage of these admixtures and plasticizers one can achieve a suitable concrete with desired properties and characteristics. Hence in this research mainly the focus is kept on the changes in characteristics of normal concrete when Alccofine, metakaolin and Lignosulphate are used in 5% and 10% replacing with cement.

GENERAL

Introduction

Concrete is the premier construction material around the world and most widely used in all types of civil engineering works and it is a man-made product,essentiallyconsistingofcement,aggregates,waterandadmixtures.Concreteinspiteofbeingthemostpopularandmosteconomicalconstructionmaterialhasmajorshortcomingsintermsofembeddedenergyandisalsooneofthemajorcausesofgreenhousegaseffect.However,theproductionofPortlandcement,anessentialconstituentofconcrete,leadstotherelease of significant amount of CO_2, a green house gas. One ton of Portland cement clinker production creates one ton of CO_2 and other green house gases (GHGs).So as to reduce the emission of CO_2 concerning the production of cement, we must reduce the use, and therefore the demand of Portland cement. Therefore, there is a need to look for alternate types of materials The CO_2 emissions associated with the manufacturing of Portland cement can be reduced significantly by reducingtheproductionofcurrentclinker.TheresultinglossinPortlandcementproductioncanbeovercomebytheincreaseduseofsupplementarycementing materials.

LERATURE SURVEY AND REVIEW

Till the date there are so many researches are being carried out and various conclusions are being made with the use of Alccofine, metakaolin and Lignosulphonate.

Cite this article as: Velamarthi Bala Kumar, Mr.Deepak Patil & A.Karthik, "Characteristic Study on Concrete by Partially Replacing Cement with Metakaolin and Alccofine and by Adding Conplastsp 430, Compost NC & Sodium Lignosulphonate as Admixtures", International Journal & Magazine of Engineering, Technology, Management and Research, Volume 6 Issue 5, 2019, Page 54-58.

ISSN No: 2348-4845
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Following are the few literature reviews carried out in order follow the reference for this project.

1) EFFECT OF METAKAOLIN AND ALCCOFINE ON STRENGTH OF CONCRETE

By FouziaShaheen, Mohammed SamiuddinFazil

In this journal it is emphasized that now-a-days enormous development occurred in thefield of concrete technology. Many researchers have carried outseveral studies to investigate the possible utilization of broadrange of supplementary cementitious materials as partialreplacement of Portland cement. The use of supplementarycementitious materials in the production of concrete can result inmajor saving of cost and energy. It also helps to improve thestrength and durability properties of concrete. The presentinvestigation is carried out to study the effect of metakaolinandAlccofine as partial replacement of cement on compressivestrength and flexural strength of concrete. The replacement levelsofmetakaolin are selected as 5% and 7.5% and the replacementlevels of Alccofine are selected as 5%, 10% and 15% by weight ofcement. From the results, it is observed that the compressivestrength and flexural strength were increased with increase inreplacement levels of metakaolin and Alccofine.

MATERIALS ANDTEST PROCEDURES

3.1MATERIALSUSED

Thematerialsused in this investigation are:

1. OrdinaryPortland Cement (53 Grade-BIRLA SUPER)
2. Fineaggregate(sand)
3. Coarseaggregate
4. Water
5. Super-plasticizer

a) (ConplastSP-430)

b)Conplast-NC

6. Sodium Lignosulphonate

The detailed description about the materials used is given below.

3.1.1ORDINARYPORTLAND CEMENT

OrdinaryPortlandCement(OPC)isavailableindifferentgrades;themostcommongrades inIndiaareGrade,Grade43andGrade33.OPC53gradecementconfirmingtoIS12269987hasbeenusedintheexperimentalstudies.OPC53gradecementisknownoritsrichqualityandishighlydurable.Standardtestisconductedtodeterminewhetherthecementisofrequiredstrength.InthisexperimentOPC53gradeofbrandnameBirlaSuperhasbeenused,cementwasfreshwithoutanylumps.Thephysicalandchemicalpropertiesofcementweredeterminedbymanufacturerconductingtestsinthelaboratory.

Graph showing grain size distribution of sand

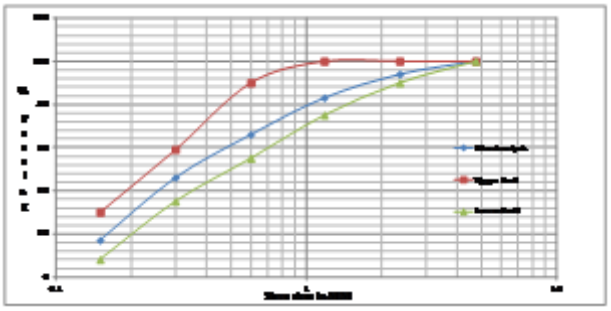

Table 3.3.1: ClassificationofSlumpvalues

Classificationofconcrete	SlumpValue
Stiff	0
Poorlymobile	10-30 mm
Mobile	40-150 mm
Cast mix	>150 mm

3.3.2Mechanical strength characteristics:

Compressivestrengthisthecapacityofamaterialtowithstandaxiallydirectedpushingforces.Whenthelimitofcompressivestrengthisreached,materialsarecrushed.Thecompressivestrengthofconcreteisthemostcommonperformancemeasureusedbyeengineerindesigningbuildingsandotherstructures.Thecompressivestrengthismeasuredbybreakingcubicalconcreteormortarspecimensinacompressiontestingmachineandthestrengthisrecorded.Thecompressivestrengthofhardenedconcretewhichisgenerallyconsideredtobeanindexofitsotherproperties,dependsuponmanyfactorslikequalityandquantityofcement,waterandaggregates;batchingandmixing; placing,compactionandcuring.

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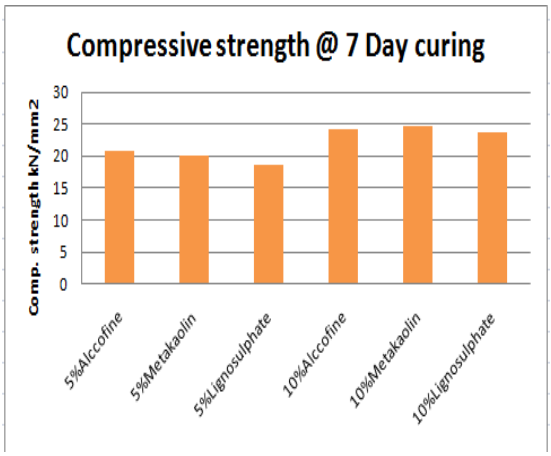

Fig Compressive strength for 5% & 10% after 7Days of curing

Compressive Strength Test

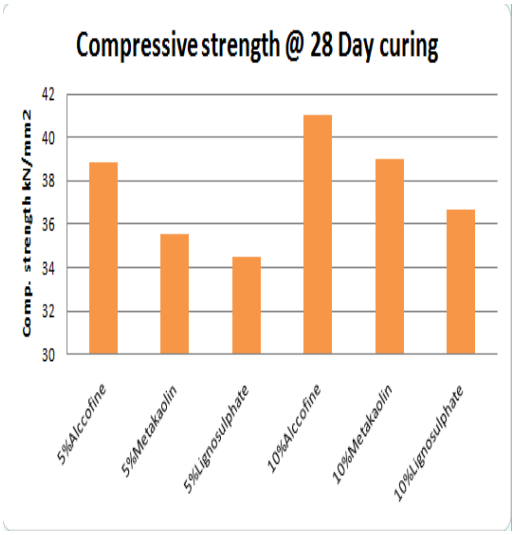

Fig Compressive strength for 5% & 10% after 28Days of curing

Tested Specimen

Screen Shots

Casting of Moulds

Split Tensile Strength Test

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Tested Specimen

CONCLUSIONS AND FUTURE SCOPE OF WORK

With reference to the detailed research carried out above many facts and results are found out. Following are the conclusions made by me from the research

- With the help of naturally occurring admixtures it feasible to utilize such in concrete in order to modify its properties.
- Naturally occurring admixtures are cost efficient compared to artificial admixtures.
- Utilization of Alccofine, metakaolin and Lignosulphonate not only reduces the demand of cement but it also reduces environmental impact that is caused from the manufacturing of cement.
- Alccofine, metakaolin and Lignosulphate adds themselves as an important factor in order to enhance the physical properties of nominal concrete.
- During the strength analysis of the concrete it is observed that with addition of 5% of Alccofine there is nearly 10% of increase in compressive strength. By the addition of 5% of metakaolin there is 12% increase in the strength. And in case of Lignosulphate the increase percentage has found upto 8%.
- Maximum compressive strength was observed in case of 10% Alccofine after 28 days of curing ie 41kN/mm^2.
- In case of split tensile strength the maximum strength was observed for 10% Lignosulphate after 28 days of curing. Nearly 35% of strength was increased after 28 days of curing.
- Maximum flexural strength was observed as 4.7kN/mm^2 in case of 10% replacement of Lignosulphate after 28 days of curing.
- Due to the finer content of Alccofine, metakaolin and Lignosulphate in each case the concrete has became dense. Hence it can be more advantageous where dense concretes are required.
- As SCM are highly water absorptive in nature its essential to use super plasticizers to compensate the additional water requirement.
- With overall review of the research it can also be concluded that with 5 to 10% addition of Alccofine, Metakaolin or Lignosulphate overall 20% of mechanical properties can be enhanced.
- Research also enlightens on the cementitious behaviour of these admixtures as we have seen that the strength has sufficiently increased due to the pozzolanic reactions taken place.
- With the promising results obtained from the research one can predict that these materials can also be used in higher grade concretes like M50 and more.
- As the concretes were dense so it promotes the use of these materials in water surrounded places such as dams' reservoirs etc.
- With overall review on the research and obtained results one can finally conclude that use of Alccofine, metakaolin and Lignosulphate will be a advantageous and economical

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