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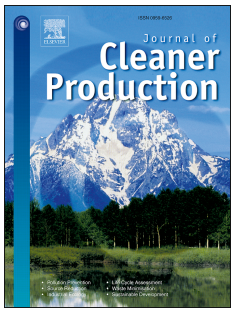

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4964

RICE HUSK ASH AND SPENT DIATOMACEOUS EARTH AS A SOURCE OF SILICA TO FABRICATE A GEOPOLYMERIC BINARY BINDER

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Abstract

The goal of this research is to propose the use of industrial by-products as solid sources of silica in replacement of commercial sodium silicate (SS) for the manufacture of geopolymeric binary binders. The result of this approach is a binder with good mechanical properties and environmental benefits, which can be used in civil engineering applications such as the manufacturing of masonry elements.

A Colombian fly ash (FA) and a commercial metakaolin (MK) were used as geopolymer precursors. Rice husk ash (RHA), spent diatomaceous earth (SDE) and commercial sodium silicate were used as sources of silica to adjust the SiO_2/Al_2O_3 molar ratio. These silica sources were mixed with a sodium hydroxide (NaOH) solution. Three alkaline solutions were used to activate the binary system FA/MK; SN (sodium silicate and sodium hydroxide), RN (rice husk ash and sodium hydroxide) and DN (spent diatomaceous earth and sodium hydroxide). A FA/MK proportion of 70/30 by weight, and the respective SiO_2/Al_2O_3 and Na_2O/SiO_2 molar ratios of 4.4 and 0.2 were kept constant for all experiments. Mechanical and microstructural analysis were conducted on the three systems, and compressive strength was measured at 28, 180 and 360 days. The reaction products were characterized by using X-Ray Diffraction (XRD) and Scanning Electron Microscopy (SEM).

Results show that it was feasible to utilize RHA and SDE as a source of silica for geopolymerization. The use of these alternative silica sources delayed the initial and final setting time at 60°C of a FA/MK-based binary alkali activated geopolymer system. Regardless of the source of silica used, the mechanical strength of the resulting geopolymer binders did not show a significant change over time. The FA/MK-SN system exhibited a final compressive strength of 75 MPa at 360 days, and at the same age FA/MK-DN and FA/MK –RN both reached final compressive strength values of 38 MPa.

Key words: silica source, metakaolin, fly ash, geopolymer, diatomaceous earth, rice husk ash.