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Strength Behaviour of Geopolymer Concrete by using Different Mineral Admixtures

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Abstract: *The world is developing rapidly and therefore the construction of buildings takes vital role. If we bear thoroughly the usage of concrete gets raised up so it ends up in the shortage of the natural resources. so as to save lots of our natural resources, by replacing a number of the proportions within the concrete with the subsequent measures. By using ash and GGBS as admixture in geopolymer concrete in equal percentages (50-50%). The results obtained from compressive strength, split durability test for the age of 7-and 28-days strength-polymer concrete is one among the building materials that became more popular in recent years thanks to the very fact that it's significantly more environment friendly than standard concrete-polymer concrete could be a variety of concrete that's made by reacting aluminates and silicate bearing materials with a caustic activator. Commonly, waste materials like ash or slag from iron and metal production are used, which helps result in a cleaner environment. Geo-polymer concrete completely replaces cement by ash, ground granulated furnace slag and therefore the polymer materials.*

Keywords: Fly Ash, GGBS, Sodium Hydroxide and Sodium Silicate

I. INTRODUCTION

Concrete is the widely used construction material that makes best foundations, architectural structures, bridges, roads, block walls, fences and poles. The production of one ton of Portland cement emits approximately one ton of CO_2 into the atmosphere. Among the greenhouse gases, CO_2 contributes about 65% of global warming. The contribution of ordinary Portland cement (OPC) production worldwide to greenhouse gas emissions is estimated to be approximately 1.35 billion tons annually or approximately 7% of the total greenhouse gas emissions to the earth's atmosphere. However, the cement industry is extremely energy intensive. After aluminium and steel, the manufacturing of Portland cement is the most energy intensive process as it consumes 4GJ of energy per ton. After thermal power plants and the iron and steel sector, the Indian cement industry is the third largest user of coal in the country. The industry's capacity at the beginning of the year 2008-09 was about 198 million tons.

II. OBJECTIVE

The aim of the project is to study the strength difference between the two geopolymer concrete using 3 different mineral admixtures for two different ages. The present study is limited to check the strength behaviour of the geopolymer concrete made of different mineral admixtures.

III. MATERIALS

In this project the following materials are used; Fly ash, ggbs, and alkaline solution: sodium hydroxide, sodium silicate, sand.

Table 1: Physical properties of binding materials used

S. no	Physical Properties	Fly Ash
1.	Colour	Light grey
2.	Specific Gravity	2.1

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Table 2: Physical properties of GGBS

S.no	Physical Properties	ggbs
1.	Colour	White
2.	Specific Gravity	2.8

IV. EXPERIMENTAL RESULTS

4.1 Compressive Strength Test

The cube specimens of 150mm x 150mm x150mmwere cast and tested in compression testing machine for 7 and 28days of curing period for different proportions of concrete mix and presented in table below. The test results for the compressive strength for the two mixes are presented in the below table

Table 3: Test Results for Compressive Strength

S. no	Molarity	7 days (N/mm$^{2)}$	28 days (N/mm$^{2)}$
1	NC	34.15	49.65
2	12M	39.19	56.08
3	14M	39.75	57.87
4	16M	40.56	58.11

Table 4: Compressive Strength for Combination of Fly Ash and Ggbs

S. No	Molarity	Age	Split tensile strength results **(N/mm$^{2)}$**
			Flyash and ggbs
1	**16M**	**7 days**	4.38
		28 days	6.84

4.2 Split Tensile Strength Test

At the age of 7 and 28days, the cylindrical specimens (150mm diameter x 300mm height) were tested for evaluating the split tensile strength. The test results for the split tensile strength for the two mixes are presented in the below table.

Table 5: Test results for split tensile strength

S.no	Activator Ratio	7 days (N/mm^2)	28 days (N/mm^2)
1	NC	3.37	4.90
2	12M	3.80	5.48
3	14M	3.86	5.65
4	16M	3.96	5.68

TABLE 6: Split tensile strength for combination of fly ash and ggbs

S. No	Molarity	Age	Split tensile strength results Fly ash and ggbs **(N/mm$^{2)}$**
1	**16M**	**7 days**	4.38
		28 days	6.84

V. CONCLUSION

1. In the context of this analysis, it is observed that geopolymer concrete made of fly ash and GGBS at 12 M of NaOH with alkaline ratio of 1:2 ($NaOH/Na_2SiO_3$) gives a compressive strength of 39.19Mpa & 56.08Mpa for 7days and 28days age.

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2. In the context of this analysis, it is observed that geopolymer concrete made of fly ash and GGBS at 14 M of NaOH with alkaline ratio of 1:2 ($NaOH/Na_2SiO_3$) gives a compressive strength of 39.75Mpa & 57.87Mpa for 7days and 28days age.
3. In the context of this analysis, it is observed that geopolymer concrete made of fly ash and GGBS at 16 M of NaOH with alkaline ratio of 1:2 ($NaOH/Na_2SiO_3$) gives a compressive strength of 40.56Mpa & 58.11Mpa for 7days and 28days age.
4. In the context of this analysis, it is observed that geopolymer concrete made of fly ash and GGBS at 12 M of NaOH with alkaline ratio of 1:2 ($NaOH/Na_2SiO_3$) gives a split tensile strength of 3.80Mpa & 5.48Mpa for 7days and 28days age.
5. In the context of this analysis, it is observed that geopolymer concrete made of fly ash and GGBS at 14 M of NaOH with alkaline ratio of 1:2 ($NaOH/Na_2SiO_3$) gives a split tensile strength of 3.86Mpa & 5.65Mpa for 7days and 28days age.

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