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Investigation of Compressive Strength of Slag-Based Geopolymer Concrete Incorporated with Rice Husk Ash Using 12M Alkaline Activator

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Abstract : Geopolymer concrete's (GPC) compressive strength was investigated. The GPC was incorporated with rice husk ash (RHA) and ground granulated blast furnace slag (GGBFS), which may have potential in the construction industry to replace Portland limestone cement (PLC) concrete. The sustainable construction binders used were GGBFS and RHA, and a solution of sodium hydroxide (NaOH) and sodium silicate gel (Na_2SiO_3) was used as the 12-molar alkaline activator. Five GPC mixes comprising fine aggregates, coarse aggregates, GGBS, and RHA, and the alkaline solution in the ratio 2: 2.5: 1: 0.5, respectively, were prepared to achieve grade 40 concrete, and PLC was wholly substituted with GGBFS and RHA in the ratios of 0:100, 25:75, 50:50, 75:25, and 100:0. A control mix was also prepared which comprised of 100% water and 100% PLC as the cementitious material. The GPC mixes were thermally cured at 60-80ºC in an oven for approximately 24hrs. After curing for 7 and 28 days, the compressive strength test results of the hardened GPC samples showed that GPC-Mix #3, comprising 50% GGBFS and 50% RHA, was the most efficient geopolymer mix. The mix had compressive strengths of 35.71MPa and 47.26MPa, 19.87% and 8.69% higher than the PLC concrete samples, which had 29.79MPa and 43.48MPa after 7 and 28 days, respectively. Therefore, geopolymer concrete containing GGBFS incorporated with RHA is an efficient method of decreasing the use of PLC in conventional concrete production and reducing the high amounts of CO_2 emitted into the atmosphere in the construction industry.

Keywords : alkaline solution, cementitious material, geopolymer concrete, ground granulated blast furnace slag, rice husk ash
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