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Factors Influencing the Compressive Strength and Permeability of Geopolymer Concrete Based on Granulated Ground Blast Furnace Slag Cured at Ambient Condition

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ABSTRACT

In recent years, geopolymers, as a new class of green cement binders, have been considered as an environmental-friendly alternative to Ordinary Portland Cement (OPC) which can potentially reduce negative environmental impacts of OPC. Geopolymers are inorganic alumina-silicate materials produced from raw materials in combination with an alkaline activator solution. The alkaline activator solution as one of pillar of the geopolymerization process, playing an important role in the formation of crystalline structures of Si and Al. Therefore, it seems necessary to study the impact of various alkaline activator solutions on the mechanical strength of Geopolymer Concrete (GPC). On the other hand, in most pervious research, high temperature curing condition have been studied. Hence, in this research, granulated ground blast furnace slag and ambient curing condition were used to make GPC. The obtained results indicated that in ambient curing condition, using sodium hydroxide and sodium silicate, results in higher compressive strength as well as, lower permeability compared to potassium-based (potassium hydroxide and potassium silicate) and combination of sodium and potassium-based alkaline activator solutions. Moreover, simultaneous inclusion of NaOH and KOH led to decline the compressive strength. Furthermore, the obtained results indicated that increasing the NaOH and KOH concentration resulted in higher compressive strength. The optimal SiO2/Na2O ratio was 2 in the case of using 14M NaOH solution and 2.5 in the case of using 10M NaOH solution.

Keywords:

Geopolymer concrete, Granulated ground blast furnace slag, Compressive strength, resistance to acidic condition