iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 Issue: VIII Month of publication: August 2022

DOI: https://doi.org/10.22214/ijraset.2022.46448

Performance on Fly Ash Based Geopolymer Concrete with 8, 10 & 12 Molar Naoh Activator Using M_{40} Grade of Concrete

J. Sree Naga Chaitanya[1], Dr. K. Chandramouli[2], Dr. D. Vijaya Kumar[3], T. Swarna Kumar[4]
[1]Assistant Professor, [2]Professor & HOD, [3]Principal, [4]UG Student
[1,2,4]Department of Civil Engineering, NRI Institute of Technology, Visadala (V), Medikonduru (M), Guntur, Andhra Pradesh, INDIA
[3]Department of Civil Engineering, kodada institute of technology and sciences for women, Telangana, INDIA

***Abstract:** Ordinary Worldwide, Portland cement is a vital building component. A source of carbon dioxide emissions alongside deforestation and the use of fossil fuels is the cement making business. The atmosphere is polluted by greenhouse gases like CO2, which contribute to global warming. CO2 makes up roughly 65% of the greenhouse gases that cause global warming. Around 7% of the planet's total greenhouse gas emissions come from the cement industry. Alternative binders for the manufacturing of concrete are required to overcome the environmental impacts associated with Portland cement. In this work, a geopolymer based on fly ash from Vijayawada with a low calcium content (Class F) was utilised. A thermal power plant was used to create geopolymer concrete. Flyash activation employed an alkaline solution made of sodium silicate and sodium hydroxide solutions. The ratio of alkaline solution to fly ash was adjusted to 0.45. The sodium hydroxide solution's concentration was kept at 8M, 10M, and 12M. (Molars). As ambient curing, different curing conditions for geopolymer concrete were used. At different ages, including 7 and 28 days, the geopolymer concrete's compressive strength and split tensile strength were evaluated. According to the test results, the strength of geopolymer concrete increases along with the alkaline solution to fly ash ratio.*
***Keywords:** Fly ash, Metakaolin Geo-polymer concrete, alkaline solution. , Compressive strength and Split tensile strength.*

I. INTRODUCTION

Standard Portland cement (OPC), an essential ingredient in the production of concrete, acts as the binder to bond the different parts together. However, utilising cement uses up resources and harms the environment (limestone). Geopolymer concrete was created to minimise the aforementioned drawback because the production of cement requires the burning of enormous amounts of fuel and the disintegration of stone, both of which are necessary for the emission of carbonic acid gas (Kong and Sanjaya, 2008). Geopolymer concrete offers a number of innovative benefits, including high compressive strength, low creep, outstanding acid resistance, and low shrinkage. Ash is utilised in place of the binder in geopolymer concrete because it has great strength and the same pozzolanic properties as cement. Ash is a common byproduct of burning coal that helps with waste management strategies. Different raw materials, such as particle size and distribution, crystallisation level, etc., as well as different alkali-activators, such as sodium/potassium hydroxide and sodium/potassium silicate, and their ratios, etc., as well as different Si/Al ratios, water/ash ratios, and curing conditions, can all significantly affect the geopolymerization reaction (temperature, moisture degree, opening or healing condition, curing time, etc,).

II. OBJECTIVES

1) To investigate the impact on fly ash-based geopolymer concrete of the ratio of alkaline solution to binder, sodium hydroxide solution concentration, and curing conditions.
2) To assess the compressive and split tensile strengths of fly ash-based geopolymer concrete at different ages, such as 7 and 28 days.

III. MATERIALS

Thematerialsusedformakingflyash-basedgeopolymerconcretespecimens were low-calcium fly ash, aggregates, alkaline liquids, extra water and metakaolin.

Table 1:-Physical properties of Fly ash

S.No	Description	Values
1	Specific Gravity	3.14
2	Fineness of fly ash	7.24

Table2:-Chemical composition of fly ash

S. No.	Name of the Chemical	% by weight
1	Sulfate (SO_4)	1.24%
2	Magnesium Oxide (MgO)	0.91%
3	Titanium Dioxide (TiO_2)	0.42%
4	Ferric Oxide ($Fe_2O_3 + Fe_3O_4$)	4.17%

IV. EXPERIMENTAL INVESTIGATIONS

A. *Compressive Strength Results*

The compressive strength conducted in compression testing machine for the cast and cured specimens and the results are furnished in Table 3.

Table 3: Compressive Strength of geopolymer concrete

S.No	Molarity	Compressive strength results,N/mm^2	
		7 days	28 days
1	NC	34.52	49.46
2	8M	35.66	50.98
3	10M	36.94	52.79
4	12M	37.43	54.27

B. *Split Tensile Strength Test*

The cylindrical specimens (150 mm diameter x 300 mm height) were examined to determine the split tensile strength at ages 28, 56, and 90 days. A cylindrical sample is placed horizontally between the loading surface of a compression-testing machine, and a load is applied until the cylinder fails along the vertical diameter.

Table 4:-Split tensile strength of concrete with recycled aggregates as partial replacement of cement in concrete

S.No	Molarity	Split tensile strength results, N/mm^2	
		7 days	28 days
1	NC	3.35	4.88
2	8M	3.46	4.96
3	10M	3.61	5.17
4	12M	3.76	5.25

V. CONCLUSIONS

A. The compressive strength of normal concrete at 7 and 28 days is 34.52, and 49.46 N/mm^2.

B. The split tensile strength of normal concrete at 7 and 28 days is 3.35 and 4.88 N/mm^2.

C. At 12Mpartial replacement of flyash and metakaolin with cement the compression strength of concrete at 7 and 28 days are 37.43 and 54.27 N/mm^2.

D. At 12M partial replacement of fly ash and metakaolin with cement the split tensile strength of concrete at 7 and 28 days are 3.76 and N/mm^2.

REFERENCES

[1] Hymavathi G and Ranga Rao V. Strength characteristics of fly ash based geopolymer concrete with 14 molar naoh activator, International Journal of Civil Engineering and Technology,8(1),(2017), 431-437.

[2] Nurul Aida Mohd Mortar[1] , H. Kamarudin[1] , R. A. Rafiza[1] , T.A.F Meor1 and M Rosnita[1]. Compressive Strength of Fly Ash Geopolymer Concrete by Varying Sodium Hydroxide Molarity and Aggregate to Binder Ratio, Materials Science and Engineering 864, (2020),1-6.

[3] Ajay Sharma[1], Juned Ahmad[2]. Factors affecting compressive strength of geopolymer concrete-a review, International Research Journal of Engineering and Technology, 04 (04),(2017), 2026-2031.

[4] Mohammed Rabbani Nagral et al, "Effect Of Curing Temperature And Curing Hours On The Properties Of Geo-Polymer Concrete" , 04 (9) , (2014).

[5] P. Abhiram and SS. Asadi, Implementation of Lean Methodology in Indian Construction. International Journal of Civil Engineering and Technology, 7(6), 2016, pp. 641–649.

[6] On the Development of Fly Ash-Based Geopolymer Concrete", ACI Materials Journal, Vol. 101, No. 6, Nov- Dec -2004, pp.467-472.

[7] Djwantoro Hardjito and Tsen, M.Z., "Strength and Thermal stability of fly ash based geopolymer mortar", The 3rd International Conference -ACF/VCA, 2008, pp.144-150.

[8] IS: 2386 – 1963, "Methods of test for aggregates for concrete", Bureau of Indian Standards, New Delhi.

[9] IS: 516 – 1959, "Method of test for strength of concrete", Bureau of Indian Standards, New Delhi.

[10] XuH,van Deventer JSJ.The Geopolymerisation of Alumino-Silicate Minerals. International Journal of Mineral Processing2000; 59(3):247-266.