

EXPERIMENTAL STUDY OF OPTIMAL MIX DESIGN OF FLY ASH BASED GEOPOLYMER CONCRETE AND ITS DURABILITY STUDIES

Abstract

Geopolymer Concrete is a better option for construction, compared to Ordinary Portland Cement concrete. The main reason for this insinuation is GPC minimize the emission of harmful greenhouse gases and also it minimizes the cost of construction by using fly ash as a binder material. In the use of fly ash as a binder material we need a proper Mix Design Method which gives optimal strength and durability. As per the available literature a better quality GPC mix depends upon – proportioning of ingredients, proportioning of optimum Alkali activator ratio, molarity of the alkali activator ratio, aggregate type and total aggregate to fine aggregate ratio, admixtures, the curing regime and temperature. Research works in this field are ongoing, to find a better Mix Design and design methods. But, until now research in this field has not attained a satisfactory mix design as compared to OPC concrete.

Introduction

Geopolymer Concrete primarily consists of binder paste (fly ash and alkaline solution), aggregates (both fine and coarse), and admixtures. Considering strength parameters class F fly ash perform well as compared to class C fly ash. Alkaline activators are the chemical solution used along with the fly ash to generate binder paste. The alkali activator ratio and its molarity play an important role to obtain an optimal mix. In GPC the main constituent is the aggregates (70 to 80 %) of volume compared to Portland cement concrete. So the selection of aggregate type, gradation and total aggregate to fine aggregate ratio enhance the strength parameters. Admixtures are chemical materials which are added in fresh concrete to improve its durability, early strength, workability, setting time etc.

Objective

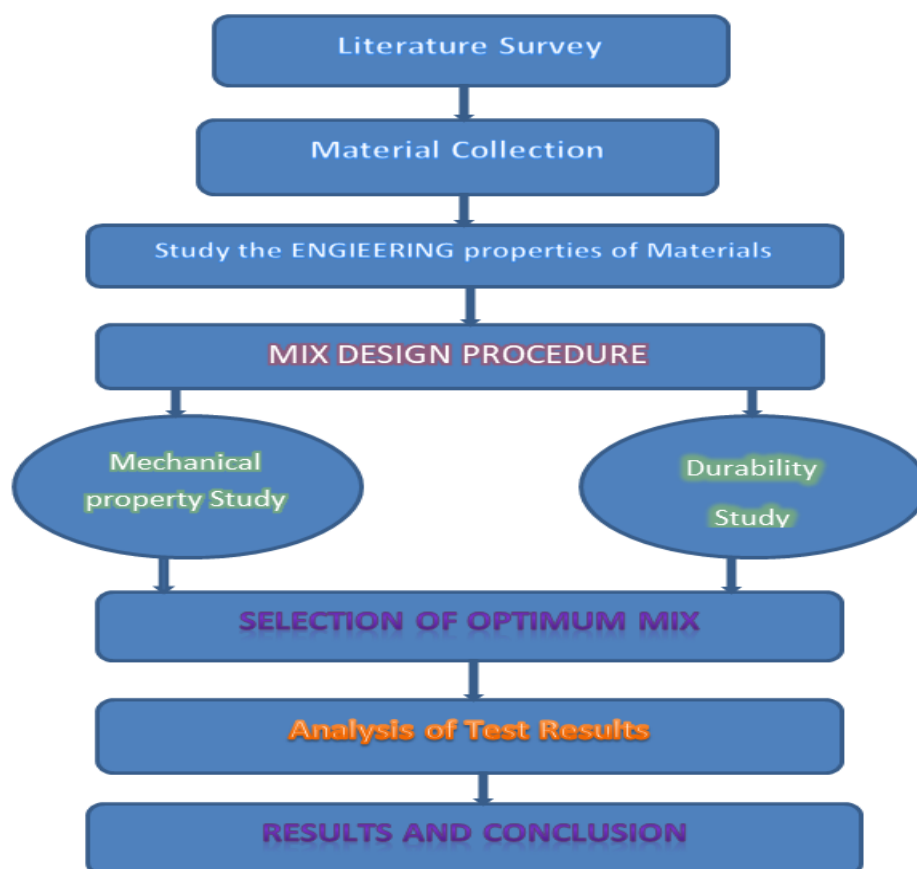
Main objective of the study is to find an optimum mix design using locally available materials. Here the material properties have a greater role in the mix strength. So the study should be started from the engineering properties of ingredients. Later the study lead is on design of an optimum mix of geopolymer concrete based on strength parameters such as compressive strength, splitting tensile strength and flexural strength. The next objective is to check the durability

parameters of the optimum mix such as permeability, sorptivity, acid and chemical resistance.

Potential Applications

GPC is cost effective and is also a sustainable construction material as compared to Portland cement concrete. The main component of GPC, the fly ash, is an industrial by product and its use for construction is an effective mode of waste disposal and ecological sustainability.

Methodology



Conclusion

In order to reach an optimal mix designs the material proportioning must be appropriately correlated through the trial and error method. Alkali activator ratio and the molarity of alkaline solution also play an important role in the strength attainment. Here in our studies strength parameters along with durability parameters like permeability, sorptivity, accelerated corrosion, sulphate resistance,

acid resistance and serviceability parameters like cracks, deflexion etc. jointly determines the performance level of GPC and its use in huge construction are also thoroughly evaluated.

The searches for a substitute to ordinary Portland cement conferred the novel Geopolymer Concrete. Unearthing of a proper optimum mix design of GPC can reduce pollution due to manufacturing of OPC and the construction cost. From the available literature on Geopolymer concrete we understood that GPC is not only an environmental friendly construction material but also it possesses excellent mechanical properties, both in short term and long term. Further research is needed to understand the science behind geopolymer technology like microstructure, rheology of fresh concrete etc. The economic benefits and contributions of geopolymer concrete to sustainable development are evident. The reduced CO₂ emissions of GPC make them a good alternative to OPC. It can be said that the geopolymer concrete is good alternative as a construction material considering its strength and durability compared to OPC.

References

1. Avinash Ojha, Praveen Aggarwal (2021) A review paper on fly ash based Geopolymer Concrete. Springer Nature B.V. 2021
2. Shriram Marathe, Mithanthaya, N Bhavani Shankar Rao (2016) A Review on Strength and Durability Studies on Geopolymer Concrete. IJIRSET
3. Salmabanu Luhar, Urvashi Khandelwal (2015) Durability Studies of Fly Ash Based Geopolymer Concrete. IJERA
4. Faiz Uddin Ahmed Shaikh (2016) Mechanical and durability properties of fly ash geopolymer concrete containing recycled coarse aggregates. International Journal of Sustainable Built Environment – ELSEVIER
5. Chithambar Ganesh.A, Muthukannan.M (2018) A Review of Recent Developments in Geopolymer Concrete. International Journal of Engineering & Technology