STUDIES ON STRENGTH OF GEO-POLYMER CONCRETE BY USING FLYASH AND GRANITE WASTE

R.SOWMIYA[1], S.ANANDKUMAR[2]

P.G. Student, Department of Civil Engineering, Sengunthar Engineering College, Tiruchengode, TamilNadu, India[1]

Assistant Professor, Department of Civil Engineering, Sengunthar Engineering College, Tiruchengode, TamilNadu, India[2]

ABSTRACT

The major problem the world is facing today is the environmental pollution. In the construction industry main lythe production of Portland cement will causes the emission of pollutants results in environmental pollution. We can reduce the pollution effect on environment, by increasing theusageofindustrialby-productsinourconstructionindustry.Geopolymerconcreteissucha one and in the present study, to produce the geo-polymer concrete the Portland cement is fully replaced with fly ash and the fine aggregate is replaced with granite dust and alkaline liquids are used for the binding of materials. The binder is the only difference to the ordinary Portland cement concrete. To activate the Silicon and Aluminium content in fly ash, a combination of sodium hydroxide solution and sodium silicate solution was used. Hence concrete with no Portland cement. The alkaline liquids used in this study for the polymerization are the solutions of Sodium hydroxide (NaOH) and sodium silicate (Na_2Sio_3). Different molarities of sodium hydroxide solution i.e. 8M, 12M and 14M are taken to prepare different mixes. And the compressive strength is calculated for each of the mix. The Geo polymer concrete specimens are tested for their compressive strength at the age of 7days, mixes of varying sodium hydroxide molarities i.e.8M,12M and 14M are prepared and they are cured by direct sun-light and strengths are calculated for 7 days.

KEYWORDS**:** *Geo polymer concrete, Fly ash, NaOH, Na_2Sio_3, Curing*

INTRODUCTION

The main ingredient to produce concrete is Portland cement. On the other side global warming and environmental pollution are the biggest menace to the human race on this planet today.

The production of cement means the production of pollution because of the emission of CO_2 during its production.

The cement industry contributes about 5% of total global carbon dioxide emissions.

And also, the cement is manufactured by using the raw materials such as lime stone, clay and

ISSN (Print): 2204-0595
ISSN (Online): 2203-1731

other minerals.

Granite of these raw materials is also causes environmental degradation. To produce 1 ton of cement, about 1.6 tons of raw materials are required and the time taken to form the lime stone is much longer than the rate at which humans use it.

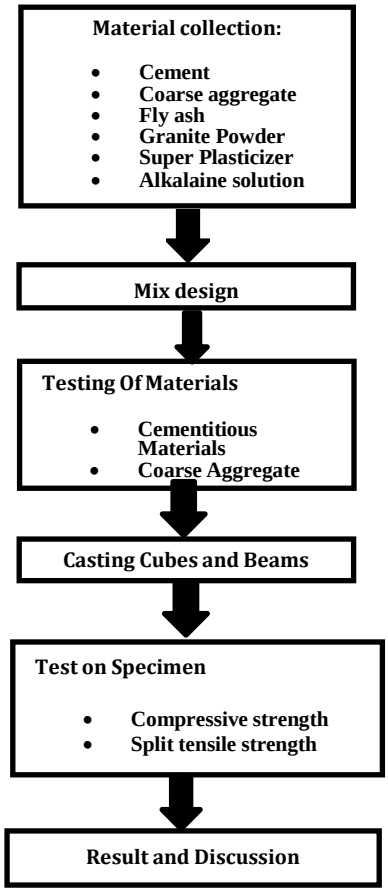
But the demand of concrete is increasing day by day for its ease of preparing and fabricating in all sorts of convenient shapes.

So to overcome this problem, the concrete to be used should be environmental friendly.

SCOPE OF THE PROJECT

- Investigations on the effect of varying percentage of reinforcement on flexural and shear capacity of reinforced Geo-polymer concrete beams.
- Development of high strength Geo-Polymer concrete manufactured with silicates and hydroxides strength in the flexural behavior of Geo-polymer concrete beams.
- To find out the effective utilization of these waste materials in the construction industries.
- To study the mechanical properties of geopolymer concrete specimens.

METHODOLOGY



IV MATERIAL SPECIFICATION

TABLE 4.1 Properties of cement

Type of geo-polymer	Specific gravity	Initial setting time
OPC-53 grade	3.15	30 minutes

TABLE 4.2 Coarse aggregate

Size of aggregate	Speific gravity	Fineness
Passing through 20mm sieve	2.70	1.5
Passing through 4.75mm sieve	2.64	II

V EXPERIMENTAL INVESTIGATION

MIX PROPORTION:

TABLE 5.1 Mix proportion

Name Of the Mixture	Fly ash (kg/m^3)	Granite Dust (kg/m^3)	Coarse Aggregate (kg/m3)		Sodium Silicate solution (kg/m^3)	Sodium Hydroxide solution (kg/m^3)	Super- Plasticizer (kg/m^3)
			20mm	12mm			
GP1	288	768	400	600	137.15	54.8	7.2
GP2	288	768	400	600	137.15	54.8	7.2
GP3	288	768	400	600	137.15	54.8	7.2

COMPRESSIVE STRENGTH:

Compressive strength is the capacity of a material or structure to withstand axially directed pushing forces. Cubes of 150mm×150mm×150mm were casted and compressive strength test was conducted on specimens at 7 days. To conduct the test the specimens are placed in a compression testing machine and the load is applied to the cube and the load at failure is noted as failureload.

TABLE 5.2 Compressive test of cube

Name of the mix	Compressive strength in N/mm^2 of specimens Cured by		
	7days	14days	28days
CC	17.6	22.52	27.5
GP1	18.23	23.43	28
GP2	19.26	25.20	29.36
GP3	20.35	26.40	30.4

SPLIT TENSILE TEST:

TABLE 5.3Split tensile test reading

Name of the mix	Split Tensile Test in N/mm^2 of specimens Cured by		
	7days	14days	28days
CC	1.6	2.27	2.76
GP1	1.9	2.36	2.82
GP2	2.5	2.48	2.89
GP3	2.8	2.55	2.95

WORKABILITY TEST:

Table 5.4 Workability test reading

S.NO	Name of the Mix	Workability in mm
1	CC	67
2	GP1	78
3	GP1	83
4	GP1	94

ISSN (Print): 2204-0595
ISSN (Online): 2203-1731

VI CONCLUSION

- Higher concentration (in terms of molar) of sodium hydroxide solution results in higher compressive strength of fly ash & granite dust based geo-polymer concrete.
- Longer curing time, in the range of 4 to 96 hours (4 days), produces higher compressive strength of fly ash &quarry dust based geo-polymer concrete. However, the increase in strength beyond 24 hours is not significant.
- The fresh fly ash-based geo-polymer concrete is easily handled up to 120 minutes without any sign of setting and without any degradation in the compressive strength.
- The mix GP3 gives higher compressive strength, as it has high molarity of NaOH
- We Observe that the compressive strength is increased with the increase in the molarity of the sodium hydroxide
- After three days of curing the increase the compressive strength is not sufficient
- The geo-polymer concrete shall be effeviely used for the beam column junction of the reinforced concrete structure
- Geo-polymer concrete shall also be used in the Infrastructure works.

REFERENCES

1. P. Pavani , A. Roopa , Dr. J. Guru Jawahar , C. Sreenivasulu Experimental Study on Geo-polymer Concrete Using Granite Slurry Powder As Partial Replacement of Fine Aggregate International Journal of Recent Trends in Engineering & Research (IJRTER) pp3033-3035Volume 04, Issue 06; June -2018.
2. M.Manikandan, Dr. T. Felixkala Experimental study on properties of granite waste in self compacting high Performance International Journal of Civil Engineering and Technology (IJCIET) Volume 8, Issue 4, April 2017, pp.2246–2254.
3. C.Sreenivasulu, J. Guru Jawahar, M. Vijaya Sekhar Reddy and D. Pavan Kumar Effect of fine aggregate blending on short-term mechanical properties of geopolymer Asian journal of civil engineering (bhrc) vol. 17, no. 1 (2016) pp127-135.
4. Allam M. E., Bakhoum E. S., Ezz H. and Garas G. L. influence of using granite waste on the mechanical properties of green concrete arpn journal of engineering and applied sciencespp2808-2811.
5. Palomoa, M.W. Grutzeckb,*, M.T. Blancoa Alkali-activated fly ashes A cement for the future, Cement and Concrete Research 29(1999) pp1323–1329.
6. Dr. I.R. Mithanthaya Effect of Glass Powder and GGBS on Strength of Fly Ash Based Geopolymer international journal of engineering trends and technology (ijett) PP66-71.
7. Eliyas Basha Shaik, Sreenivasulu Reddy Geo Polymer Concrete with the

ISSN (Print): 2204-0595
ISSN (Online): 2203-1731

Replacement of Granite Aggregate as Fine Aggregate International Journal of Science andResearch(IJSR)IndexCopernicusValue(2013):6.14|ImpactFactor(2013): 4.438 pp19-24

8. Prof. U.R Kawade ,Mr. Vaibhav Kharde Geopolymer concrete & Conventional concrete with partially replacement of granite waste a fine Aggregate- Review International Journal of Recent Trends in Engineering & Research (IJRTER) Volume 04, Issue 07; July - 2018 pp 45-48.
9. M. Nazeer, R. Arun Kumar Strength Studies on Metakaolin Blended High- Volume Fly Ash Concrete International Journal of Engineering and Advanced Technology (IJEAT), Volume-3Issue-6, August2014 pp176-179.
10. Collins, M. P., D. Mitchell, J.G MacGregor (1993) Structural Design Considerations for High Strength Concrete, ACI Concrete International15 (5):N27-34 pp11-13.
11. Dr.G.Prince Arul raj Mr.A.Adin and Mr.T.Suresh Kannan granite powder concrete IRACST – Engineering Science and Technology: An International Journal (ESTIJ), Vol.3, No.1, February 2013pp193-198.
12. Rania A. Hamza, Salah El-Haggar, and Safwan Khedr Marble and Granite Waste: Characterization and Utilization in Concrete Bricks International Journal of Bioscience, Biochemistry and Bioinformatics, Vol. 1, No. 4, November 2011 pp286-291
13. B. Vijaya Rangan Fly Ash-Based Geopolymer Concrete Proceedings of the International Workshop on Geopolymer Cement and Concrete, Allied Publishers Private Limited, Mumbai, India,December2010,pp68-106
14. Robina Kouser Tabassum, Ankush Khadwal A Brief Review on Geopolymer Concrete Vol. 2, Issue 3 (July - Sept. 2015)) international journal of advanced research in education technology (IJARET)pp70-73
15. Triwulan, Prasma Wigestika and Januarti Jaya Ekaputri addition of super plasticizer on geopolymer concrete vol. 11, no. 24, December 2016asian research publishing network (ARPN)pp14556-14562
16. Mr. K. Madhan Gopal Mr. B. Naga Kiran Investigation on Behavior of Fly Ash Based Geopolymer Concrete in Acidic Environment International Journal of Modern Engineering Research (IJMER) www.ijmer.com Vol.3, Issue.1, Jan-Feb. 2013 pp- 580-586

ISSN (Print): 2204-0595
ISSN (Online): 2203-1731