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Effect of Concentration of Alkaline Liquid on Alumino Silicate Concrete

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ABSTRACT: The consumption of Ordinary Portland cement (OPC) caused pollution to the environment due to the emission of CO₂. As such, alternative material had been introduced to replace OPC in the concrete. Fly ash is a by-product from the coal industry, which is widely available in the world. Moreover, the use of fly ash is more environmental friendly and save cost compared to OPC. Fly ash is rich in silicate and alumina, hence it reacts with alkaline solution to produce alumina silicate gel that binds the aggregate to produce a good concrete. The compressive strength increases with the increasing of fly ash fineness and thus the reduction in porosity can be obtained. Fly ash based geo polymer also provided better resistance against aggressive environment and elevated temperature compared to normal concrete. This paper presents the laboratory investigation to study the compressive strength with effect of concentration of molarity and curing temperature. It is concluded that higher concentration of molarity and increase in temperature increases the compressive strength.

KEYWORDS: Fly ash, geo polymer, alkaline solution, Compressive strength, Temperature.

I.INTRODUCTION

Demand for concrete as construction material is on the increase so as the production of cement. The production of cement is increasing about 3% annually.[1] Among the green house gases CO₂ contributes about 65% of global warming. The production of one ton of cement liberates about one ton of CO₂ to atmosphere. Furthermore, it has been reported that the durability of ordinary Portland cement concrete is under examination, as many concrete structures, especially built in corrosive environments start to deteriorate after 20 to 30 years, even though they have been designed for more than 50 years of service life [14].

Although the use of Portland cement is unavoidable in the foreseeable future, many efforts being made to reduce the use of Portland cement in Concrete. In this respect geopolymer is very promising technique. The term Geo polymer describes a family of mineral binders with chemical composition same as Zeolite. Hardened geopolymer concrete has an amorphous microstructure [2] which is quite similar to that of ancient structures such as Egyptian pyramids and Roman amphitheatres. Geo polymer is produced by a polymeric reaction of alkaline liquid with source material of geological origin or by product material such as fly ash. In terms of reducing global warming, geopolymer technology could reduce approximately 80% of Co₂ emission to the atmosphere caused by cement and aggregate industry.[3] Compared with ordinary Portland cement concrete, geopolymers show many advantages. Geopolymers show substantially superior resistance to fire[4] and acid attack[5] and much less shrinkage than OPC Concrete. Geopolymer concrete can obtain 70% of the final compressive strength in the first four hours of setting. The compressive strength after 14 days was found in the range of 5-50 MPa.[6] The tensile strength of geopolymer concrete falls within the range observed for OPC based concrete. Also, the flexural

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strengths are generally higher than the standard model line for OPC based concrete. This favourable behaviour can be attributed to the type of matrix formation in geo polymer concrete.[7] It has been reported that the stress strain relationship of fly ash based geo polymer concrete is almost similar to that of ordinary Portland cement concrete.[8]

These advantages make the geopolymer concrete a strong alternative for replacing ordinary Portland cement concrete. The present study in this paper presents the results of an investigation on strength and curing time characteristics of geo polymer concrete prepared by using fly ash source material and NaOH and Na_2SiO_3 as alkaline liquid which was taken as activator [15].

II. EXPERIMENTAL PROGRAMME

The experiments were carried out using five different concentrations of NaOH solution [13]. Compressive strength were conducted at 7, 14, 28 days. For a particular concentration Compressive strength Test was conducted for different curing temperatures.

Materials

Coarse aggregates

Coarse aggregates of 20 mm downgraded and specific gravity of 2.56 were used.

Fine aggregates

Sand conforming to Zone III as per IS 383[9] was used as fine aggregate for the tests conducted. Locally available river sand having a specific gravity of 2.70 was used as fine aggregate for Geo polymer concrete mixes.

Fly ash

Locally available fly ash obtained from Ennore Thermal power station, Chennai was used for the concrete mixes.

Test variables

The variables taken for preparation of geo polymer concrete mixes were; 8M, 10M, 12M, 14M, 16M concentration for a curing time 48 hrs. For each of the NaOH concentration and a constant Na_2SiO_3 concentration, a constant curing time has been kept for the study. Hence properties of total five concrete mixes have been studied. A single NaOH concentration is selected and a study has been done for different curing temperatures [9].

The ratio of fly ash: fine aggregate: Coarse aggregate is 1:1.04:2.11 were taken. The ratio of sodium silicate solution by mass was kept as 2.5, while the ratio of Activator solution to fly ash by mass was kept as 0.35. The mix proportions were shown in Table 1 [10].

Preparation of Geopolymer Concrete

Preparation of solution

Separate solutions of NaOH and Na_2SiO_3 of required concentrations were prepared 24 hrs prior to the casting. Both the solutions were mixed together at the time of mixing.

Mixing

Weighed quantity of fly ash, fine aggregates and coarse aggregates were dry mixed in a rotating mixer for about 3 minutes. After dry mixing, wet mixing was done for another 3 minutes. 9 cubes of $15 \times 15 \times 15 \text{ cm}^3$ were prepared for each variable. Compaction was done by applying a manual strokes, followed by compaction on a vibration table for 20 seconds. A handling time of 30 minutes was adopted for the study.

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Curing

After casting the cubes, they were kept (with moulds) in a Hot air oven at 100c for 24 hrs. Then the cubes were remoulded and the cubes were placed at the oven for another 24 hrs. Then the cubes were kept at the room temperature for the required curing time until the period of testing [11].

Tests performed

Compressive strength test for different concentrations, different curing temperature and different handling time were conducted [12].

III.RESULTS AND DISCUSSIONS

The compressive strength test was performed taking three cubes from each set after 7, 14, 28 days. The results were plotted in the Fig.1. The compressive strength test for different curing temperature was performed and plotted in Fig.2 and a Higher concentration of sodium hydroxide solution yielded higher compressive strength than the corresponding lower concentration mix. Higher curing temperature resulted in higher compressive strength. Results for handling time indicates that fresh low calcium fly ash based geopolymer concrete can be handled up to 120 minutes after mixing.

IV.CONCLUSIONS

- High compressive strength. Higher concentration (in terms of molar) of sodium hydroxide solution results in higher compressive strength of fly ash-based geopolymer concrete.
- As the curing temperature in the range of 30°C to 90°C increases, the compressive strength of fly ash-based geopolymer concrete also increases.
- The fresh fly ash-based geopolymer concrete is easily handled up to 120 minutes without any sign of setting and without any degradation in the compressive strength. The average density of fly ash-based geopolymer concrete is similar to that of OPC concrete.

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Effectiveness of Guided Imagery on Depression among the Elderly

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ABSTRACT: A comfortable old age is the reward of a well-spent youth. Instead of its bringing sad and melancholy prospects of decay, it would give us hopes of eternal youth in a better world (Chevalier, 2010). Ageing is a universal process. In the word of Seneca "Old Age is an Incurable Disease". Ageing is a natural process that begins at birth, a process that progresses throughout one's life and ends at death (Prakash, 2004).

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