

Effect of Partial Replacement of Alkaline Activators on Fly Ash-Based GPC – Review

S.L.Hake¹, Nitin Kharat², Vitthal Kotkar³, Mayur Shinde⁴, Vitthal Chande⁵

Assistant Professor, GH Raisoni College of Engineering, Chas, Ahmednagar, Maharashtra, India¹

B. E Student, GH Raisoni College of Engineering, Chas, Ahmednagar, Maharashtra, India^{2,3,4,5}

ABSTRACT: As we know that basic infrastructure development is increasing for these things, the first important thing is cement. Cement is produced in the ratio of crushing, milling and lower materials. CaO: Limestone, chalk, shells, shell or scorched rock from silica, SiO₂: sand, old bottles, clay or arbalests rock alumina, Al₂O₃: Bauxite, Recycled aluminium, Iron with clay, F₂O₃: Ceramics, iron ore, scrap iron and fly ash gypsum, mixed with lime stone, but we produce cement Cannot forget the Save the pollution. In this paper, we want to find the effect of the combination of various workers like calcium silicate, calcium hydroxide, sodium silicate, sodium hydroxide, potassium silicate, potassium hydroxide. We are going to activate fly ash in Geopolymer concrete. For this investigation, we have selected the M₃₀ grade design of the contract, we are going to examine the effect of these activists in different percentages with different peas and solid materials, and in the end, we will combine these combinations with geopolymer concrete are optimized to be the best combination for activation. Of these, we can use geopolymerConcrete for our traditional work on the site.

KEYWORDS: Geopolymer Concrete (GPC), Alkaline Activators

I. INTRODUCTION

Recently, the reduction in cement usage became an important issue in the construction industry. This is because in its production process, cement CO₂ gases were released which contribute to the formation of the influence of glass house. To succeed in the sustainable development mission, geophysical materials were introduced as an alternate environmental green material. Geographic content is an inorganic material in which silica, alumina and alkaline are included as a catalyst. So far, the raw material used for making geo-polymer concrete was fly ash. Fly ash can be used as raw material in geopolymer concrete because it is rich in silica and alumina. In this research, new alternative raw materials named Tram were introduced. Truss is a volcanic material that is rich in silica and alumina, can be used as alternate raw material next to fly ash. However, different materials of silica and alumina can be distributed to different mechanical properties of geo-polymer concrete. Traces, which have the same content to fly in hopes of an increase in the mechanical behaviour of the geo-polymer concrete. To release unnecessary ions in the polymerization reaction, there was a need to react with alkaline. Sodium hydroxide or NaOH, which is characterized by strong alkalis, was used as an alkaline reagent, while sodium silicate or no 2 seo3 was used as catalyst. In the previous review by Hardjito, it has been said that the ratio between Na₂SiO₃ to NaOH was influenced by the mechanical properties of the Bhupolimar concrete. In order to check the effect of basic catalytic ratio in infinitesimal concrete, the population ratio was applied in the range of 0.5 to 2.5. Geopolymer technology was first introduced by Davidovats in 1978. His work is well-known that adopting the Geopolymer technology can reduce CO₂ emissions due to cement industries. Davidovites proposed that an alkaline liquid can be used to react with the source material or by-product material such as alumina silicate of geological origin, such as fly ash to make a dam. Geopolymer has been synthesized by poly-condensation of silica-aluminate structures. High alkaline solvents such as NaOH and KOH are included with the rich source material in SiO₂ and AL₂O₃.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 5, May 2017

II. RESEARCH REVIEWS

This paper provides the effect of low-concentration alkaline activators on geopolymer concrete. The steel fibres are used to increase the flexural strength of concrete, compressive strength, split tensile strength of fly ash, and slag-based geopolymer concrete are also carried out. Tests were also carried out to check the fracture energy, and finally, the results of these tests were compared with ordinary Portland-based cement concrete. According to this paper, the force required for us can be obtained by the use of low-concentration alkaline activators (Sundar Kumar, et al., 2013).

In this paper, the geo polymer is synthesized by thermally activating aluminate base materials such as fly ash, GGBS, metakaolin, etc., which are used with activator as sodium hydroxide and sodium silicate. In this paper, the mechanical properties were tested using a variation of the alkaline solution. For these studies, M_{30} , M_{40} , M_{50} and M_{60} are used and the molarity is 8 m. The ratios of sodium silicate to sodium hydroxide are 2.0.2.5.3.0 and 3.5.as their research increases the compressive strength of concrete with increasing curing time. (Shankar H. Sanni1 & R. B. Khadiranaika, 2013).

This paper represents the flight-ash-based geopolymer concrete. In geopolymer concrete, the fly ash, which has a high content of silicon and aluminium, is chemically activated by a highly alkaline solution to form a paste which can contribute to the improvement of the binding property. This paste binds the coarse aggregate, fine aggregates and other materials presented in mixture. The activator used in this paper is the combination of sodium silicate and sodium hydroxide. The results obtained by researches in this paper show the effect of various parameters on mechanical properties such as compressive strength, flexural tensile strength, and cracked tensile strength of geopolymer concrete. (DjwantoroHardjito, et al., 2004).

This paper provides alkaline activated binders with superior technical properties and durability as with ordinary Portland cement. In these paper properties, such as mechanical strength, modulus of elasticity, ultrasonic pulse rate, and shrinkage of various concrete mixes. This paper provides alkaline activated binders with superior technical properties and durability as with ordinary Portland cement. In these paper properties, such as mechanical strength, modulus of elasticity, ultrasonic pulse rate, and shrinkage of various concrete mixes. Test data were used for Taftanpozzolanto to check the effects of water-binder ratios (w / b) and curing conditions on the properties of geopolymer concrete. (Dali Bondar, et al., 2011).

In this thesis the investigation of mechanical properties such as static elasticity modulus, pulse ratio, compressive strength and bending strength are investigated. The experimental readings were recorded and analysed. They found that the mechanical properties of geopolymer concrete are similar to that of ordinary Portland cement concrete. This paper represents the mechanical characterization of 25 geopolymer concrete batches, each batch being produced. This paper also shows that the relationship between the modulus of elasticity and the compressive strength of geopolymer concrete is similar to ordinary Portland cement concrete. (E.I. Ivan Diaz-Loya, et al., 2011).

The study, which is based on the use of Flyash in the synthesis of cement-free geopolymer, and the subsequent study of durability is done in the paper. In this work the compressive strength was obtained at 120 degrees Celsius for 72 hours. In geopolymer concrete contents of alumina-silicates acts as a binder, while the conventional concrete has cement-produced C-H-S gel. Now days different acids, sulphates and chloride salts and are used with fly ash and the strength by these chemicals are compared with ordinary concrete. (Neetu Singh, et al., 2013).

In this paper, the change in the mechanical properties of geopolymer concrete was determined using a combustor fly ash and an alkaline activated fly ash complex to check the strength of geopolymer concrete. In the combustion plant the ash is chemically stabilized. The results are also to be encouraged for the future. The IFA was stabilized when used as a replacement (up to 60%) with respect to CFA. (KunalKupwade-Patil and Ms Rashedul-Islam, 2014).

We all know that geopolymer is a class of aluminosilicate bonding materials synthesized by thermal activation of solid aluminosilicate base materials such as fly ash, metakaolin, GGBS, etc., with an alkali metal hydroxide and silicate solution. This paper presents the experimental investigation of the variation of the alkaline solution on the mechanical properties of geopolymer concrete. The degrees selected for the study were M_{30} , M_{40} , M_{50} and M_{60} , the mixtures were designed for 8 molarity. The test samples were 150x150x150 mm cubes and 100x200 mm cylinders, which were heat

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 5, May 2017

cured at 60 ° C a furnace. The freshly prepared geo-polymer mixtures were cohesive and their workability increased with the increase in the ratio of the alkaline solution. (M.Poojidha, et al., 2016).

III.METHODOLOGY

Geopolymer material is an inorganic material containing silica, alumina and alkaline as the activator. So far, raw material has been used to make geopolymer concrete. Fly ash can be used as a raw material in geopolymer concrete as it is rich in silica and alumina. In this research, new alternative raw materials called Trass were introduced. Trass, a volcanic material rich in silica and alumina, can be used as an alternative raw material besides fly ash. However, the different content of silica and alumina could provide different mechanical properties of geopolymer concrete.

In this work, we will describe variations of activators such as:

- Ca (OH) + Ca₂ SiO₃; (Molarity of hydroxide 8M)
- Ca (OH)₂ + NaOH + Ca₂SiO₃ + Na₂SiO₃ (molarity for hydroxide 12M)
- KOH + K₂SiO₃ (molarity for hydroxide 12M)
- KOH + K₂SiO₃+ NaOH + Na₂SiO₃ (molarity for hydroxide 12M)
- KOH + K₂SiO₃+ NaOH + Na₂SiO₃ + Ca₂ (OH)₃ + Ca₂SiO₃ (molarity for hydroxide 12M)

After collecting materials, we take some tests on these materials (coarse aggregates, fine aggregates) to check the strength of geo polymer concrete we have done some tests, and these are compressive strength, bending strength, split tensile strength to the specimens of geo polymer for each test variation of chemicals we cast three blocks for tests and the average of these three blocks is taken as the final strength for this test. Concrete mixes that offer a wide range of mechanical and durable properties to meet the design requirements of a structure. The compressive strength is used for quality control.

Concrete mixes that offer a wide range of mechanical and durable properties to meet the design requirements of a structure. The compressive strength is used for quality control, acceptance of concrete, etc. Various factors influence the compressive strength of the concrete such as raw material properties, mixing ratio, etc. For compression tests we take variations of our chemicals according to their requirements. Water and for each test three blocks are required, therefore we box three blocks for each variation and tests are taken after a certain period such as 7days, 14days, 28days.

After compressive strength on geopolymer concrete by mixing various combinations of activators in concrete mix, we found the best variation of the activator. This combination should give us the required strength and thus the split tensile strength and flexural strength. After splitting and bending tests we find that this combination of our concrete mix gives enough strength.

IV.CONCLUSION

- 1) The utilization of sodium hydroxide and sodium silicate is more for manufacturing of GPC, The combination effect of alkaline activators shows their importance in it.
- 2) The alkaline activators combinely used shows or gives the optimal use of alkaline activators.
- 3) The potassium (hydroxide and silicate) and calcium (hydroxide and silicate) plays important role for activators of Geopolymer Concrete (GPC).
- 4) The combined effect shows the importance of alkaline activators with different combination ratio based on different activators of Geopolymer Concrete (GPC).

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 5, May 2017

REFERENCES

- [1] Mr. S. L. Hake, Dr R.M. Damgir, Dr S. V. Patankar “State of Art-Investigation of methods of curing on Geo polymer concrete “ ISOR Journal of Mechanical and civil engineering (ISOR-JMCE) ,Volume 12,Issue 3 Ver. I (May-June.2015)
- [2] O. M. Omar, G. D. AbdElhameed , A. M. Heniegal , H.A. Mohamadien “Effect Of Crashed Stone On Properties Of Fly Ash Based – Geopolymer Concrete With Local Alkaline Activator in Egypt” International journal of Civil, Environmental, Structural, Construction and Architectural Engineering, Volume 9,No:10, 2015.
- [3] MuhdFadhilNuruddin, AndriKusbiantoro, SobiaQazi, Nasir Shafiq “Compressive Strength and Interfacial Transition Zone Characteristic of Geopolymer Concrete with Different Cast In-Situ Curing Conditions” International Science Index, International Journal of Environmental, Chemical, Ecological, Geological and Geophysical Engineering Vol: 5 No: 1, 2011.
- [4] M. FadhilNuruddin, Samuel Demie, M. Fareed Ahmed, and Nasir Shafiq” Effect of Super plasticizer and NaOH Molarity on Workability, Compressive Strength and Microstructure Properties of Self-Compacting Geopolymer Concrete” International Science Index International Journal of Environmental, Chemical, Ecological, Geological and Geophysical Engineering Vol:5 No: 3, 2011.
- [5] O. M. Omar, A. M. Heniegal, G. D. AbdElhameed, H. A. Mohamadien” Effect of Local Steel Slag as a Coarse Aggregate on Properties of Fly Ash Based-Geopolymer Concrete” International Science Index International Journal of Civil, Environmental, Structural, Construction and Architectural Engineering Vol:9 No: 11, 2015.
- [6] Sundar Kumar, S. , Vasugi, J., Ambily, P. S. and Bharatkumar, B. H. “Development and Determination of Mechanical properties of fly ash and slag blended Geo polymer concrete” International Journal of Scientific & Engineering Research, Volume 4, Issue 8, August 2013.
- [7] Subhash .V .P. Sanjay .S.J. Yuwaraj .M.G,” Effect of water to Geopolymer Binder Ratio on the Production of Fly Ash Based Geopolymer Concrete” International Conference on Recent Trends in engineering & Technology -2013 (ICRTET2013) Organized By: SNJB LateSau. K.B. Jain College of Engineering Chandwad, 2013.
- [8] Sunilaa George , Dr. R. Thenmozi “ Flexural Behaviour Of Activated fly Ash Concrete” International journal of engineering Science Technology (IJEST), vol.3 No.10 oct 2011.
- [9] Fared Ahmad Memon , MuhdFadhilNuruddin, Sadaqatullahkhan,nashirShafg and TehminaAyub,” Effect of sodium, Hydroxide Concentration on Fresh properties and Compressive Strength of self compactingGeopolymer concrete ”
- [10] DjwantoroHardjito, Chua Chung Cheak and Carrie Ho Le Ing, “Strength and Setting Times of Low Calcium Fly Ash-based Geopolymer Mortar”, Modern Applied Science, Volume 2, No.4, July 2008, pp.3-11.
- [11] Vanita Aggarwal, Gupta S.M. and Schdeva S.N., ”Investigations on Fly Ash Concrete For Pavemnts”, International Journal of Civil & Structural Engineering, Volume 2, No.3, ISSN 0976-4399, February 2012,pp.876-883.
- [12] Kamlesh. C. Shah, Prof A.R. Parikh and Prof. k. J. Parmer, “study of Strength Parameters and Durability of Fly ash based geopolymer Concrete”, PARIPEX – INDIAN Journal Of Research, Volume 3, Issue 7, ISSN – 2250-1991, July 2014, pp. 207-210.
- [13] Anurag Mishra and DeepikaChoudhari, “Effect of Concentration of Alkaline Liquid and curing Time on Strength Water absorption of geopolymer concrete” ARPJ JOURNAL OF Engineering and Applied sciences, Volume 3, NO. 1, ISSN 1819-6608, February 2008, pp.14-18.
- [14] M. Poojidha,” Review Paper on Reaction of Alkaline Solution in GEO-Polymer Concrete” International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169 Volume: 4 Issue: 10, October 2016.
- [15]Concrete Neetu Singh, Sameer Vyas, R.P.Pathak, Pankaj Sharma, N.V.Mahure,S.L. Gupta,”Effect of Aggressive Chemical Environment on Durability of GreenGeo polymer” International Journal of Engineering and Innovative Technology (IJEIT) Volume 3, Issue 4, October 2013