International Journal for Modern Trends in Science and Technology, 8(08): 75-84, 2022

ISSN: 2455-3778 online
DOI: https://doi.org/10.46501/IJMTST0808012
Available online at: http://www.ijmtst.com/vol8issue08.html

Mix proportioning of Geopolymer concrete with recycled coarse aggregate

S Vasudha | P Prashanth

Department of Civil Engineering, JNTUH College of Engineering, Hyderabad, India.

To Cite this Article
S Vasudha and P Prashanth. Mix proportioning of Geopolymer concrete with recycled coarse aggregate. International Journal for Modern Trends in Science and Technology 2022, 8(08), pp. 75-84. https://doi.org/10.46501/IJMTST0808012

Article Info
Received: 06 July 2022; Accepted: 02 August 2022; Published: 08 August 2022.

ABSTRACT

Significantly to green house gas emissions with total emissions because of cement production estimated to be about 1.35billion tons annually. Cement production ends up in approximately 0.8-1tonne of carbon dioxide per tonne of cement, equating to approximately 3% of global total green house emissions. Concrete is that the one in all the foremost consumed resources within the world. With an increased global specialize in environmental concern like warming, sustainable development and recycling; alternatives to traditional concrete are being researched like geo polymer concrete. Geo polymer concrete replaces cement based binder with an alternative binder which contains no cement. one variety of geo polymer binder is that which contains fly-ash activated by alkaline solution of sodium hydroxide and sodium silicate .Utilizing recycled concrete waste from construction and demolition sites, that would somewhat be disposed of into landfill, as a source of aggregate offers a possible environmental and economic benefit.

Environmental concerns: Global warming and global climate change are increasingly important issues, with many government observing other ways to scale back green house gas emission to assist fulfill their obligations under the kyoto protocol. Carbon dioxide is one in every of the foremost detrimental green house gases with 65% of worldwide warming caused by carbonic acid gas Cement contributes

KEYWORDS: geo polymer, fly ash, recycled concrete aggregate, compressive strength .

1. INTRODUCTION

Nowadays, increase in people's attention on the conservation of natural resources and minimization of environment depletion has led to look at the alternatives to accustomed construction material. Currently ordinary portland cement based concrete is the leading construction material all across the world ,with the cement usage being 4.0billion tons per annum and growth rate being 4%per annum(Mineral commodities summary,2014).The major problem associated with the portland cement are its production, Which is energy consuming and more significantly it releases very high volume of carbon dioxide into the atmosphere. At the same time disposal of industrial wastes such as fly-ash ground granulated blast furnace slag, mine waste red mud etc, has become a big problem, it requires large areas of useful land and also has huge impact on the environment. Therefore, the need is emanated from further investigation into safe waste disposal and investigation into alternative to cement products with

reduced environmental impacts. In these circumstances geo polymer concrete is found to be one of the better alternatives in terms of reducing the global warming, as it can reduce the co_2 emissions caused by cement industries by about 80%(Gartner,2004).Geo polymer concrete is a sustainable material which not only uses industrial wastes such as fly-ash effectively but also serve as a better alternative to ordinary portland cement concrete(McLellan et al,2011).From the past decade or so geo polymer concrete is certainly emerges as a novel construction material and has a huge potential to become a prominent construction product of good environmental sustainability (Chindaprasart and chalee,2014 sun et al,2013).Geo polymer concrete is a new form of concrete which is produced by the alkali activation of the material rich in alumino silicates(Davidovids,1991).Geo polymers binders can be produced from variety of natural materials and industrial byproducts -like meta kaoline, fly-ash, GGBS, red mud ,mine waste etc(Fatten et al,2013;rahimah et al,2015)of these fly-ashes widely used source material due to its low cast ,abundance availability and greater potential for making geo polymers(Xu and deventer ,2000).

The alkaline activator solution mainly consists of soluble alkalies that are usually of sodium or potassium based. Sodium hydroxide (NaOH)in combination with sodium silicate(Na_2sio_3)is the commonly used alkaline activator to develop GPC(Kong and Sanjayan,2008).The common way to develop GPC is to dry mix the solid constituents of 3 min followed by addition of liquid constituents of the mixture and wet mixing for another 4min(Hardzato and rangan,2005),but Rattansak and Chindaprasirt(2009)noticed that mixing sequence has an effect on geo polymerization and final compression strength of the geo polymers .Also ,it has been reported that molarity of NaOH solution influences the leaching behaviour of aluminates and silicates from fly-ash.

Construction embankments, as a backfill material, and as a sub-base material. Fly ash is a by-product of electricity generating plant using coal as fuel. During combustion of powdered coal in modern power plants, as coal passes through the high temperature zone in the furnaces, the volatile matter and carbon are burned off, whereas most mineral impurities, such as clay ,quartz and feldspar, will melt at high temperature.

In 1978 , Davidovits proposed that binders could be proposed by a polymeric reaction of alkaline liquids with the silicon and the aluminium in source materials of geological origin or by-product material such as fly-ash and rice-husk ash. He termed these binders as geo polymers .Palomo et al suggested that pozolans such as blast furnace slag might be activated using alkaline liquids to form a binder and hence totally replaced the use of OPC in concrete. In this scheme, the main contents to be activated are silicon and calcium in the blast furnace slag.

In this respect, the geo polymer technology proposed by davidovits shows considerable promise for application in concrete industry as an alternative binder to the portland cement and has generated lot of interest among engineers.

1.1.WHAT IS GEOPOLYMER CONCRETE:

Geo polymer concrete might be a form of concrete that is made by reactive aluminate and silicate baring materials with a costic activator. Commonly, waste material such as fly-ash or slag from iron and metal production are used, which helps end in cleaner environment.

emissions it produces more durable infrastructure capable of design life measured in many years. Conserve many thousands of acres currently used for disposal of coal combustion of products it protect acquifiers and surface bodies of water via the elimination of fly-ash disposal sites. It has greater corrosion resistance Its setting mechanism depends on polymerization.

1.1.1. Constituents of geo polymer concrete:

The following of the constituents of geo polymer concrete.

- Fly ash-rich in Silica and Aluminium.
- Sodium Hydroxide or Potassium Hydroxide
- Sodium Silicate and Potassium Silicate

1.2.1. NECESSITY OF GEOPOLYMER CONCRETE:

Construction is one in all the fast growing fields worldwide. As per the current world statistics, every year around 2,60,00,000 loads of cement is required .This quantity are increased by 25% within a span of another 10 years. Since the limestone is that the main source material for the normal ordinary portland cement an acute shortage of limestone may come after 25-50 years. Moreover while producing one tone of cement, approximately 1 of carbon dioxide are emitted to the

atmosphere, which is may be a major threat for the environment. In addition to the above huge quantity of energy is additionally required for the production of cement hence it is most essential to seek an alternate binder.

The cement production generated carbon dioxide which pollutes atmosphere. The thermal industry produces a waste called fly-ash which is just dumped on earth , occupies larges areas. The waste water from industry is discharged into the bottom which contaminates the ground water. By producing Geo polymer Concrete all the above mentioned issues shall be solved by re arranging them.

Waste fly-ash from thermal industry + waste water from chemical refineries = Geo polymer Concrete. Since Geo polymer Concrete doesn't use any cement, the production of cement shall be reduced and hence the pollution of atmosphere by the emission of carbon dioxide shall even be minimized.

1.2. MATERIALS USED FOR GEOPOLYMERS CONCRETE:

The material used for creating Geo polymer Concrete specimens are low calcium dry fly-ash because the source material, GGBS, aggregates and alkaline liquids.

There are two main constituents of GPC, namely the source and therefore the alkaline liquids. The source for geo polymers supported alumino-silicate should be in rich in silicon(si) and aluminium(Al).These can be natural minerals like kaolinite ,clays, micas, andalousite, spinel,etc whose emperical formula contains si, Al, oxygen(o) (Davidovits,1988c.).Alternatively,by-product ,materials like fly ash, silica fume, slag, rise-husk ash, red mud ,etc may be used as source. The choice of the source for creating geo polymer depends on factors like availability, cost, and sort of application and specific demand of the tip users.

The alkaline liquids are from soluble alkali metals that are usually sodium or potassium based.

1.3 .SOURCE MATERIALS:

❖ **FLY-ASH:**

Fly-ash may well be a chic replacement for portland cement in concrete and using it improves strength, segregation and easy of pumping concrete.

The speed of substitution is often specified could be a minimum of 1-11/2 pounds of fly -ash to 1 pound of cement.

Fly-ash particles provide greater workability of the powder portion of the concrete mixture which ends in greater workability of the concrete and a lowering of water requirement of same concrete consistency.

Fly-ash utilized in the study was low calcium dry fly-ash N.T.P.C. Dadri , uttarpradesh. The setting time for Geo polymer rely upon many factors like composition of alkaline solution and ratio of alkaline liquid to fly-ash by mass fly-ash rich in silicate and alumina, hence it reacts with alkaline solution to supply alumina silicate gel that binds aggregates to provide goof concrete.

❖ **GGBS :**

GGBS means the bottom granulated blast furnace slag is by product of the manufacturing of pig iron.

Iron ore, coke and lime-stone are fed into the furnace and also the resulting molten slag floats above the molten iron at a temperature of about 1500^0c-1600^0c.The molten slag contains a composition near to the chemical composition of portland cement.

After the molten iron is tapped off, the remaining molten slag, which consists of mainly siliceous and aluminous residue is that the water-quenched rapidly, leading to the formation of glassy granulate.

This glassy granulate is dried and ground to the desired size, which is understood as ground granulated blast furnace(GGBS).By use of GGBS 80% of co_2 emission may be reduced. At the identical time studies have revealed use GGBS in concrete partial replacement OPC have increased compressive strength, tensile strength, durability and reduce the permeability, embodied energy and price per cubic metric capacity unit. GGBS are going to be impact factor to cut back overall cost of concrete .

Aggregates:

Local aggregates, comprising 10mm coarse aggregates and M-Sand(standard sand) , in saturated surface dry condition, were used. The coarse aggregates were crushed to granite-type aggregates and also the fine aggregate was standard sand. The fineness modulus of combined aggregate was 5.0.

1.3.1. ALKALINE LIQUIDS:

❖ **SODIUM SILICATE:**

sodium silicate is technical and a typical name for a mix of such compounds, chiefly the meta silicate, also called water glass, liquid glass the merchandise has wide selection of uses, including the formulation of cements, passive fire protection, textile and lumber processor, manufacture of refractory ceramics ,as adhesives, and within the production of silica gel.

The commercial product, available in water solution are in solid form, ease of in greenish are blue as a result of the presence of ion-containing impurities. In industry, the varied grades of sodium silicate are characterized b their SiO_2:Na_2O weight ratio.

Sodium silicates are stable in neutral and alkaline solutions. In acidic solutions, the silicate ions react with hydrogen ions to make silicic acids, which tend to decompose into hydrated silicon dioxide gel. The main applications of sodium silicates are in detergents ,papers, water treatment and construction material.

SODIUM HYDROXIDE:

Sodium hydroxide, also called lye and caustic soda, is an inorganic compound with the formula NaOH. It is a white solid ionic compound consisting of sodium cations Na^+ and hydroxide anions OH^-.Its molar mass is 39.997gm/mole. Its boiling point is 1388^0c.Its IUPAC name is Sodium oxidanide.

It is major ingredient in drain and oven cleaners. It is employed in chemical manufacturing, oil refining, hydraulic fracturing , water treatment and metal processing. Exposure to sodium hydroxide solid or solution can cause eye and skin irritation.

1.4. PROPERTIES OF GEO POLYMER CONCRETE:

1.4.1. MECHANICAL PROPERTIES:

Compressive strength of GPC is found up to 70MPa.The concrete gains its compressive strength rapidly and faster than ordinary portland cement concrete.

The concrete strength after 24 hours are found to be more than 25MPa.Compressive strength after 28 days have been found to be 60-70MPa.

1.4.2. OTHER PROPERTIES:

- The drying shrinkage of is way less compared to cement concrete. This makes it well compatible for thick and heavily restrained concrete structural members.
- It has low heat of hydration as compared with cement concrete.
- The fire resistance is considerably better than OPC based concrete.
- This concrete are found to posses very high acid resistance when tested under exposure to 2% and 10% sulfuric acids.

1.5. MIX DESIGN:

Mix Design for Optimum Alkaline Solution to Binder Ratio:

From earlier studies GPC is produced with many combinations of materials viz GGBS, fly-ash& binders. Here a shot is created initially to supply GPC of strength 4MPa using locally available materials. Based on observations made on initial trials, further trials are modified. Initially the density of Geo polymer Concrete is assumed as 2350kg/m^3. The full quantity of aggregates considered is 75%-80% but can be taken from 72%-80% of the whole mass in kg/m^3.

The remaining mass is combination of alkaline solution and binder(Geo polymer paste).Assuming the alkaline solution to binder ratio from 0.17-0.24,masses of alkaline solution and binder in kg/m^3 are obtained. Assuming the Sodium Silicate solution to Sodium Hydroxide solution ratio as 2.5,mass Sodium silicate solution and Sodium Hydroxide solution are obtained(kg/m^3).Assuming the molarity of Sodium Hydroxide solution 8M,the Geo polymer mix is intended.

MIXTURE PROPORTIONS:

An extensive study on the development and the manufacture of low-calcium fly ash based geo polymer concrete were already been reported in several publications.

The mix design for the present study is presented in this below table;Design mix proportion

Material	**Quantity kg/m^3**	**Quantity(150*150*150 mm)**
Fly ash	510kg	200gms
fine aggregate(M-sand)	554kg	267gms
Coarse aggregate	991kg	410gms

Solution NaOH Alkaline Liquid Silicate gel	38.06 kg solids 47.66 lts of water 214.29kg(52% of water)	16gms of solids 20ml of water 85gms (52%of water)
Extra water	15+12=27	12gms

Calculation:

A/b = 0.45

200g each cube →

Alkali activator =0.45*200g

=90g

Ratio: 0.5 1/2 = Na_2sio_3/NaOH →

Na_2sio_3 =1/3*90g=30g

For calculate 6 cubes 1.1 is 10%

= 30*60*1.1 wastage

=198g

NaOH is double = 198g*2

=396g

Cement mortar cube:

200g - cement

600g - sand

In 200g - cement

Replace with GGBS and FLY ASH

GGBS and FLY ASH for 6 cubes

90% 10%

200g*6 cubes*1.1 =1320*0.9 =1320*0.1

(1.1 wastage) =1188g =132g

FLY ASH GGBS

NaOH Gram molecular weight is 40

12M*40=480g for 1 lit of water

Calculate for water and NaOH crystals

480g/1000lit =X/(396-X) = 128.43gm (NaOH crystal)

=268gm

1.6.MANUFACTURING OF TEST SPECIMENS:

- **Preparation of liquids:**

The Sodium hydroxide (NaOH) solids were dissolved in water to create the solution .The mass of NaOH solids in a very solution varied looking on the concentration of the solution expressed in terms of molar M.For instance ,NaOH solution with a concentration of 16M consisted of 18*40=720gms of NaOH solids (in flake or pellet form) per litre of the solution, where 40 is that the relative molecular mass of NaOH.

The mass of NaOH solids was measured as 590gms per kg of NaOH solution of 16M concentration. Similarly, the mass of NaOH solids per kg of the solution for14M concentration was measured as 4040gms.Note that the mass of NaOH solution , and water was the main component.

It's strongly recommended that the sodium hydroxide solution must be prepared for twenty-four hours before se and also if it's exceeds 36 hours it terminate to semi solid liquid state .So the prepared solution must be utilized in time.

The sodium silicate solution and also the sodium hydroxide solution were mixed together a minimum of in some unspecified time in the future before use to arrange the alkaline liquid. One the day of casting of the specimens, the alkaline liquid was mixed along with the super plasticizer and therefore the extra water(if any)to prepare the liquid component of the mixture.

Manufacture of fresh concrete and casting

The fly ash and therefore the aggregates were first mixed together within the 10-litre capacity laboratory concrete pan mixer for about 4minutes.the liquid component of the mixture was then added to the dry materials and also the mixing continued for further about 5 minutes to manufacture the fresh concrete.

The fresh concrete was cast into the moulds. For compaction of the specimens, each layer was given 60to80 manual strokes employing a rodding bar, and then vibrated for 12 to fifteen seconds on a vibrating table.

Fresh Geo polymer concrete

Compaction of concrete specimens

Compaction of cubes

1.6.1. CURING AND TESTING OF SPECIMEN:

CURING:

The curing process of Geo polymer concrete (GPC)differentiates it from conventional concrete. Unlike conventional concrete water curing steam curing and dry curing is mostly accustomed activate the chemical reaction that takes place in Geo polymer matrix.

Types of curing:

- Heat/oven curing
- Steam curing

HEAT/OVEN CURING:

within the Geo polymerization process of Geo polymer concrete, water is given out during the reaction and this water tends to vaporize because the specimens were subjected to heat during the curing process(Hardjito and rangan,2005).Similarly, the drain shrinkage becomes negligible because of the little quantity of water within the pores of the rigid specimens. Several efforts (Perera et al.,2007;kani and Allahverdi,2009;Rovnanik,2010;Heah et al.,2011)were dispensed for determining the influence of curing conditions on the physical and mechanical properties Geo polymer paste and Concrete.

For near perfect Geo polymerization the curing temperatures were observed between 40^0c-85^0c.They also observed that longer duration curing leads to better strength but the rise of strength is negligible when curing time was extended beyond 24 hours.

After casting the test specimens were covered with vaccum bagging film in minimize the water evaporation during curing at an elevated temperature .Two sorts of heat curing were utilized in this study for dry curing the test specimens were cured within the oven

STEAM CURING:

There's a limited experimental work on steam curing of Geo polymer concrete and among the few research studies, the work of found that strength of Geo polymer concrete improves at higher temperature for steam curing, while for water curing, the strength obtained after 28 days was but the characteristic strength thanks to low development at lower temperature .Moreover, Pangdaeng et al.(2014) have reported that addition of OPC in high calcium fly ash enhances the attributes of Geo polymer concrete cure in steam and thus facilitated the hydration process thanks to the presence of OPC within the binder and thereby yields improvement in compressive strength. Similar work of Yunsheng et al.,(2007) revealed that condition of curing have significance influence on the strength of slag based Geo polymer concrete.

For stream curing the test specimens were cured in the steam curing chamber. Based on studies, the specimens were heat cured at60^0c for twenty-four hours

After the curing period , the test specimens were left in the moulds for atleast 6 hours so as to avoid a drastic change within the environmental conditions.

After demoulding, the specimens were left to air-dry within the laboratory until the day of test. Some series of specimens weren't heat-cure, but left in ambient conditions at temperature in the laboratory.

DRY (oven) curing

Steam curing

TESTING:

The test specimens for acid resistance test on Geo polymer concrete are 400*200*150mm blocks for the change in mass test. To study the results of exposure to acidic environment, specimens are immersed in 3% solution of sulfuric acid of 98% purity.

CHEMICAL TEST:

Sulphate resistance test:

Test specimens:

Test specimens for compressive strength and alter in mass test were 70*70mmcubes.Four specimens were prepared for every compressive strength and alter in mass test.

Specimens for sulphate resistance test

TEST PARAMETERS:

The sulphate resistance of geo polymer concrete was evaluated by measuring the residual compressive strength, visual appearance change in mass after sulphate exposure the test parameters for sulphate resistance are presented in below table only mixture -1 was used and also the test specimens were dry cured at 60^0c for twenty-four hours.Test parameters for sulphate resistance test

Parameter to study	**Specimens (28 cubes)**	**Test condition of specimen**	**Exposure peroid(in weeks)**
Change in compressive strength	Cubes 70*70mm	SSD* Dry	4-8 weeks
Change in mass	Cubes 70*70mm	SSD*	4-8 weeks

*saturated-surface-dry

Tes1.7.1t procedure:

The test procedure for sulphate resistance test was developed by modifying the related standards for normal portland cement and concrete. The test specimens were immersed in sulfate solution on the 48 hours after casting.

Sulphate solution:

Sodium sulphate (Na_2SO4) solution with 10% concentration was used because the standard exposure solution for all tests. The specimens were immersed within the sulphate solution in an exceedingly container; the volume proportion of sulfate solution to specimens was four to 1 .In order to take care of maintain the concentration of the answer was replaced every week.

Change in compressive strength:

The change in compressive strength after sulphate exposure resolved by testing the compressive strength of the specimens after selected periods of exposure. The specimens were tested either in SSD(saturated-surface-dry) condition or during a dry condition .For the SSD condition , the specimens were removed from the sulphate solutions, wiped clean, and tested immediately in compression. For the dry conditions ,the specimens were off from the sulphate solution, left to air-dry for per week within the laboratory ambient condition, and then loaded in compression

CHANGE IN MASS:

Change in mass specimens was measured after selected periods of exposure up to 4-8 weeks. On the day the mass was measured , the specimens were aloof from the sulphate solution, and cleaned before the measurement. Mass measurements were done employing a laboratory scale, The specimens were returned to the sulphate solution container immediately after the measurement was done.

1.6.2. VISUAL APPERANCE:

The visual appearance of test specimens after different exposures are shown in figure ,it can be seen that the visual appearance of the test specimens after soaking in sodium chloride solutions up to the one month revealed that there was no change within the appearance of the specimens compared to the conditions before they were exposed ,there was no sign of surface erosion ,cracking or spoiling on the specimens .The specimens soaked in H2O also showed no change within the visual appearance.

Visual appearance of geo polymer concrete specimens after one month of exposure.

CHANGE IN MASS:

Changes in mass for chloride samples

Sample name	Weight (before soaking)	Weight (after Soaking for 4 weeks)	Weight (after soaking for 8 weeks)
M5a	757gms	764gms	772gms
M5b	754gms	759gms	768gms
M5c	760gms	768gms	775gms
M5d	763gms	766gms	774gms

Changes in compressive strength:

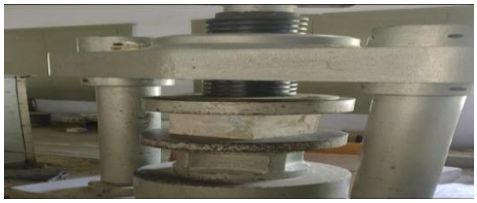
The test specimens soaked in liquids were aloof from the immersion container, wiped clean, and tested after 4 hours in saturated-surface-dry (SSD) condition. The test results for various exposure periods are presented above figure.

Sample name	Strength(before soaking)	Strength(after soaking for 4 weeks)	Strength(after soaking for 8 weeks)
M5a	43.7MP	43.3MPa	43MPa
M5b	43.2MP	42.8MPa	42.7MPa
M5c	42.2MP	42MPa	42MPa
M5d	41.5MP	41.1MPa	41MPa

COMPRESSIVE STRENGTH TEST:

Compressive strength test are meted out on a 100*200mm cylindrical specimen employing a compression testing machine. The specimens were cured at an ambient temperature and in oven at 600c.The result showed that a compressive strength of up to 45MPa may be obtained from the this mixture of GPC

The compressive strength of GEO POLYMER concrete is about 1.5times quite that of the compressive strength with the normal portland cement concrete ,for the identical mix.



Compressive strength testing of geo polymer concrete.

2. APPLICATIONS OF GPC:

- In the short term , there is an oversized potential for Geo polymer concrete applications for bridges, such as precast structural elements and decks also as structural retrofits using Geo polymer-fiber composites.
- Other potential near-term applications precast pavers and slabs for paving, bricks and precast pipes.
- Pre -cast concrete products like railway sleepers , electric power poles ,parking ties etc.
- Future use in major projects.

3. SCOPE IN INDIA:

From the available literatures on Geo polymer and supported the findings during this research, following works are suggested for further research.

- Development of high strength Geo polymer concrete manufactured with silicates and hydroxides of potassium and also the effects of upper strength within the flexural behavior of Geo polymer concrete beams.
- Investigations on the effect of varying percentage of reinforcement on flexural and shear capacity on reinforced Geo polymer concrete beams.
- Shear strengthening of reinforced Geo polymer concrete beams with fibre wrapping.
- All the works executed by hydro thermal mode of curing shall be experimented with dry-heat curing mode.

4. ADVANTAGES AND DISADVANTAGES OF GPC:

ADVANTAGES:

- Cutting the world's carbon.
- The price of ash is low.
- Better compressive strength.
- Fire proof.

- Low permeability.
- Eco-friendly.

DISADVANTAGES:

The following are the disadvantages;

- Bringing the underside material fly ash to the specified location.
- High cost for the alkaline solution.

5. RESULT:

Joseph Davidois found that fly-ash reacted with alkaline solution and formed a binding material. Hadijito&Rangan observed that higher concentration of sodium hydroxide resulted higher compressive strength and better the ratio of sodium silicate-to-sodium hydroxide liquid ratio by mass, showed higher compressive strength of Geo polymer concrete .They handled the Geo polymer concrete up to 120 minutes with none any sign of setting and with none any degradation within the compressive strength, resulted little or no drying shrinkage and low creep.

Rajiwala Etal noticed that the compressive strength of GPC increased over controlled concrete by 1.5 times (M-25 achieves M-45)Split enduringness of GPC increased over controlled concrete by 1.45 times and flexural strength of GPC increased over controlled concrete by 1.6 times. Muhd Fadhil Nuruddin etal recommended that cast in-situ application in Geo polymer concrete could be a viable one. Douglas etal successfully used geo polymer concrete in waste stabilization. Geo polymer concrete immobilized chemical toxins and reduced leachate level concentrations.

6. CONCLUSION:

1. There's no substantial gain within the compressive strength of heat-cured fly ash based geo polymer concrete with age.
2. Fly ash based geo polymer concrete cured within the laboratory ambient conditions gains compressive strength with age. The 48hours the compressive strength of ambient -cured specimens depends on the common ambient temperature during the first week after casting; higher average ambient temperature higher is that the compressive strength.
3. The test results demonstrate that heat-cured fly ash based geo polymer concrete as a superb resistance to chloride and sulphate attack. There is no damage to the surface of test specimens after exposure to sodium chloride and sulphate solution up to 1 month. There aren't any significant changes within the mass and exposure to compressive strength of test specimen after various periods of exposure to up to month.
4. The U.P.V. result showed concrete quality of differently treated cubes within which fire resistance and sulfuric acid specimen lied in poor to very poor category.
5. The XRD showed the assorted chemicals at various angles.
6. The D.S.C showed the decomposition of various chemicals at different temperatures.
7. Specimens showed deteriorated corroded surface when observed under an optical microscope which progresses with time.
8. Those specimens were fully dealkalized, it still had substantial residual compressive strength conforming its high resistance.

7. ACKNOWLEDGEMENT

We would like to express our deep sense of gratitude to the professors Dr.P. Dasharatham, JNTUH who are very cooperative and their guidance was invaluable & inspiring in doing this research paper.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

REFERENCES

[1] Alawode,0.,Idowu,0.1.,2011.Effects of water-cement ratios on the compressive strength and workability of concrete and laterite concrete mixes.Pac.J.Sci.Technol.12(2),99-105.

[2] Alabitar,M.,Visintin,P.,Ali,M.S.M.,Dreeshler,M.,2015.Assessing behaviour of fresh and hardened Geo polymer concrete mixed with class-F ash.KSCEJ.Civ.Eng.Struct Eng.19(5),1445-1455.

[3] Amol,A.P.,Chore,h.s.,Dodeb,P.A.,2014.Effect of curing condition on strength of Geo polymer concrete.Adv.Concr.Constr.2(1),29-37.

[4] Anuradha,R.,Sreevidya,V.,Venkatasubramani,R.,Rangan,B.V.,20 2.Modified guidelines for Geo polymer concrete mix design using Indian Standard. Asian J.Civ.Eng.Build.Hous.13(3),353-364.

[5] Arioz,O.E.,Kockar,O.M.,2013.Mechanical and microstructural properties of fly-ash based geo polymers .Int.J.Chem.Eng.Appl.4(6),397-400.

[6] ASTM C 143,2005.Standard Test Method for Slump of Cement Concrete. Annual Book of ASTM Standards.

[7] Bakiri,A,M,M,A.,Kamarudin,H.,Bnhussian,M.,Rafiza,A.R.,Zarina ,Y.,2012.Effect of Na2SiO3/NaOH ratios and NaOH molarities on compressive strength of fly-ash based Geo polymer concrete under marine site. Constr.Build.Mater 63,303-310.

[8] Davidovits,J.,1991Geo polymer: inorganic polymer new material .J.,Therm.Anal. 37,1633-1656.

[9] Ferdous M.W.,Kayali,O.,Khennane,A.,2013.A detailed procedure of mix design for fly-ash based geo polymer concrete. In Fourth Asia-Pacific Conference on FRP in structures;Australia,11-13 December.

[10] IS10262,2009.Recommended Guidelines for concrete Mix proportioning, Bureau of Indian standards, New Delhi.