

# AN EXPERIMENTAL STUDY OF POLYPROPYLENE FIBRE REINFORCED GEOPOLYMER CONCRETE

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## Abstract:

The ordinary Portland cement (OPC), which is widely used material not only consumes significant amount of natural resources and energy but also pollutes the atmosphere by the emission of CO<sub>2</sub>. So also reduce this ill effect, the search for alternative result is Geo-polymer concrete. The strength study has to be carried out for different binder composition of fly ash and GGBS incorporated 0.25% polypropylene fibres. The mechanical properties of the specimen were studied for both Ambient and Heat curing.

**Keywords:** Geo-polymer concrete, Sodium silicate, Sodium hydroxide, GGBS, Fly Ash, Polypropylene fibre.

## 1. INTRODUCTION

Nowadays, ordinary Portland cement (OPC) concrete is the most popular and widely used building materials, due to its availability of the raw materials over the world its ease for preparing and fabricating in all sorts of conceivable shapes, About 1.5 tonnes of raw materials is needed in the production of every tonne of Portland cement, at the same time about one tonne of carbon dioxide (CO<sub>2</sub>) is released into the environment during the production. Currently, the world annual OPC production is about 1.6 billion tonnes or about 7% of the global loading of industrial alumino silicate waste materials such as FA and GGBS. Since for GPC, it does not have any standards loads for mix design. The strength study has to be carried out for different binder composition of fly ash and GGBS in corporate with 0.25% polypropylene fibres.

## 2. SCOPE OF THIS WORK

In this project, using a fly ash and GGBS as a cement replacement material in concrete, in addition with chemicals such as sodium silicate and sodium hydroxide. Compressive strength, Tensile strength, Flexural strength. To enhance the flexural behaviour of the polypropylene fiber's reinforced Geo-polymer concrete.

## 3. MIX PROPORTION AND DETAILS

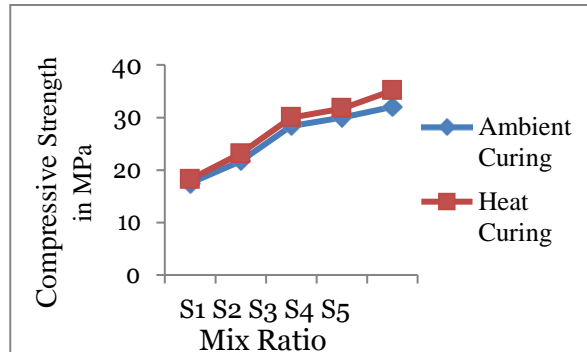
### 3.1 Mix design of Geo-polymer concrete

The mix design in the case of Geo-polymer concrete is inverse to that of conventional concrete. In the case of conventional concrete the material proportion can be found out for the required strength using the code. But in the case of Geo-polymer concrete there is no design method or codal provisions. Here only by means of trial mixes the concrete is being produced. The mass of combined aggregates may be taken to between 75% to 80% mass of the Geo-polymer concrete. The alkaline liquid to binder ratio of mix id S1,S2,S3 is 0.45 and S4,S5 is 0.55. The ratio of Sodium hydroxide to sodium silicate ratio is 1:2.5(Rangan, 2005). Extra water were added to the mix by 10% of binders to achieve workable concrete.

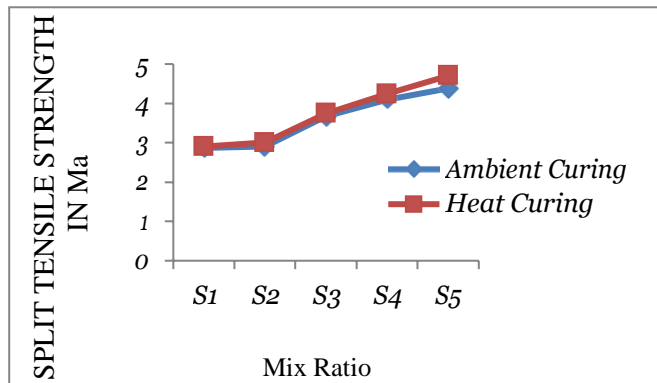
## 4. RESULTS AND DISCUSSIONS

In this study hardened properties of Geo-polymer concrete were investigated by using polypropylene fibre Reinforced concrete at a different binder composition of the concrete. In the present study, such properties of Geo-polymer concrete were investigated based strength studies.

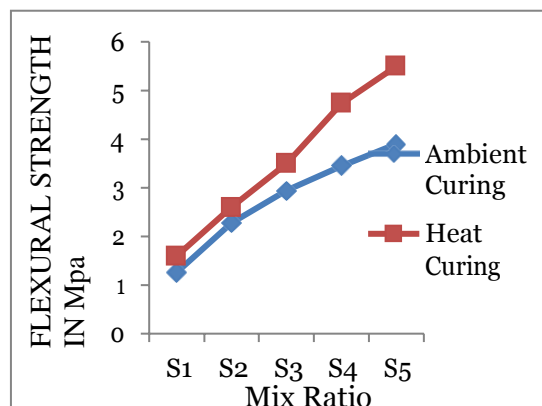
### Compressive Strength Test Results



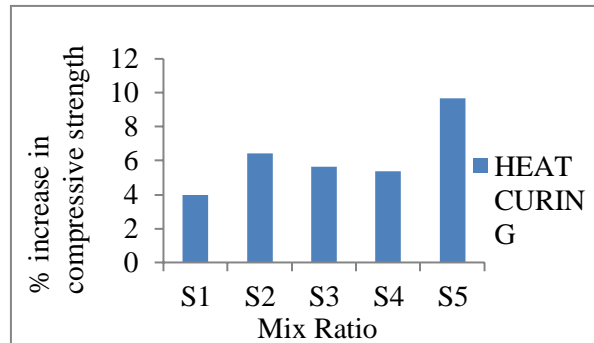
### Split Tensile Strength Result



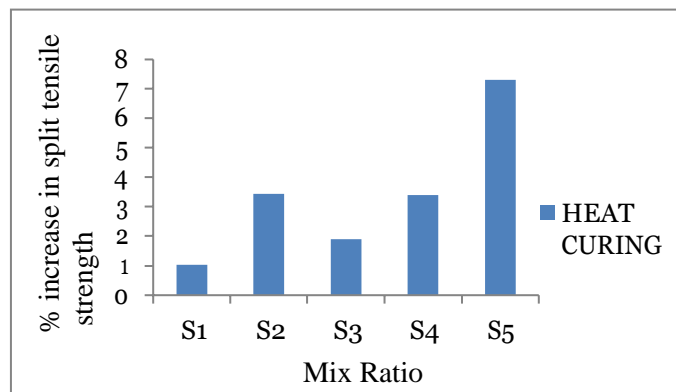
### Flexural strength test result



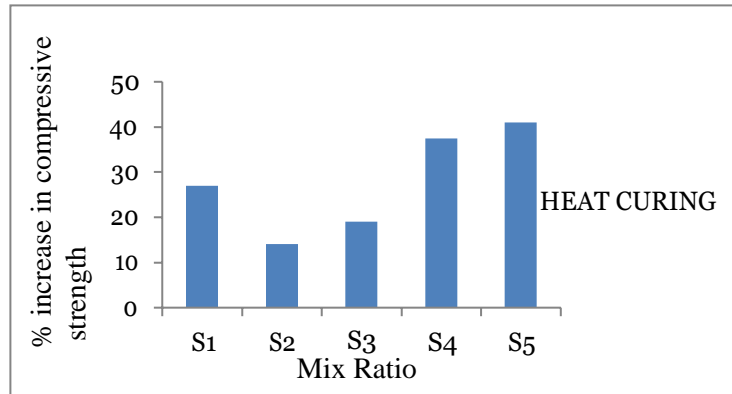
### Percentage Increase of Compressive Strength Values for Heat curing from Ambient curing



### Percentage Increase of Split tensile Strength Values for Heat curing from Ambient curing



### Percentage Increase of Flexural Strength Values for Heat curing from Ambient curing



## CONCLUSION

- In Geo-polymer material, Fly ash and GGBS is used as the source material, instead of the Portland cement, to make concrete.
- There is no mix design procedure for Geo-polymer concrete.
- The higher concentration of GGBS (slag) results in higher compressive, split tensile and flexural strength of Geo-polymer concrete.
- There is no necessity of exposing Geo-polymer concrete to higher temperature in 0% F.A and 100 % GGBS attained high strength in Mix S5.
- The percentage increases were studied and it is found that the GPC has shown good improvement in flexural strength.

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