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Devolopement of Geopolyer Concrete by using Different Ingredient at Ambient Temprature

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***Abstract* – Concrete is the most important aspect in present scenario. All the construction is being done with the help of this binding material. Use of cement is rising on the peak from the last few decades due to enormous demand of construction of mega structures. In addition to that cement is the only material whose demand is increasing day by day in order to meet the needs of mankind. Subsequently the price of cement is also increasing as its demand is increasing profoundly and also it available limited only. Manufacturing of cement results in emission of CO2 and other gases which contribute in global warming and which further contribute in climate change and thus it is one of the most complicated material. Its use cannot stopped but can be limited by using various materials. Compressive strength and water absorption tests were carried out after consequent 7, 28 days respectively.**

***Keywords* – geopolymer concrete , compressive strength, GGBS, fly ash,cement.**

I. INTRODUCTION

Cement is widely used material in the construction of every small structure ranging from a construction of a house to a wild construction of a dam. The demand of cement is rising day by day because of globalisation and to fulfil the needs of human. This demand is resulting in the emission of CO2 and other harmful gases in the atmosphere. The manufacturing of cement is responsible for 6-7% of all harmful gasses emission such as CO2,etc which results in global warming and further added to climate change. Apart from greenhouse gases CO2 contributes 70-72% of global warming.

The reason for such high emission is that the production of 1 tonn of cement results in production of approximately one tonn of CO2 in the atmosphere. There are various substitues available in market but are used very rarely such as rice husk, metakaolin, silica fume, flyash , etc. Indeed these materials cannot replace cement completely but Can be used as good alternative to some extent . This new technology promises for less CO2 emmision , which ultimately helps in reducing global warming. The use of geopolymer concrete will also add on to the strength, durability and resistance to acid attack on concrete structures. Also the use of geopolymer concrete will be affordable and effective. Low calcium flyash based geopolymer concrete uses flyash and alkaline solution (rich in Silica and Alumina) as binding agent. The flyash available in India are mostly low calciumbased which when used in geopolymer concrete shows a good result in terms of compressive strength, fire resistance and chemical attack in previous researches. Geopolymer is an inorganic polymer made up of aluminium and silica. It is an alumina-silicate chain formed by the activation of natural resources having alumina and silica as their ingredients or by-products like flyash, ground granulated blast furnace slag with alkaline solution. Previous researches have significantly shown a good result when a molarity of sodium hydroxide solution in the range of 10M to 16 M with the flyash to alkali activator ratio in the range of 2.5 to 3.3 are used . In the heat curing

II. EXPERIMENTAL STUDY

1. Material used

GGBS – Ground granulated blast furnance slag is used as replacement for cement in this geopolymer concrete. The specific gravity of this material used was 2.88.(IS CODE)

Flyash – This material was waste product and hence it was easily available in industries. We will taking locally available fly ash.

Fine aggragates – The aggreagtes which passes through sieve number 4 (4.75mm) is known as fine aggregates. We have used sand and some crashed stones as fine aggregates.

water absorption for fine aggregates is 8 %

solution absorption for fine aggregates is 10%

Coarse aggregates – The coarse aggregates are those which retain on sieve greater than 4.75mm sieve.

water absorption for 10mm aggregates and 20mm aggregates is 8 % & 0% resp.

solution absorption for 10mm aggregates 20mm aggregates is 3 % & 1% resp.

Sodium hydroxide - The sodium hydroxide solids were obtained in pellet form (3 mm), with a specific gravity of 2.130. It was then dissolved in water to form a solution manually. We make 14M concentration of solution .

2. Sodium silicate solution

The chemical composition of the sodium silicate solution was Na2O = 8%, SiO2= 24% and water = 68% by mass.

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Mix design of Geopolymer concrete

The primary difference between geopolymer concrete and Portland cement concrete is the binder. To form geopolymer paste alkaline activator solution used to react with silicon and aluminium oxides which are present in fly ash and GGBS. This alkaline activator solution helps to bind coarse aggregate and fine aggregate to form geopolymer mix. The fine and coarse aggregate occupy nearly 75% to 80% mass of geopolymer concrete. The fine aggregate was taken as 30% of total aggregate. The density of geopolymer concrete is taken 2400 kg/m3.The workability and strength of concrete are influenced by properties of materials that make geopolymer concrete. Fly ash is replaced by GGBS in the range of 25%, 50% and 75%. The ratio of sodium silicate to sodium hydroxide is 2.5 and is kept constant throughout this study.The ratio of alkaline activator to the fly ash is 0.40 kept constant.

3. Preparation of Alkali Solution

The preparation of solution is done by dissolving sodium hydroxide in water. The concentration of sodium hydroxide changes with molarity. The quantity of sodium hydroxide solution with a concentration of 14M is calculated. The mass of NaOH solids in solution varied depending on the concentration of the solution expressed in terms of molar, M. The NaOH solution with concentration of 14M consisted of 14*40 = 560gm of NaOH solids per liter of the solution, where 40 is the molecular weight of NaOH. The sodium hydroxide is added to the water and stirred about fifteen minutes to get cool down. Then the sodium silicate is added to solution. This solution is used after 24 hours of its preparation.

4. Preparation of Tests Specimens Mixing

The alkaline activator solution is prepared before 24 hours of casting. Initially, all dry materials were mixed properly for three minutes. Alkaline activator solution is added slowly to the mixture. Mixing is done for 5 minutes to get uniform mix

5. Casting

Properly mixed geopolymer concrete is poured immediately into the moulds. Concrete is placed in three layers and tamping is done for each layer by giving more than 25 blows, in order to get fully compacted geopolymer concrete specimens. Then the top surface is well finished. The sizes of the moulds used are cube (150mmx150mmx150mm).

6. Curing

After 24 hours moulds were demoulded and were kept in room temperature for curing. The average temperature recorded during the period of curing was -28+2 ºC. The curing is done for 7 days and 28 day

V.TEST RESULTS

1. Fully replacing the cement :

Table –I:

Designation of Mix	% fly ash	% GGBS	% Cement	Compressive test result @ 7 days
G1	50	50	-	5.4
G2	60	40	-	4.87
G3	80	20	-	2.16
G4	90	10	-	1.57

2. Partially replacing the cement:

Table –II:

Designation of Mix	% fly ash	% GGBS	% Cement	Compressive test result @ 7 days
M1	50	-	50	14.5
M2	60	-	40	11.57
M3	70	-	30	8.87
M4	80	-	20	5.307

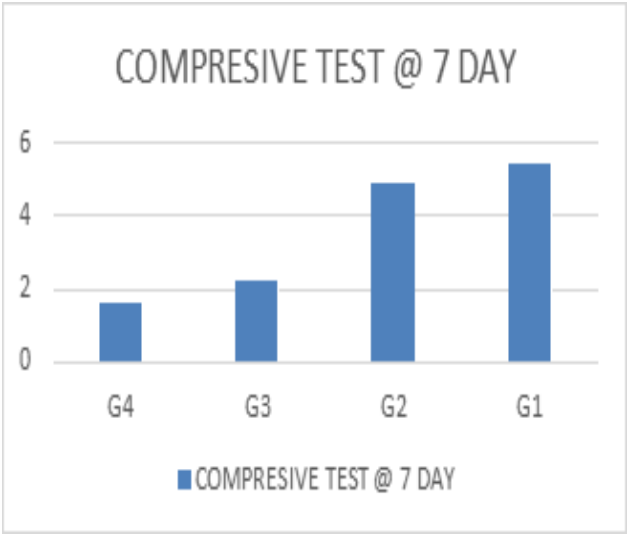

Fig. 1. Chart shows compressive test results at 7days in N/mm2 with fully replacing the cement in concrte.

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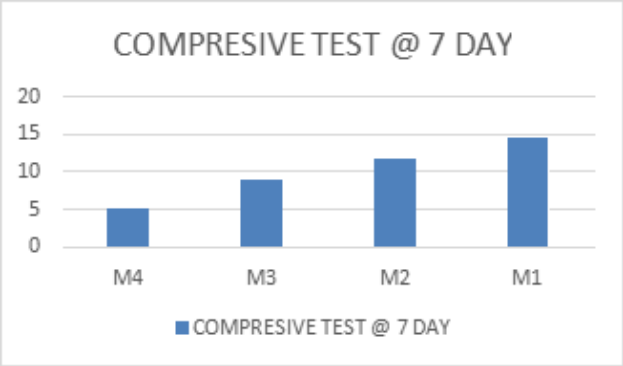

Fig. 2 . Chart shows compressive test results at 7days in N/mm2 with partially replacing the cement in concrte.

VI. CONCLUSION

In this study, the following conclusions are made for geopolymer concrete:

1. We observe there is absence of bonding between fly ash ,aggregates and sand due improper properties of fly ash
2. Excessive carbon content occure in fly ash
3. In fully cement replacing concrte, strength of concrte will be reduce by increasing the fly ash content
4. In partially cement replacing concrte, strength of concrte will be reduce by also increasing the fly ash content
5. The waste material like fly ash and GGBFS can effectively be used as construction material.
6. By effective utilizations of the waste materials like fly ash and GGBFS the strength and durability aspects can be increased and can reduce the air pollution by converting this pollution causing particulate matter in to useful building materials.
7. With the utilization of waste material the Environmental pollution and disposal of waste can effectively be reduced and paves new path for the innovative construction materials & techniques.

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