

Study on solids-to-liquid and alkaline activator ratios on kaolin-based geopolymers

Abstract

Kaolin and alkali activator were mixed with the solids-to-liquid ratios in range of 0.60–1.20 ($\text{Al}_2\text{O}_3/\text{Na}_2\text{O}$ molar ratio of 0.63–1.27). Sodium silicate and sodium hydroxide ranged between 0.16 and 0.36 ($\text{SiO}_2/\text{Na}_2\text{O}$ molar ratio of 3.19–3.67) were mixed together to prepare alkali activator. The results concluded that compressive strength was affected by both S/L and $\text{Na}_2\text{SiO}_3/\text{NaOH}$ ratios and strength increased with ageing day. Both these ratio also influenced the workability of the mixes. Besides, the kaolin geopolymers showed good volume stability in water. Compressive strength was highest at S/L and $\text{Na}_2\text{SiO}_3/\text{NaOH}$ ratios of 1.00 and 0.32, respectively. In term of molar ratios, optimum was achieved at $\text{Al}_2\text{O}_3/\text{Na}_2\text{O}$ of 1.09 and $\text{SiO}_2/\text{Na}_2\text{O}$ molar ratios of 3.58. Microstructures showed that kaolin particles were slightly activated with large part of unreacted raw materials remained in the system. Geopolymer sample reduced in peak intensities over time as presented by XRD analysis and the presence of crystalline peaks in the kaolin geopolymers was Zeolite X. FTIR analysis showed the presence of geopolymer bonding increased over age. In overall, kaolin geopolymers does not undergo complete geopolymerization and showed slow strength development. Vast research works have to be carried out to further improve the properties of kaolin geopolymers.