

Geopolymer Concrete: A Review

Gomasa Ramesh



Abstract: Geopolymer Concrete is a new innovative type of concrete, and it is used widely in the construction industries. This type of concrete comes into place due to reduced cement content usage in the construction of structures. Already we are using cement as a binding material widely in the construction sector, but the problem is due to the cement content CO_2 emissions are mainly produced and one more problem is greenhouse gases are increasing rapidly during the manufacturing of cement. Then after a lot of researchers, finally we got a geopolymer as a replacement for cement. By replacing cement content with geopolymer, we can reduce the cost of construction and reuse the structural materials. So, this type of concrete is different from standard conventional concrete. We can minimize CO_2 and greenhouse gases' problem in the atmosphere and make the structure an environmentally friendly solution. So, this type of concrete is very famous in the construction industry, and there are benefits also excellent. So, it can be used widely in construction sectors worldwide. This paper may help understand Geopolymer Concrete for everyone quickly. It gives a quick review of the Geopolymer Concrete.

Keywords: Sustainable material, geopolymer Concrete, Recycled Concrete, Compressive Strength, Mix design, Manufacturing, Mechanical Properties.

I. INTRODUCTION

Geopolymer concrete is a particular type of concrete used to construct all civil engineering and structural engineering works. It plays an essential role in the construction. The combination of different inorganic molecules produces this type of concrete. It is a good alternative and one of good innovative material compared to standard conventional concrete. It can be famous for reducing CO_2 emissions, so it can also be known as Green Concrete. It is also known as one of the exemplary sustainable construction materials. Geopolymer concrete was first used in the 19th century, and Joseph Davidovits can name it. He is the first person to obtain this type of concrete from the reaction of fly ash and geopolymerization. So later, he named geopolymer as that product. It is the one of finest good sustainable construction material. This type of concrete can be obtained from wastes. It can also be used for the replacement of cement in the concrete mixture. So, we can reduce the cost of construction easily. Almost by using geopolymer concrete, we can reduce eighty percentage of CO_2 emissions. So, day by day, the importance of geopolymer concrete is increasing. A lot of researches going on this type of concrete. Most Research Scholars are also interested in this Research Area only. We can see a lot of Research Papers on Geopolymer Concrete every year.



Fig. Geopolymer Concrete in Reinforcement

This type of concrete is used to replace cement and GGBS, and also, we can reduce the amount of cement in the construction of structures. It is an internationally used material for the construction of structures. It is the one of most used material in the world. It extensively increases energy.



Fig. Geopolymer Concrete

II. LITERATURE REVIEW

Vimal Raj 2020 et al.

In this Research Paper author explained the importance of geopolymer concrete and objectives & methodologies for geopolymer concrete. The author also explained the material collection of geopolymer concrete and various tests on geopolymer concrete.

Younis 2020 et al.

This Research Paper Author explained the problems of CO_2 emissions in the environment and explained the reasons for using geopolymer concrete in the construction industry. This author also explained the background of geopolymer concrete and its mechanical properties.

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Sourav 2014 et al.

This author explained alternative material for cement and also explained the importance of geopolymer concrete. This author also explained materials used for geopolymer concrete and parameters required for geopolymerization and explained strength tests on geopolymer concrete.

III. METHODOLOGY

It is a good material to protect the structure from water contamination. It is used to reuse the waste material rather than the disposal of waste from other space. So, it can save space also. So, no disposal problem for using this type of concrete. There are four important types of geopolymer concretes are available in the market, and they are as follows.

The first one is the slag based geopolymer, and it can be used widely in the construction industry, and it is the most common type of geopolymer concrete. This type of concrete slag is used in the mix. It is also responsible for increasing compressive strength and also workability. The second important type is rock-based geopolymer concrete, and this type of concrete is obtained naturally from rocks. In this, feldspar and quartz are two important minerals for the formation of geopolymer concrete, and they can be used as a rock-forming mineral. The third important type is fly ash-based geopolymer concrete, and this type of concrete is very commonly used in construction. This concrete contains fly ash, and this type of concrete is also used to increase compressive strength and workability. The fourth and last important type of concrete is alkali and slag and silicate-based geopolymer concrete. This type of concrete is based on the composition of the material used in the mixture of concrete. In this one of the important points, cement is used worldwide in the construction of structures and cement manufactured in lots of tons every year. It creates some disturbance to the environment by carbon content and heat of hydration. To prevent this type of problems in construction, one of the good solutions is geopolymer concrete. It can be used to replace the cement content and decreases the losses in the environment. So geopolymer concrete is one of the best choices for the construction of structures. In every ten-research scholar's minimum of two scholars are working for geopolymer concrete. That is the speciality of the geopolymer concrete.

OBJECTIVES & USES

- Used in sustainable construction
- Reduce Co2 emission
- Best management
- Low cost
- Reduce carbon footprint
- Sustainable material
- Fireproof
- Replace fine materials (cement, GGBS etc.)
- Waste to Concrete
- Economical
- Increase durability
- Increase use of resources
- Good strength
- Eco-friendly material & construction
- High bonding nature

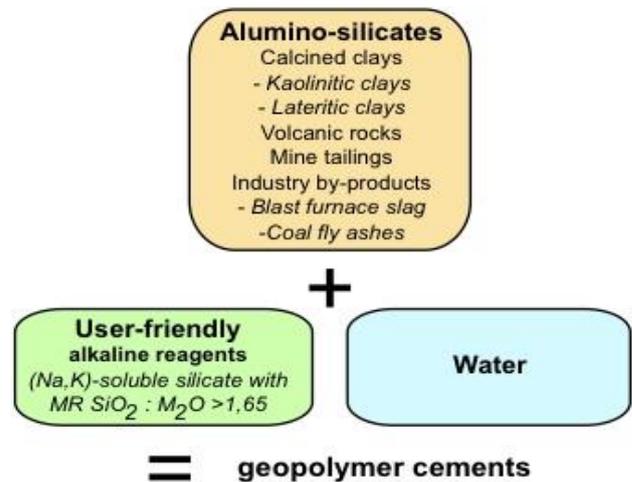
- Cost-effective
- Highly durable
- Low shrinkage
- Improves permeability
- The water-cement ratio is less
- Low creep
- Chemical resistant
- Resistant to cold and heat
- Reduce use of cement



DIS ADVANTAGES

- Require Skilled person
- Difficult to create
- Handling issues
- Sensitive

MATERIALS USED



In this concrete there are various important materials are used to get this concrete. They are as follows.

The first one is Alumino Silicates, and the second one is alkaline agents, and the last one is water. In this, different types of alkaline agents are used in the formation of geopolymer concrete. The combination of both gives to the formation of geopolymer cement and concrete. Nowadays, different types of geopolymer concretes are available in the market. Different types of concrete are used based on the purpose. In this type of concrete compressive strength is also good.





Fig. Manufacturing of geopolymer concrete [1]

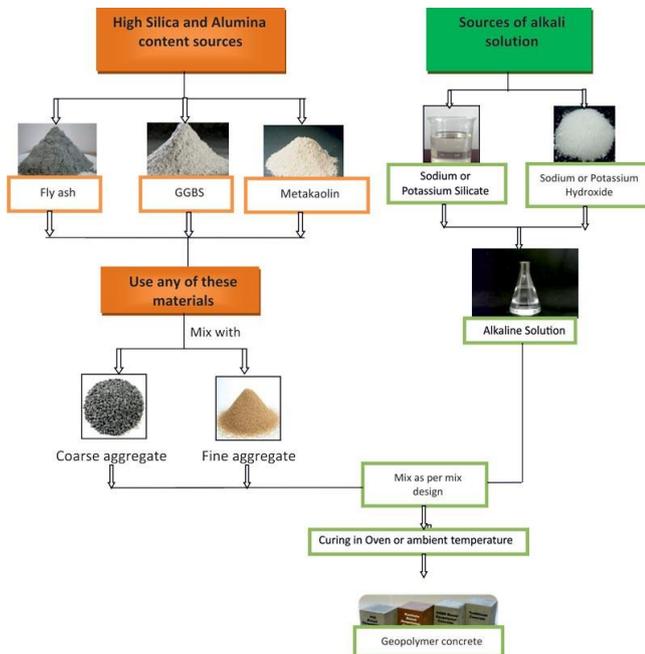


Fig. Production of Geopolymer Concrete [1]

IV. APPLICATIONS

- Used in light pavements
- Retaining walls
- Water tanks
- Ramps
- Marine environment
- Precast Beams
- Sewer pipes



Fig. Sustainable Material [5]

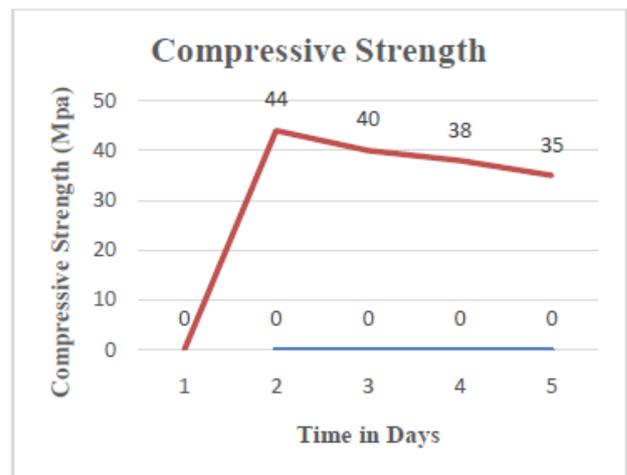


Fig. Sustainable Development Goals [5]

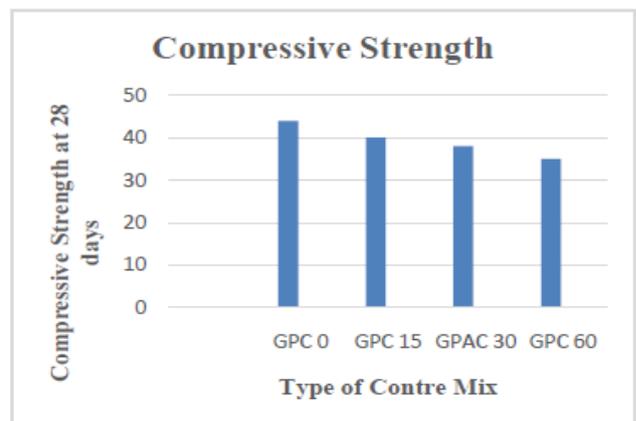
TESTS & RESULTS

There are several tests conducted on geopolymer concrete to test its capacity. The most conducted tests are the creep and shrinkage test and compressive strength tests, and modulus elasticity test.

In this, we got results of compressive strength of geopolymer concrete at several days are plotted below. The results are approximately and also satisfactory. The below graph clearly understands about compressive strength of geopolymer concrete.



This figure shows the compressive strength of geopolymer concrete concerning the type of concrete mix used. The results are plotted after 28 days of the compressive strength test.



VI. CONCLUSION

Geopolymer Concrete is one of the excellent materials used in the construction industry, and it is used worldwide. The main importance of geopolymer Concrete is to reuse waste materials. The concrete can be obtained from waste materials. It also gives better results than conventional concrete. The main important factor for using this type of concrete is to eliminate carbon emissions from the environment, decrease the carbon content from the environment, decrease carbon footprint, and increase structural strength and durability. Most importantly, to make the structure sustainable. It has high strength compared to conventional concrete and low creep and shrinkage.

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REFERENCES

- Vimal raj 2020 et al, "Investigation Study on Geo-Polymer Concrete" Volume 7 Issue 6, INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN TECHNOLOGY.
- Younis 2020 et al, An Overview of Geo-Polymer Concrete Including Recycled Aggregate; INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH VOLUME 9, ISSUE 03, MARCH 2020.
- Sourav Das 2014 et al; Geo-polymer Concrete–Green Concrete for the Future—A Review; International Journal of Civil Engineering Research, Volume 5, Number 1.
- Gomasa Ramesh, Dr. Annamalai Rangasamy Prakash, "Repair, Rehabilitation and Retrofitting of Reinforced Concrete Structures," Special Issue 2021, International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 Published by, www.ijert.org NCACE - 2020 Conference Proceedings.
- Sustainability and sustainable development
- Srinath, Doddipati, et al. "Mechanical properties of sustainable concrete by using RHA and hydrated lime." Materials Today: Proceedings (2021). [CrossRef]
- Dharna Ramya, Gomasa Ramesh and Dr. Annamalai Rangasamy Prakash, "Shear Behavior of Hybrid Fiber Reinforced Concrete", International Journal for Modern Trends in Science and Technology, Vol. 07, Issue 02, February 2021, pp.-79-82, DOI:10.46501/IJMTST0702013
- Gomasa Ramesh, Dharna Ramya, Mandala Sheshu Kumar; "Health Monitoring of Structures by Using Non-Destructive Testing Methods", International Journal of Advances in Engineering and Management (IAEM) Volume 2, Issue 2, pp: 652-654, DOI:10.35629/5252-45122323
- Ramya, Dharna, et al. "Shear Behavior of Hybrid Fiber Reinforced Concrete." Concrete", International 7.02 (2021): 79-82. [CrossRef]
- Doddipati Srinath, Gomasa Ramesh, "Mechanical Properties of Sustainable Concrete by using RHA and Hydrated Lime", International Journal for Modern Trends in Science and Technology, Vol. 07, Issue 02, February 2021, pp.-83-86, DOI:10.46501/IJMTST0702014 [CrossRef]
- Ramesh, Gomasa, et al. "Repair, rehabilitation and retrofitting of reinforced concrete structures by using non-destructive testing methods." Materials Today: Proceedings (2021). [CrossRef]
- Gopu Anil, Gomasa Ramesh and Dr. Annamalai Rangasamy Prakash, "An Experimental Study Investigation on Self Compacting Concrete and Strength Properties by using Fiber Reinforcement", International Journal for Modern Trends in Science and Technology, Vol. 07, Issue 02, February 2021, pp.-93-96, DOI: 10.46501/IJMTST07022016
- Krishna, Bonagani Vamshi, et al. "Effect of Geo-Activator on Strength and Durability Properties of Geopolymer Concrete." (2021).
- Sriramoju Sravani, Gomasa Ramesh and Dr. G. Dinesh Kumar, "Study on Percentage Replacement of Cement by Glass powder for M20 Grade Concrete", International Journal for Modern Trends in Science and Technology, Vol. 07, Issue 02, February 2021, pp: 129-132, DOI:10.46501/IJMTST0702022
- Bandi Pooja, Gomasa Ramesh and Dr. G. Dinesh Kumar, "Experimental Study on Mechanical Properties of Geopolymer Concrete by using Fly Ash and RHA", International Journal for Modern Trends in Science and Technology, Vol. 07, Issue 02, February 2021, pp.-50-55, DOI:10.46501/IJMTST0702008
- Palakurthi Manoj Kumar, Gomasa Ramesh and Dr. Annamalai Rangasamy Prakash, "Evaluation of Different Tests and their Comparisons by Combining Cement with Various Binders," International Journal for Modern Trends in Science and Technology, Vol. 07, Issue 03, March 2021, pp.: 119-122, DOI: 10.46501/IJMTST0703021
- Bonagani Vamshi Krishna, Gomasa Ramesh and Dr. Annamalai Rangasamy Prakash, "Effect of Geo-Activator on Strength and Durability Properties of Geopolymer Concrete," International Journal for Modern Trends in Science and Technology, Vol. 07, Issue 03, March 2021, pp.: 123-126, DOI:10.46501/IJMTST0703022
- Gomasa Ramesh, Doddipati Srinath, Mandala Sheshu Kumar; "Earthquake Resistant of RCC Structures" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-4, Issue-5, August 2020, pp.808-811.
- Gomasa Ramesh, Doddipati Srinath, Mandala Sheshu Kumar, "Importance of Dynamic Analysis for RCC Structures," International Journal for Modern Trends in Science and Technology, 6(8): 271-276, 2020, DOI:10.46501/IJMTST060844 [CrossRef]
- Gomasa Ramesh, D Srinath, "Repair, rehabilitation and retrofitting of reinforced concrete structures by using non-destructive testing methods," March 2021, Materials Today: Proceedings, DOI: [10.1016/j.matpr.2021.02.778](https://doi.org/10.1016/j.matpr.2021.02.778) [CrossRef]
- D Srinath, G Ramesh, "Mechanical properties of sustainable concrete by using RHA and hydrated lime," March 2021, Materials Today: Proceedings, DOI: [10.1016/j.matpr.2021.02.785](https://doi.org/10.1016/j.matpr.2021.02.785) [CrossRef]

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