STRENGTH CHARACTERISTICS OF FLY ASH BASED GEOPOLYMER CONCRETE WITH 8, 10 & 12 MOLAR NAOH ACTIVATOR

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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 concrete manufacturing are required to overcome Portland cement's negative environmental consequences. 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.For the activation of fly ash, sodium hydroxide and sodium silicate solution was utilised as an alkaline solution. 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, several curing conditions for geopolymer concrete were used. At different ages, including 7 and 28 days, the compressive strength and split tensile strength of the geopolymer concrete were tested. According to the test findings, the strength of geopolymer concrete improves along with the alkaline solution to fly ash ratio.

Key words: *Geo-polymer concrete, fly ash, metakaolin & alkaline solution.*

1.INTRODUCTION

Normative In the process of making concrete, Portland cement (OPC) is a crucial component that serves as the mixture's binder. However, using cement depletes resources and has negative effects on the environment (limestone). The process of making cement results in the burning of massive amounts of fuel and the breakdown of stone, which is essential for the release of carbonic acid gas . Geopolymer concrete was therefore developed to lessen the above disadvantage. Additionally, geopolymer concrete offers excellent outcomes such as high compressive strength, minimal creep,

fantastic acid resistance, and low shrinkage (Lodeiro et al., 2007).Ash, which also has cement-like pozzolanic characteristics and is rich in corundum and salt, replaces the binder used in geopolymer concrete. Ash is a byproduct of coal combustion that is widely available and contributes to waste management plans. Different raw materials such as particle size and distribution, crystallisation level, etc., different alkali-activators such as sodium/potassium hydroxide, sodium/potassium silicate, and the ratio of these two, etc.

2.Objectives

The objectives of this study are as follows

1. Investigation of the effects of alkali to binder ratio, sodium hydroxide concentration, and curing conditions on fly ash-based geopolymer concrete.
2. Determination of compressive and splitting tensile strength of fly ash based geopolymer concrete at different ages such as 7 days and 28 days.

3.MATERIALS

The materials used for the production of fly ash-based geopolymer concrete were low calcium fly ash, aggregates, alkaline liquids, additional water and meta kaolin.. The properties of fly ash are presented in Table 1.

Table 1:-Physical properties of Fly ash

S. NO	DESCRIPTION	VALUES
1	Specific Gravity	3.12
2	Fineness of fly ash	**7.13**

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%

Table 2:- Chemical composition of fly ash

EXPERIMENTAL INVESTIGATIONS

4.1 Compressive strength results

The cube specimens of 150mm x 150mm x150mmwere cast and tested in compression testing machine for 7 ,28 days of curing period for different proportions of concrete mix and presented in table.

Table 3 :-Compressive Strength of geopolymer concrete

S.no	Molarity	7 days	28 days
1	NC	19.29	28.05
2	8M	20.08	28.62
3	10M	20.63	29.52
4	12M	21.01	30.66

4.2 Split tensile strength test

At the age of 28,56 and 90days, the cylindrical specimens (150mm diameter x 300mm height) were tested for evaluating the split tensile strength. The experiment is

performed by putting a cylindrical sample horizontally between a compression-testing machines loading surface and the 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	7 days	28 days
1	NC	1.89	2.76
2	8M	1.94	2.79
3	10M	2.03	2.91
4	12M	2.13	2.97

5.Conclusion

In this study, the concrete ingredients like cement is partially replaced by fly ash and metakaolin. Fly ash various different molarities of 8M, 10M and 12M.

The Compressive strength of normal concrete at the age of 28,56 days and 90 days are N/mm² are 41.78 &62.84 N/mm² .

1. At 8M partial replacement of fly ash with cement the compression strength of concrete at 7 and 28 days are 20.08 and 28.62N/mm^2.
2. At 8M partial replacement of fly ash with cement the split tensile strength of concrete at 7 and 28 days are 1.94 and 2.79N/mm^2.
3. At 10M partial replacement of fly ash with cement the compression strength of concrete at 7 and 28 days are 20.63 and 29.52N/mm^2.
4. At 10M partial replacement of fly ash with cement the split tensile strength of concrete at 7 and 28 days are 2.03 and 2.91N/mm^2.
5. At12Mpartialreplacementofflyasha ndmetakaolinwithcementthecompre ssion strength of concrete at 7 and 28 days are 21.01and 30.66 N/mm^2.
6. At 12M partial replacement of fly ash and metakaolin with cement the split tensile strength of concrete at 7 and 28 days are 2.13 and 2.97 N/mm^2.

6.REFERENCES

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