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Concrete Experimental Study on Elastic Constants of Hybrid Geopolymer

Karthik M. P.[1], Sree Vidya V.[2], Arul Gnapragasam A[3] and Saravanakumar N.[4]
[1, 3 & 4]Asst. Prof. SSM Institute of Engineering and Technology, Dindigul, Tamilnadu, India
[2]Sri Krishna College of Technology, Coimbatore, Tamilnadu, India

Abstract: In this project low calcium fly ash with GGBS were used as the source material in concrete to fully replace of cement is known as Geopolymer concrete. Additionally Steel, Polypropylene, and coir are incorporated to improve its strength aspects in the concrete are called as hybrid geopolymer concrete at low volume fraction of 0.5. The manufacturing of geopolymer concrete was carried out using the usual concrete technology methods. The silicon and the aluminium are the source material to activate by a combination of sodium hydroxide and sodium silicate solutions to form the geopolymer paste that binds the aggregate sand other un-reacted materials. This paper aims to study about the elastic constants of hybrid geopolymer concrete for the different molarities of NaOH. The molarities of NaOH solution used in this work were 8M, 10M & 12M.
Keywords: Fly ash, GGBS, Geopolymer Concrete, Steel, Polypropylene, coir s, hybrid geopolymer concrete, elastic constants, molarities of NaOH

Introduction

Concrete is conventionally formed by using the ordinary Portland cement as the primary ring binder. Cement developed causes environmental impacts at all stages of the process. The manufacturing of Portland cement releases carbon dioxide (CO_2) that is a significant provider of the greenhouse gas emissions to the atmosphere. The amount of CO_2 emitted by the cement industry is nearly 900 kg of CO_2 for every 1000 kg of cement producedTo reduce the environmental impact of the concrete industry, Mehta (2002) suggests two approaches, a short term and a long term approach. The short term approach would be to practise "industrial ecology" which involves the use of industrial by-products as cement surrogate materials. According to the report of Central Electricity Authority of India (CEA), the total fly ash generation from April 2014 to March 2015 is 184.14 Million Tonnes. The use of Ground Granulated Blast-furnace Slag (GGBS) will increase the strength as well as enhance the mechanical properties of the concrete.

In 1978, Davidovits (1999) projected that binders might be produced by a polymeric reaction of alkaline liquids with the silicon and the aluminium in source materials of geological origin or by-product materials such as fly ash and rice husk ash. He termed these binders as geopolymer.

Concrete is the largest part broadly used construction substance in the world due to its high compressive strength, long service life, and low cost. However, concrete has inbuilt disadvantages of low tensile strength and crack resistance. To perk up such weaknesses of the material, numerous studies on reinforced have been performed by Sung Bae Kim et al 2012.

The variation of two or more fibres in the concrete is called as Hybrid Fibre Reinforced Concrete. The function of short-cut fibres as secondary reinforcement in concrete is primarily to reduce crack instigation and transmission (Hsie et al., 2008).

The large and the strong fibres control large cracks. The small and soft fibres control crack initiation and propagation of small cracks (Sivakumar and Santhanam, 2007).

In this experimental work the cement is replaced by low calcium fly ash and Ground Granulated Blast-furnace Slag (GGBS). Low calcium fly ash and GGBS is activated by alkaline activator solution for binding. The bond between the materials in concrete is achieved by the process of polymerization. Additionally s have been added in 0.5% of volume fraction by keeping the steel as permanent and adding other s as partial. The manufacture of hybrid geopolymer concrete (H_yGPC) is carried out using the usual concrete technology methods.

Materials Used:

Fly Ash: Fly ash used in this experimental work was collected from Tuticorin Thermal Power Station located in Tamil Nadu, India. The burning of harder, older anthracite and bituminous coal typically produces Class F fly ash. This fly ash is pozzolanic in nature, and contains less than 7%lime (CaO) is used.

GGBS: Ground Granulated Blast-Furnace Slag is a waste material generated in iron or slags Industries have significant impact on Strength and Durability of Geopolymer Concrete. It also continues to gain strength over