Comparitive Study On Effect Of Alccofine To Flyash And Ggbs To Flyash Ratios On Gpc At Varying Molarities

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Abstract- *The usage of cement is increasing day by day for satisfying the need of development of infrastructure facilities. As the emission of carbon dioxide during the production of cement is more and thus causes serious problems to degradation of environment. In view of this, there is a significant expectation on the researchers to reduce co2 emission. In order to reduce the usage of ordinary Portland cement, there is a need to find the alternate material to the cement. Geopolymer concrete is a new generation concrete and it uses GGBS, flyash, alccofine and alkaline solution as the binding materials. Fly ash is a byproduct from coal industry and GGBS is aalso a byproduct from steel industry, both are widely available in the country. Replacing GGBS and Alccofine with fly ash up to some broaden can take out oven curing and it gets reasonable to utilize ambient curing conditions successfully. This paper presents the influence of various fly ash GGBS and fly ash Alccofine mixes at different molarities of alkaline solutions on properties of geopolymer concrete and detecting workability, compressive strength, flexural and tensile strength on comparison with conventional concrete.*

Keywords- Ground Granulated Blast Furnace Slag (GGBS), Alccofine, compressive strength, split tensile strength test, flexural strength test.

I. INTRODUCTION

Cement is the most important ingredient of the concrete which produces carbon dioxide which is May harmful. So it is a main concern to reduce the usage of cement. Creation of cement isn't just making ecological contamination moreover that the creation of cement requires tremendous measure of crude materials. Because of the overabundance utilization of crude materials they may confront a risk of getting removed in the close by future. To destruction of raw materials and furthermore the plunder of raw materials we can receive another kind of material of development called Geopolymer concrete which can be made utilizing source materials such fly ash, GGBS, alccofine, metakaoline, rice husk ash and etc., alongside alkaline activators namely sodium hydroxide, sodium silicates, potassium hydroxideand potassium silicates so on. New sort of concrete comprised of source material like fly ash, ground granulated blast furnace slag (GGBS), rice husk ash, metakaoline and alccofine and so on and a solution called alkaline activator or alkaline solution arranged by utilizing sodium silicate (Na2SiO3) and sodium hydroxide (NaOH) of appropriate fixation. Rather than sodium silicate and sodium hydroxide we can even utilize potassium hydroxide (KOH) and potassium silicate (K2SiO3) yet numerous scientists proposed to utilize sodium based alkaline activators to reduce off cost of the alkaline solution and to improve solution which can upgrade the limiting property of the source material taken to get ready geopolymer concrete.

The main objective of the present study is to know the influence of various fly ash GGBS and fly ash Alccofine mixes at different molarities of alkaline solutions on properties of geopolymer concrete and detecting workability, compressive strength, flexural and tensile strength on comparison with conventional concrete.

II. REVIEW OF LITERATURE

This part of the study deals with the review of several research papers related to compressive strength and workability of geopolymer concrete poised by employing various source materials such as fly ash, ground granulated blast furnace slag, alccofine etc. But considering availability of material and cost considerations many researchers studied various properties of geopolymer concrete are given below.

Saxena, S. K., Kumar, M., & Singh, N. B. (2018) compared the results of geopolymer cement with opc interms of compressive strength , durability test by using sulphuric acid. The geopolymer cement was made by using fly ash , Alkaline Solution (14M NaOH) and Silicate solution (Sodium silicate solution) And also he used alccofine powder which has have similar properties of silica fume. Finally he concluded that compared to OPC this designed mix (geopolymer mix)

giving better reliable results than OPC in terms of durability, Compressive strength.

Junaid, M. T., Kayali, O., Khennane, A., and Black, J. (2015) In this paper he decided the mix proportions geopolymer concrete (GPC) by utilizing Calcium Class F Flay Ash and Alkaline solutions of sodium silicates and sodium hydroxide. For the distinctive mix plans he discovered ideal substance of alkaline fluid to fly ash (AL/FA) proportion, water to geopolymer concrete (W/GPS) proportion and Alkaline to water (AL/W) proportion.

Sangeetha,P.S.Joanna (2014) studied the structural behavior of RC beams with GGBS concrete. The results obtained from experiments states that the ultimate moment capacity of GGBS was less than the controlled beam when tested at 28 days, but it increases by 21% at 56 day. The measured crack width at service load ranged between 0.17 to 0.20mm and is within the limits (IS456-2000). The structural behavior of RC beam with GGBS resulted the typical behavior of RCC beams and there increase in load carrying capacity of GGBS beams with age. The structural behavior of Reinforced concrete beams with GGBS resembles the typical behavior of Reinforced cement concrete beams and there is increase in load carrying capacity of GGBS beams with age. Hence results of this investigation suggest that concrete with 40% GGBS replacement for cement could be used for RC beams. Having cementing properties, which can be added in cement concrete as partial replacement of cement, without compromising on its strength and durability, which will result in decrease of cement production thus reduction in emission in green house gases, in addition to sustainable management of waste

III. MATERIALS AND METHODS

The experimental investigation work is started with various tests on the constituent materials. The constituent materials are given below.

1. Cement
2. Coarse aggregate
3. Water
4. Fly ash
5. Ground granulated blast furnace slag.
6. Alccofine

Cement

Ordinary Portland Cement (OPC) was used in the experimental work which is conforming to I.S 4031-1988.The O.P.C is classified into three grades, those are 33grade, 43grade and 53 grade, depending upon the strength of the cement in this experiment 43grade cement is used.

Fine Aggregate

Fractions from 4.75 mm to 150 microns are termed as fine aggregate. Locally available river sand passed through 4.75mm IS sieve is applied as fine aggregate conforming to the requirements of IS 383:1970.

Coarse Aggregate

The crushed aggregates used were of 20mm nominal maximum size. Aggregate most of which is retained on 4.75-mm IS Sieve and containing only so much finer material as is permitted for the various types described in this standard.

Fly ash

Class f and low calcium type of fly ash is used in this study as major source material of geopolymer concrete and it was obtained from National Thermal Power Corporation Ramagundam.

GGBS

Concrete made with ground granulated blast furnace slag cement sets more slowly than concrete made with ordinary Portland cement, depending on the amount of ground granulated blast furnace slag in the cementitious material. For the present study the GGBS was brought from the Visakhapatnam steel plant by using wet bags.

Alccofine

Alccofine 1203 is used as a source material in preparing geopolymer concrete, is a fine material generally used as an suppliment material to cement to improve the strength and workability of concrete and which can be used to replace fly ash in fly ash based geopolymer concrete to increase the strength of it. The chemical properties of alccofine 1203 is given below.

IV. MIX DESIGN

The process of selecting suitable ingredients of concrete and determining their relative amounts with the objective of producing a concrete of the required, strength, durability, and workability as economically as possible, is termed the concrete mix design.. If the plastic concrete is not workable, it cannot be properly placed and compacted. The property of workability, therefore, becomes of vital

importance. Percentage dosage of super plasticizer was fixed as per the mix design method described in IS 10262- 2009. Mix proportion was arrived through various trial mixes. The grade of concrete prepared for the experimental study was M35.

V. TESTS ON FRESH CONCRETE

5.1 WORKABILITY OF CONCRETE

Workability of GPC with variable proportions is determined utilizing droop cone are given underneath in Figure. It is seen that decline in the droop an incentive as expansion in both molarity of alkaline solution and proportion of GGBS and alccofine as GGBS and alccofine are flaky in nature and high molar solution has greater viscocity when contrasted with water. Naphthalene based synthetic admixture i.e., super plasticizer is vital for redesign workability of GPC while mixing the various ingredients.

Slump test was carried out to measure the workability of various mixes. The workability of various mixes was assessed as per the IS 1199:1959 specification.Figure 5.1 and 5.2 shows that the variation of slump values with different proportions of ggbs, flyash and alccofine.

TABLE 5.1 shows the Variation of Slump Values

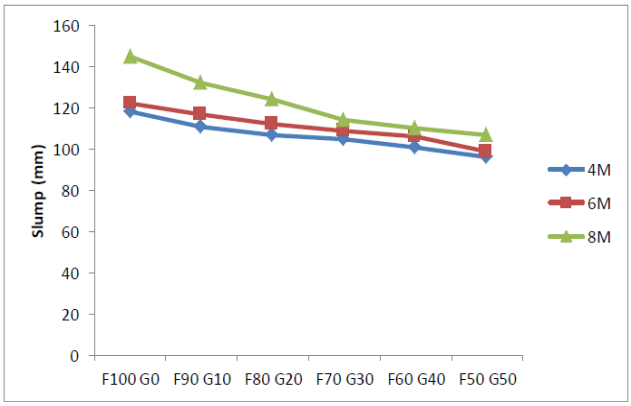

Fig 5.1: Plot shows the Variation of Slump Values for different proportions of Fly ash + GGBS

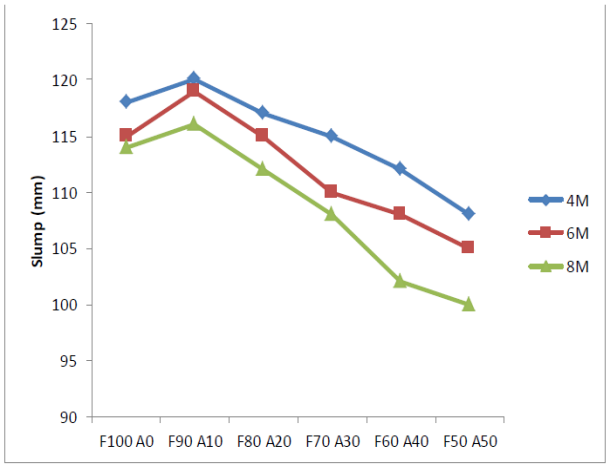

Fig 5.2 Slump values in mm (Fly ash + alccofine)

VI. TESTS ON HARDENED CONCRETE

6.1 VARIATION OF COMPRESSIVE STRENGTH FOR DIFFERENT MIXES

It is noticed that Na2SiO3/NaOH proportion of 2.5 the outcomes acquired are generally more. With expanding in molarity of alkaline solution there is an expansion in compressive strength and it is seen that at half replacement of GGBS and alccofine the compressive strength is more and the alccofine and fly ash based geopolymer concrete gives better outcomes when contrasted with GGBS and fly ash based geopolymer concrete. Practically 35% climb in compressive strength at half replacement of GGBS and alccofine when contraste with 100% fly ash related geopolymer concrete.

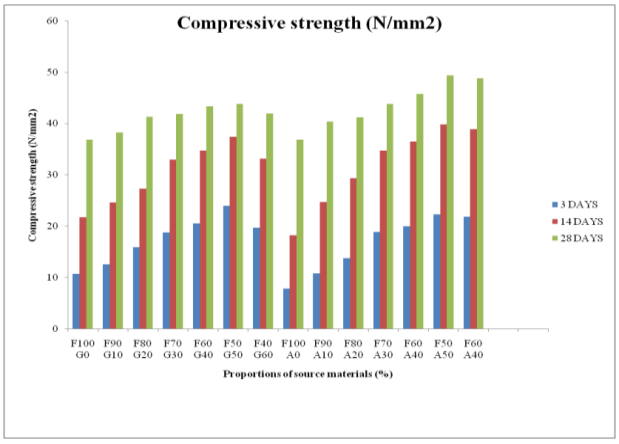

Fig 6.1: Plot shows the Compressive Strength results of Fly ash + GGBS and Fly ash+ Alccofine for molarity of 3M

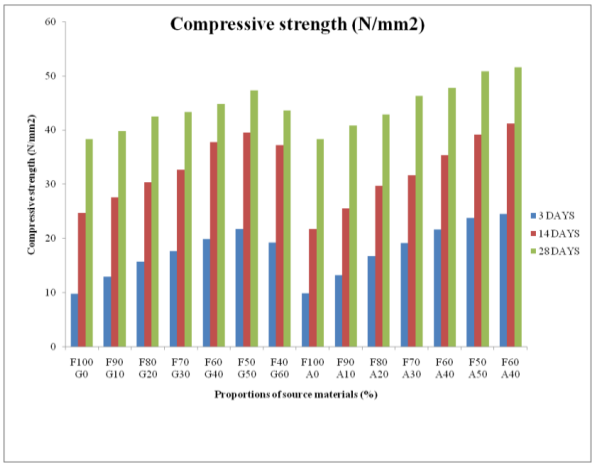

Fig 6.2: Plot shows the Compressive Strength results of Fly ash + GGBS and Fly ash+ Alccofine for molarity of 6M

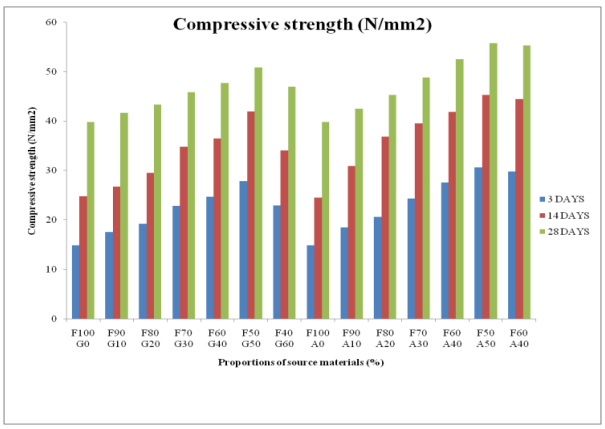

Fig 6.3: Plot shows the Compressive Strength results of Fly ash + GGBS and Fly ash+ Alccofine for molarity of 9M

6.2 VARIATION OF SPLIT TENSILE STRENGTH AND FLEXURAL STRNGTH FOR DIFFERENT MIXES

It is seen that with expanding molarity of alkaline solution, both split tensile and flexural strength esteems are expanding. At half replacement of GGBS and alccofine the strength results are moderately more. Practically 25% of strength is expanded when contrasted with 0% replacement.

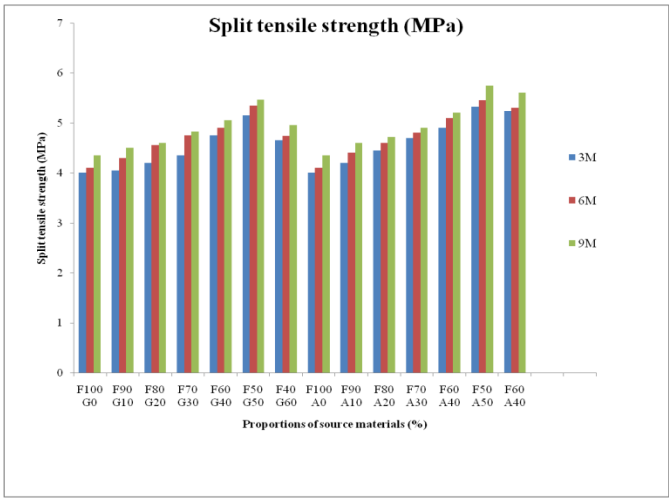

Fig 6.4: Plot shows the Split tensile Strength results of Fly ash + GGBS and Fly ash+ Alccofine for Different molarities

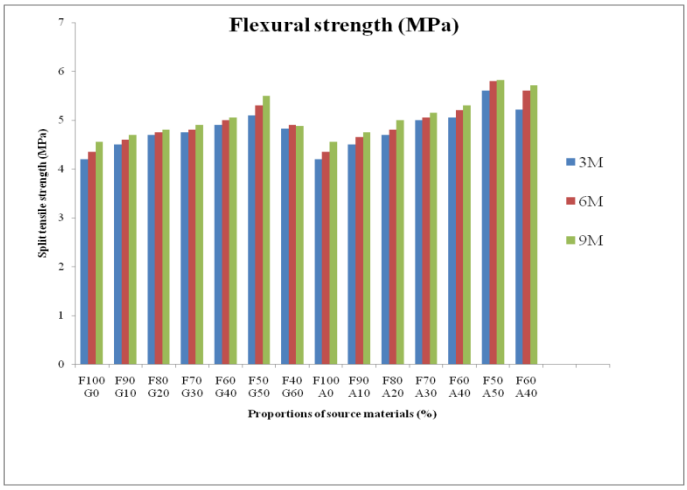

Fig 6.5: Plot shows the flexural Strength results of Fly ash + GGBS and Fly ash+ Alccofine for Different molarities

VII. CONCLUSIONS

The Conclusions and Recommendations that could be drawn from the results of this project and experiments are summarized and the use of fly ash and GGBS in concrete production was studied and after the research work is done, the following conclusions were made:

- Multiple results of compressive strength and other typical physical properties of geopolymer concrete with various proportions of GGBS and alccofine along with fly ash showed that alccofine and fly ash used geopolymer concrete is better in terms of workability and strength.
- Replacement of alccofine and GGBS can successfully eliminate oven curing hence the curing can be done at ambient curing conditions only.
- With increasing in molarity of alkaline solution there is an increase in compressive strength and it is observed that at

50% replacement of GGBS the compressive strength is more as much as 20% increase in strength further replacement leads to decrease in strength and optimum found to be 50% replacement of GGBS with flyash.

- F50G50 and F50A50 cases where fly ash is replaced upto 50% by GGBS and Alccofine respectively are giving higher compressive strength when compared to other proportions.
- Molarity of alkaline solution shows a great impact on strength, increasing concentration of solution improved the strength but decreased workability and cost of preparation of geopolymer concrete is also increased.
- At F50A50 the strength of concrete is found to be the highest but the proportion of alccofine taken upto 50% is uneconomical as it is costlier than GGBS.
- Further addition of alccofine may yield better result but comparative increase in strength is not much affected beyond 50%..

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