iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** V **Month of publication:** May 2020

DOI: http://doi.org/10.22214/ijraset.2020.5082

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue V May 2020- Available at www.ijraset.com

A Review on Study of Behaviour of Geopolymer Concrete at different Percentages of Chemical Additives say 15%, 20% and 25%

Shobhana Singh[1], Prof. Ajeet Saxena[2]
[1]*MTech Scholar,* [2]*Assistant Professor, Radharaman Engineering College, Bhopal*

Abstract: ***The research is aimed to study about the behaviour of geopolymer concrete when used with different percentage of chemical additives. Ordinary Portland cement (OPC), along with steel is the main construction material used in reinforced concrete structures. However, the manufacturing of Portland cement and the concrete production are both energy intensive and result in considerable CO_2 emissions. Cement production alone is estimated as being responsible for 6-10% of total CO_2 production worldwide, with the production of 1 ton of cement producing 1 ton of CO_2. As considerable quantities of Portland cement are manufactured worldwide, even a small reduction in its production could result in significant environmental benefits in terms of CO_2 emission. The use of inorganic residual products from certain manufacturing industries has been used for long as partial replacement for Portland cement. These are most notably fly-ash, rice husk ash, ground granulated blast-furnace slag, waste paper sludge ash, micro-silica etc. It is recognized that alkali additions to fly-ash or slag can activate these materials to set and harden in their own right thereby forming alkali-activated systems; however, the focus of this study is on the use of chemical pre-treatment of fly-ash to form a geopolymer which will set and harden and could be offered as a viable alternative to Portland cement. Studies have demonstrated that it is conceivable to utilize fly ash as a sole binder by activating it with alkaline materials such as: caustic alkalis; silicate salts; non-silicate, weak acid salts; aluminates; alumino-silicates; and non-silicate, strong acid salts. Hence, the product of this reaction is C-S-H gel i.e. the product formed during the hydration of Portland cement***
Keywords: Flyash, chemical additives (like NaOH & Na_2SiO_3), Workability test, Compressive strength test, cost analysis.

I. INTRODUCTION

Our present study aims to investigate in the same context i.e. the various properties of geopolymer concrete at different percentage of chemical additives say 15%, 20% and 25%.The manufacturing of Portland cement and the concrete production are both energy intensive and result in the emissions of CO_2. Considering that Portland cement has a high embodied energy and contributes significantly CO_2 production to the worldwide. There is considerable possibility for the advancement of cement-free binders and represents an area which could impact significantly on the drive for more sustainable construction materials and practices.

The use of some residual products from certain manufacturing industries has been used for long as partial replacement for Portland cement some of them are fly-ash, rice husk ash, ground granulated blast-furnace slag, waste paper sludge ash, micro-silica etc.

In this study we use flyash in place of cement for production of concrete. It is acknowledged that additions to fly-ash can activate these materials to set and harden in their own right thereby forming alkali-activated systems; however, the focus of this study is on the use of chemical pre-treatment of fly-ash to form a geopolymer which will set and harden and could be offered as an alternative to Portland cement. Geopolymer concrete is produced using source materials which show pozzolanic properties that are rich in silica and alumina.

One possible alternative, as noted above, the use of alkaline additives using industrial by-products containing alumino-silicate materials. Fly-ash is one of most common industrial by-product which is broadly used to upgrade physical, chemical and mechanical properties of cement and concrete. The silica and alumina in the Class-F fly ash are activated by a combination of sodium hydroxide and sodium silicate solutions to form the geopolymer paste which binds the aggregates and unreacted materials.

Si - Al Material + Chemical Additives ($NaOH + Na_2SiO_3$) + Water

↓

Geopolymer Binder + Water

The objective of the study is to understand the behaviour of geopolymer concrete at different percentage of chemical additives by means of workability test, compressive strength and cost analysis

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue V May 2020- Available at www.ijraset.com

II. LITERATURE SURVEY

Abhishek Bisarya et al., 2015 After water the usage of concrete is second around the world. OPC has been conventionally used as a primary binder in concrete production.

The environmental issues caused by OPC production are very well known. During the manufacturing of OPC, the CO_2 amount released because of the lime stone calcinations and the fossil fuel combustion is in the order of about 1 ton for every ton of OPC that is produced. Also, the energy requirement in production of OPC is next only to steel and aluminum. Therefore, there is an urgent need for the reduction of the CO_2 emission.

Being environmental friendly, the geopolymer concrete is the material of the future because in its production, CO_2 emission is about 80% less in comparison to the OPC. Geopolymer is a novel binding material which is produced due to the polymeric reaction between alkaline liquid along with aluminum and silicon rich materials like fly ash, the rice husk, silica fumes, blast furnace slag, etc. It was observed that a higher compressive strength is achievable easily in a comparatively short period of time in geopolymer concrete when compared to the OPC and it was found to develop an excellent resistance against sulphate and acid attack in comparison to the OPC. It was concluded that geopolymer concrete production had a comparatively higher strength, much better durability and excellent volume stability.

Anuar K.A. et al., 2011 Malaysia is also one of the countries dealing with challenge of environmental pollution. Geopolymer concrete comprising recycle concrete aggregate (RCA) is one of the method to reduce environmental pollution caused by the production of Portland cement. Alkaline liquid and Waste Paper Sludge Ash (WPSA) as a binder were being used for the replacement of Portland cement to form geopolymer concrete.

The alkaline liquid used in geopolymerization was the combination of sodium silicate (Na_2SiO_3) and sodium hydroxide (NaOH). In this particular study, two different series of geopolymer concrete specimens consisting of two different molar concentration of NaOH as 8M and 14M were adopted. 30 cube specimens sized 100mm x 100mm x 100mm were casted out of which 15 cubes were of 8M and another 15 cubes were of 14M.

The compressive strength testing of the geopolymer concrete specimens which were cured in laboratory under ambient conditions was performed after a period of 3, 7, 14, 21 and 28 days. The results concluded that the strength of the Waste Paper Sludge Ash (WPSA) based geopolymer concrete comprising recycle concrete aggregate (RCA) increased by increasing the molarities of NaOH.

P. K. Mehta 2002 The concrete industry has an energy intensive nature and results in the production of a large amount of carbon dioxide gas emissions.

To lower the impact of the concrete on our environment, industrial ecology must be practiced by recycling of the waste products of some industry by their substitution as the raw materials for another industry. Blended Portland cements comprising fly ash obtained from coal-based power plants and ground granulated slag obtained from blast-furnace based iron industries present excellent examples of the industrial ecology because of the holistic solution they provide by minimizing the environmental impact of many industries.

High speed building construction codes that are prescriptive rather than being performance based and the lack of a holistic approach in engineering researches and education leads to the construction of such concrete structures which develop cracking and durability problems. Greening of the concrete construction industry will have to continue till green concrete replaces the conventional concrete as the material of preference for general construction work.

Francisco J. Lópezet. al. 2014 The effect of amorphous silica obtained from biomass rice husk (RH) used along with alkaline activating solution on the characteristics was investigated in the geopolymerization process, when the aluminum source used was metakaolin (MK). With varying the molar proportion of SiO_2/Al_2O_3 between 3.0 and 10.0, and the curing for preparing of the geopolymer was done at 85˚C, 100˚C and 200˚C.

The visco-elastic characteristics of the geopolymer paste containing Al_2O_3 and SiO_2 as the components showed that the higher RH silica source successfully achieved the alkaline activation. The micro-structural and the mineralogical properties of the cured products were found to be due to the amorphous alumino-silicate.

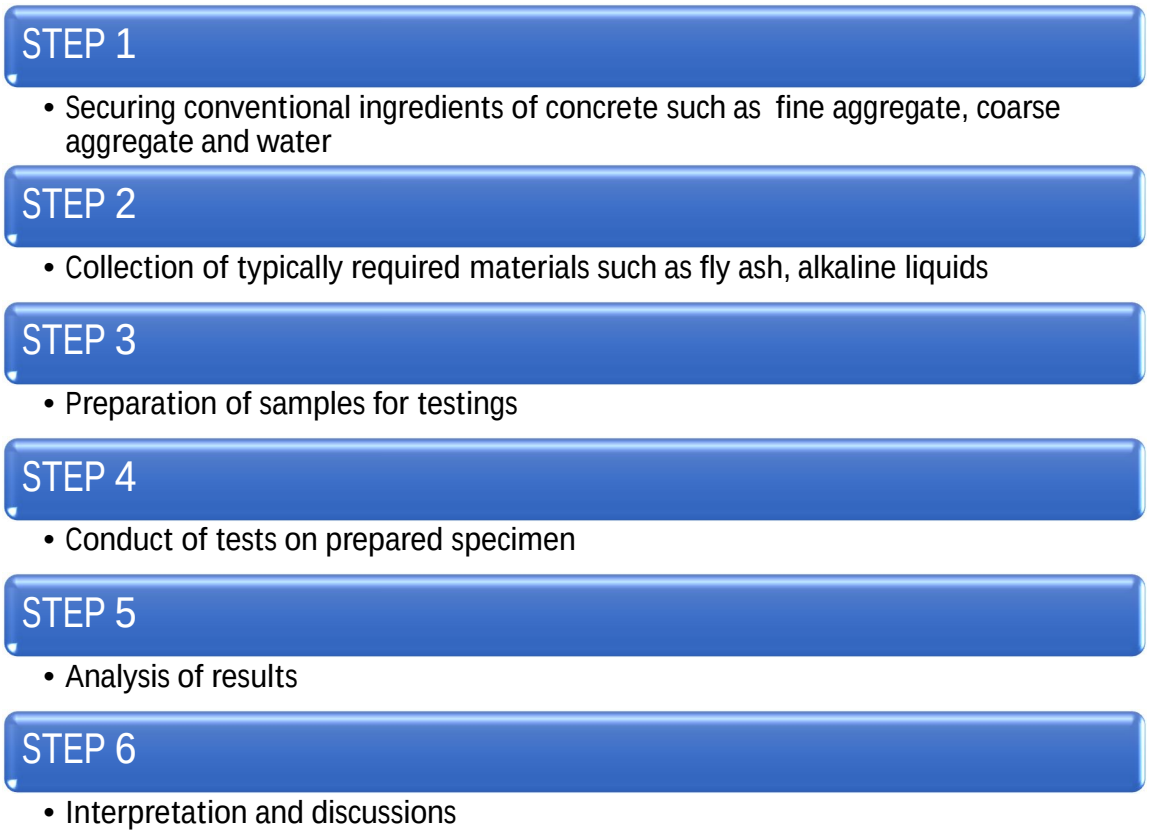
Based on the result of this study, it could be inferred that the silica made in the process of combustion of rice husk done at about 700˚C temperature acted to be a raw material for the geopolymers and it also contributed significantly towards the formation of a geopolymer matrix with the metakaolin. The role of RH silica was important during the geopolymerization reaction due to sodium hydroxide activation.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue V May 2020- Available at www.ijraset.com

III. METHODOLOGY

The whole methodology may be divided in different stages of work. The work starts with selection of material next stage to perform basic test of materials followed by preparation of specimens and final stage of work to perform test.

The following Methodology is adopted in the Research work:

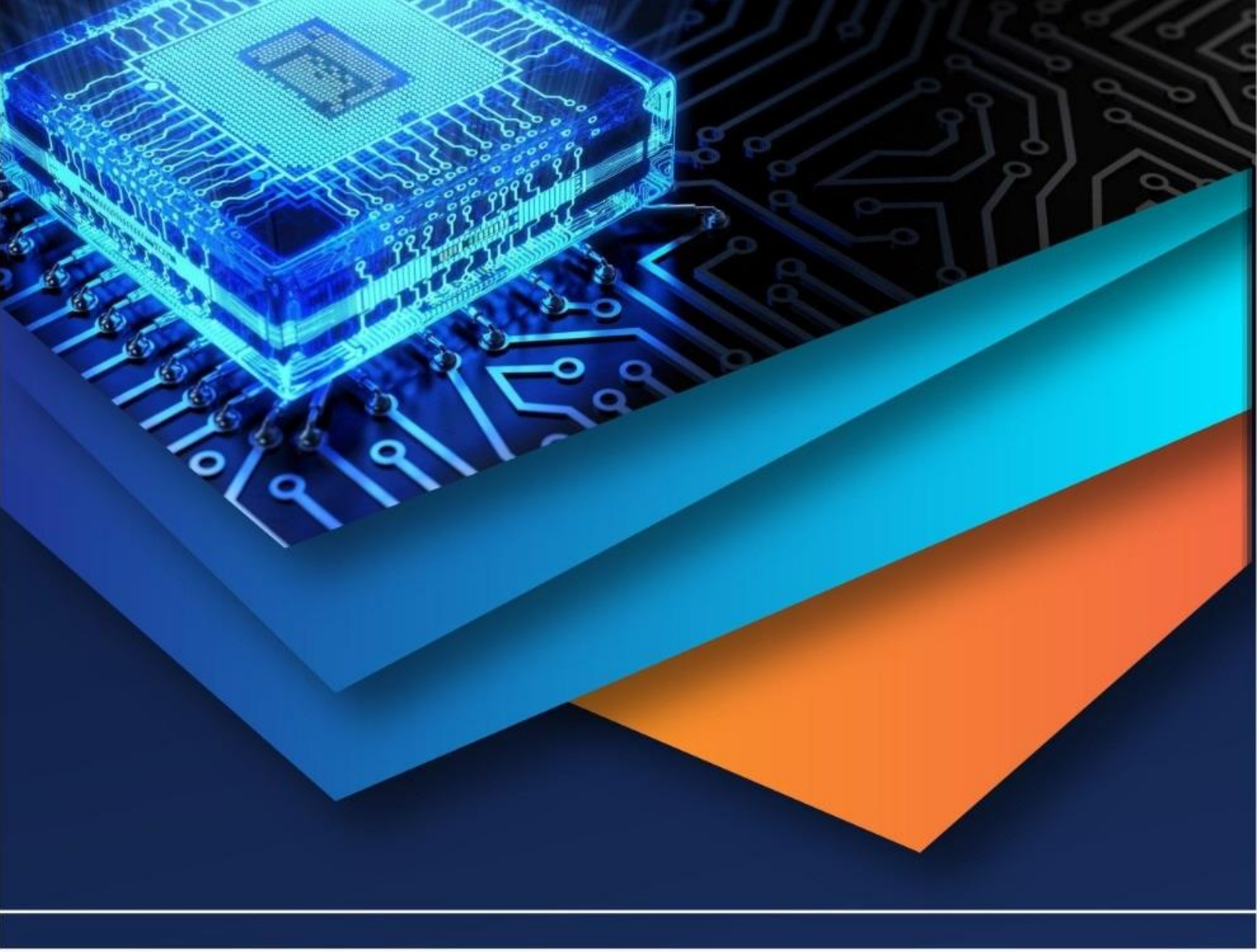


IV. RESULT AND DISCUSSION

From above literature it is found that many researchers studied about concrete strength and workability and gave their results on the same. In this research an attempt is made to study the behaviour of geopolymer concrete at different percentage of chemical additives. The main aim is to understand the effect on workability, compressive strength and cost analysis .

REFERENCES

[1] Abhishek, Bisarya, R. K. Chouhan, Manish, Mudgal, and S. S. Amritphale, "Fly ash based geopolymer concrete a new technology towards the greener environment: A review," Int. J. Innov. Res. Sci. Eng. Technol. (An ISO Certif. Organ., vol. 4, no. 12, pp. 12178–12186, 2015.
[2] K. A. Anuar, A. R. M. Ridzuan, and S. Ismail, "Strength Characteristic of Geopolymer Concrete Containing Recycled Concrete Aggregate," Environ. Eng., no. February, pp. 81–85, 2011.
[3] P. K. Mehta, "Greening of the Concrete Industry for Sustainable Development," Concr. Int., vol. 24, no. 7, pp. 23–28, 2002.
[4] F. J. López, S. Sugita, M. Tagaya, and T. Kobayashi, "Geopolymers Using Rice Husk Silica and Metakaolin Derivatives; Preparation and Their Characteristics," J. Mater. Sci. Chem. Eng., vol. 02, no. 05, pp. 35–43, 2014.
[5] Bureau of Indian Standards: IS – 10262: 1982, "Indian Standard Recommended Guidelines for concrete mix design".
[6] Bureau of Indian Standards, "IS 3812 (Part 1):2013 Pulverized Fuel Ash — Specification," Bur. Indian Stand. New Delhi, vol. 3812, no. May, 2013.
[7] Bureau of Indian Standards: IS - 516: 1959, "Methods of Test for Strength of Concrete", New Delhi, 2003.
[8] Bureau of Indian Standards: IS - 383: 1970, "Specification for coarse and fine aggregate from natural sources of concrete (second revision)"
[9] Bureau of Indian Standards: IS – 1199: 1959, "Methods of sampling and analysis of concrete"
[10] "Concrete Technology", Publication Tata Mc. Graw Hill Education Pvt Ltd, M.L. Gambhri, 2012.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY