

A STUDY ON GREEN CONCRETE

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ABSTRACT - Concrete is worldwide used construction material after water. Ordinary Portland cement (OPC) is used as primary binder to produce concrete. The production of OPC contributes 5-7% of total green house gases, such as CO₂ emission. A lot of energy and natural resources are consumed in production of OPC. Geopolymer concrete (GPC) is one of the processes that reduces cement usage and increases the usage of industrial by-products in concrete. In the present study, OPC is fully replaced by pozzolanic materials and alkaline liquids such as Sodium hydroxide (NaOH) and Sodium silicate (Na₂SiO₃) to produce the Geopolymer concrete.

The present investigation is to study the effect of pozzolanic materials and concentration of NaOH. The experimental programme is divided into two phases. In

Phase-1, three mixes were taken one is Fly ash based GPC, second is mixture of Fly ash and GGBS based GPC and the other is GGBS based GPC with 10M concentration and out of these three mixes the optimum mix is taken for further study. In Phase-2 the Optimum mix is considered and concentration of NaOH is varied (i.e. 6M, 8M, 10M, 12M and 14M) to study the compressive strength. The test specimens prepared and cured under sunlight. The GPC specimens were tested for their compressive strength at the ages of 7, 14, 28 and 56 days. The sorptivity and XRD analysis were also carried out after 28 days of curing. The XRD analysis is carried out to study the minerals of GPC.

Index Terms: pozzolanic materials, GGBS, GPC, sorptivity and XRD analysis

1. INTRODUCTION:

Concrete is worldwide used construction material after water. With rapid increase in population the demand for construction as well as concrete is also increasing. The main constituent of concrete is ordinary Portland cement which is manufactured by burning the natural materials such as lime, sand which leads to the emission of carbon dioxide. The production of OPC contributes 5-7% of total green house gases. In order to replace the usage of cement in

concrete various researches has been carried out to adopt a better alternative for ordinary Portland cement.

Geopolymer concrete is an ecofriendly concrete in which OPC is replaced by mineral admixtures such as flyash and ground granulated blast furnace slag which are the by-products of thermal and steel plants. The present investigation is to study the effect of pozzolanic materials and concentration of NaOH. The experimental programme is divided into two phases. In Phase-1, three mixes were taken one is Fly ash based GPC, second is mixture of Fly ash and GGBS based GPC and the other is GGBS based GPC with 10M concentration and out of these three mixes the optimum mix is taken for further study. In Phase-2 the Optimum mix is considered and concentration of NaOH is varied (i.e. 6M, 8M, 10M, 12M and 14M) to study the compressive strength. The test specimens prepared and cured under sunlight. The GPC specimens were tested for their compressive strength at the ages of 7, 14, 28 and 56 days. The sorptivity and XRD analysis were also carried out after 28 days of curing. The XRD analysis is carried out to study the mineral composition of GPC.

2. GEOPOLYMERS:

Geopolymers is an invention of Davidovits that belongs to the family of inorganic polymers. The main constituents of geopolymers are pozzolonic materials and alkaline activator. The chemical composition of pozzolonic material considered for geopolymer should be rich in silica and alumina. The by-product materials such as fly ash, silica fume, slag, rice-husk ash, red mud, etc could be used as pozzolonic materials. Alkaline activators in the form of alkaline liquids such as Sodium hydroxide (NaOH) and Sodium silicate (Na₂SiO₃) or potassium hydroxide (KOH) and potassium silicate (K₂SiO₃) is used to produce the Geopolymer concrete. The chemical reaction that takes place in the manufacturing of geopolymers is polymerization.

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