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Investigation on Geopolymer concrete

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ABSTRACT: - *Geopolymer concrete is the budding unconventional construction material by surrogate of cement concrete, due to the ecological effluence cement is replaces by fly ash. Fly ash is the derivative of thermal power plant industry and also it reduces the prerequisite of water, this paper cram of geopolymer concrete in special environmental stipulation and realization of daylight curing on geopolymer concrete. In useful, heat curing is not apt during assembly and is uneconomical. To surmount these difficulties, we wish the daylight curing. The results compared cement concrete and geopolymer concrete under daylight curing. mix up fraction of cement concrete is under the course of action of IS 10262-1982 using M25 grade concrete mix ratio cement: fine aggregate: coarse aggregate (1:1:2.70) and water cement share of 0.40. Geopolymer concrete unite proportion under "Modified strategy of geopolymer concrete" using M25 grade and 12M mix ratio fly ash: fine aggregate: coarse aggregate (1:1.54:3.43) and alkaline solution fly ash part of 0.55. Concrete cubes of size 150X150X150mm were geared up and cured under special environmental stipulation. The compressive potency was founded out at 3, 7,14,21,28 days. From the upshot, the geopolymer concrete attains the compressive strength without hydro-curing. The M25 grade geopolymer solid attains its target strength within 14 days of daylight curing.*

Keywords: Geopolymer Concrete, Fly Ash, Daylight Curing, Mechanical Strength.

1, INTRODUCTION

Ordinary Portland Cement (OPC) becomes an imperative material in the contraption of concrete which act as its ring binder to unite all the aggregate together. However, the consumption of cement causes effluence to the milieu and decline of raw material (limestone). The built-up of OPC requires the fiery of hefty quantities of fuel and putrefaction of limestone, resulting in sizeable emissions of carbon dioxide as such, geopolymer concrete had been introduced to diminish the above problem. In1978, J.Davidovits initiate inorganic polymeric material that can be used to retort with another source material to form a folder the purpose of this binder is recently being alert to swap Ordinary Portland Cement (OPC) scrap in concrete. The ecological issue resulted from OPC fabrication has taken the evolution of polymer research further nowadays. The support to fabricate the eco-friendly concrete can be achieve by restraining the utilization of raw materials and declining the rate of pollutant from particular OPC construction, and withdrawing the cement fraction in concrete. employ of dissipate stuff like fly ash, rice husk ash, and other cement alternate material (CRM) can only proxy cement fraction until certain entitlement. Geopolymer, named after the retort between polymer and geological origin source material, is wished-for to swap all cement portions in tangible as the main binder. The core constituents of geopolymer are alkaline liquor and source objects. Alkaline liquid is usually a mishmash of sodium hydroxide or potassium hydroxide with sodium silicate or potassium silicate. The use of only alkaline hydroxide activator will outcome in squat rate effect compared to those contain soluble silicate. The accumulation of sodium silicate solution to sodium hydroxide solution will increase the reaction rate among alkaline liquid and source material. Source materials used in this research are amalgamation of fly ash. This equipment has measurement for calcium content, which is squat in calcium. soaring calcium content in source material is not suggested since it can thwart the polymerization progression. B.Vijaya Rangan [1] willful the low-calcium fly ash-based geopolymer concrete and he accomplished Low-calcium fly ash

(ASTM Class F) is used as the source material, in its place of the Portland cement, to make concrete. Low-calcium fly ash-based geopolymer concrete has splendid compressive strength and is apt for structural applications. P.Nath and P.K.Sarker [2] have conduct study on "Geopolymer Concrete for ambient Curing Condition" and they fulfilled insertion of slag in the fly ash based gpc mixture decrease the situation time and augmented the compressive strength. calculation slag up to 30% of entire binder achieve compressive potency up to 55MPa at 28 days. With augment of alkaline activator solution in the mix from 35% to 45% of entire binder, the setting time improved and compressive strength diminish. Slump of unsullied concrete also amplified with the amplify of alkaline solution in the mixture. Djwantoro Hardjito et.al [3], accomplished the elevated concentration (in terms of molar) sodium hydroxide solution consequences in the higher compressive strength of geopolymer concrete privileged the ratio of sodium- silicate- to – sodium hydroxide liquid ratio by mass, upper is the compressive strength of geopolymer concrete. N A Lioyd and B V Rangan [4], conduct cram on Geopolymer solid with Fly ash Geopolymer concrete consequences from the retort of a source material that is affluent in silica and alumina with alkaline liquid. A summing up of the wide-ranging studies conducted on fly ash based geopolymer concrete is accessible. The paper also include brief niceties of some recent application of geopolymer concrete. Based on the cram they proposed mix proportion and manner of curing of geopolymer concrete. It is concluded from the above study to study the effect on the rest epoch before daylight curing, scenery up of curing specimens functional to the geopolymer concrete. To scrutinize the and hardened properties of fly ash-based geopolymer concrete, mainly its compressive strength. Longer curing time give elevated compressive strength with 70°C.The compressive strength of the geopolymer concrete is amplified with the escalating of concentration of NaOH.

2, MATERIALS AND MIX PROPORTIONS

2.1 Fly Ash

Fly ash consists of daintily at odds ashes fashioned by pulverized coal in thermal power stations. The chemical opus depends on the mineral opus of the coal gangue (the inorganic part of the coal). The fly ash was obtaining from Thermal Power posting Tamilnadu, India. The properties of fly ash are given in table 1.

Table -1

Properties of Fly Ash

Properties	Results
Specific Gravity	2.82
Fineness modulus	1.375
Specific surface area	310 m2/kg
Density	1.4 kg/m3

2.2. Aggregates

Local aggregates, comprising 20 mm, 14 mm and 7 mm coarse aggregates and fine aggregates, in soaking wet surface dry prerequisite, were used. The coarse aggregates were firmed granite-type aggregates and the fine aggregate was fine sand. The property of coarse aggregate is given in table 2.

Table - 2

The Properties of Aggregates

Aggregates	Specific Gravity	Fineness modulus
Coarse aggregate	2.96	6.00
Fine aggregate	2.36	2.80

2.3. Cement

Cement is a binder or a core that set and harden and can bind other materials collectively. The specific gravity of cement is 3.14.

2.4. Alkaline Liquid

The alkaline liquid used was an amalgamation of sodium silicate solution and sodium hydroxide solution. The sodium silicate solution (Na2O= 13.7%, SiO2=29.4%, and water=55.9% by mass) was purchase from a neighbouring supplier in massiveness the sodium hydroxide (NaOH) in flakes or pellets from with 97%-98% spotlessness was also purchase from a local purveyor in bulk. The NaOH solids were dissolve in water to make the solution.

2.5. Super Plasticizer

A commercially available sulphonated naphthalene formaldehyde based fabulous plasticizer (CONPLAST SP 430) was used as chemical admixture to augment the work gift of the concrete. Colour: Brown; Type: liquid; Specific gravity: 1.22-1.225 @ 300˚C.

2.6. Mix Design for Geopolymer Concrete

According to bespoke course of action of geo polymer mix proportion was arrived [5]. The geopolymer mix part becomes 1:1.54:3.43.

Table - 3

Mix Proportion for GCP 12m

2.7. Mix Design for Cement Concrete

Materials	Mass(kg/m3)
Coarse aggregate	*1276.8*
Fine aggregate	*547.20*
fly ash	*371.6*
Sodium silicate solution	*122.628*
Sodium Hydroxide solution	*81.75*
Superplasticizer	*1.5 % from fly ash*

According to IS 10262-1985 [6] the mix proportion for M25 grade of concrete was inwards.

Water	Cement	Fine aggregate	Coarse aggregate
191.6 lit	*76 kg/m3*	*473.11 kg/m3*	*290.74 kg/m3*
0.41	*1*	*1*	*2.70*

ix Proportion for Cc

2.8Casting and Curing

Habitually cube size of 150 × 150 x 150 mm is worn for the cast the specimens. The Moulds are tighten. Then oil is applying on the central of the Mould. Next stride the concrete is filled in three layers in the Mould. Each layer is trampled 25 strokes with the tamp rod. Then the shell is completed. The Mould is left to arid in air for 24 hours. For geopolymer concrete, after 48 hours of aeration, the moulds are impassive. Then the concrete is placed directly in the sunlight for the essential number of days. For predictable concrete, after 24 hours of aeration, the moulds are impassive. Then the concrete is positioned in the curing tank for the required number of days.

3, RESULTS AND DISCUSSION

3.1. Compressive Strength Test

The outcome obtains from compressive strength analysis demonstrate polymeric method in geopolymer concrete with Daylight curing dealing. The specimen of geopolymer was hardened in the period of 3,7,14,21,28 days. The typical predictable concrete was casted for the grade M25 and the specimens are wrapped up in the hose for curing, the specimens of predictable concrete also tested in the period of 3,7,14,21,28 days. The specimens were casted and veteran as per IS: 516-1959.

Table - 5

Compressive Strength of Geopolymer Concrete

Testing days	Compressive strength (N/mm2)
3	*8.77*
7	*20.84*
14	*27.11*
21	*28.44*
28	*37.33*

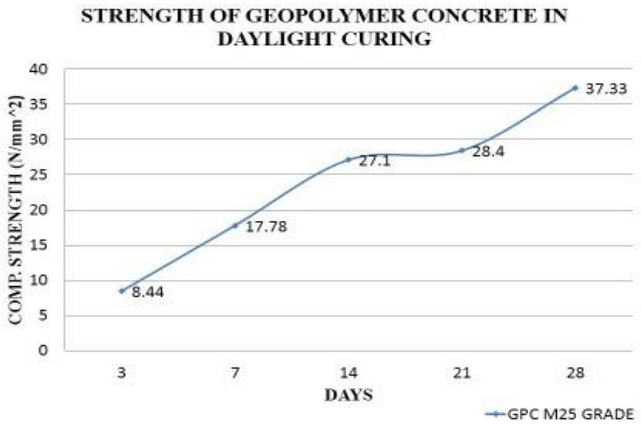

Fig. 1: The Compressive Strength of Geopolymer Concrete (12m)

Table-6

Testing days	Compressive strength (N/mm2)
3	*10.66*
7	*20.88*
14	*30.66*
21	*32.89*
28	*38.22*

Compressive Strength of M25 Grade Concrete

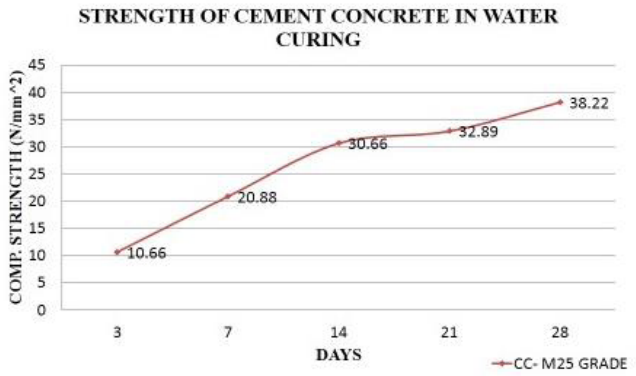

Fig. 2: The Compressive Strength of Cement Concrete with M25 Grade

1). **Comparison of GPC vs. CC**

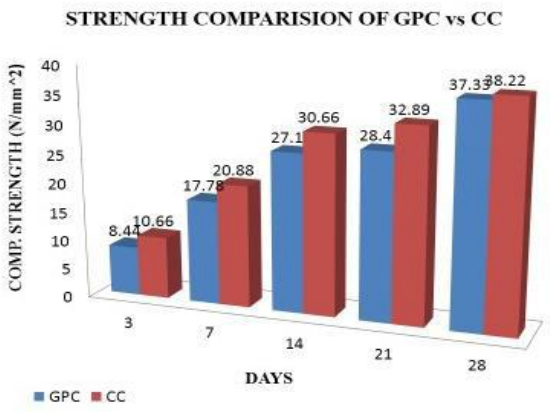

Fig. 3: Strength Comparison of Geopolymer Concrete with Cement Concrete

The consequences obtain from compressive strength exemplify polymeric progression in geopolymer with daylight curing and cement concrete with water curing treatment. The geopolymer concrete specimens are cured under daylight warmth. Figure 3.10 & 3.11 shows the temperature grade of the month February for the province roughly sivakasi. The highest average warmth was 33ºC and the minimum average warmth is 20ºC Table 4.1 & figure 4.1 shows compressive strength of the geopolymer concrete specimen were veteran in unusual days.(3,7,14,21,28).Table 4.2 & figure 4.2 shows compressive strength of the cement concrete with M25 rank specimens were tested in unusual days (3,7,14,21,28).Figure 4.3 Shows strength comparison of geopolymer solid and cement concrete

4, CONCLUSION

From our assessment fallout, we experimental that the geopolymer concrete attains the compressive strength without hydro-curing.

In handy, oven curing is not suitable during construction and is uneconomical. To overcome these difficulties, we fancy the daylight curing. While compare to the hot air oven therapeutic and steam curing, the GPC specimens attains the probable compressive strength under daylight curing and it is further beneficial.

The M25 position geopolymer concrete attain its target strength within 14 days of daylight curing with full abolition of cement and water curing.

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