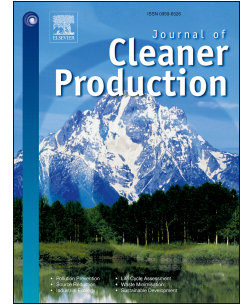


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Durability and microstructure characteristics of alkali activated coal bottom ash geopolymer cement

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Abstract: Many studies have focused on the production of mortar and concrete without cement. This is referred to as geopolymer mortar or concrete. This paper discusses the effect of alkali oxides ($\text{Na}_2\text{O} = 8, 12, 16$ wt.% and $\text{SiO}_2 = 0, 4, 8, 12$ wt.%) on compressive strength, microstructure and durability of circulating fluidized bed combustion coal bottom ash (CBA) geopolymer cements (GC). Durability and morphology tests were carried out through heating and freezing tests. The highest compressive strength (25.83 MPa) was achieved at Na_2O wt.% = 12, SiO_2 wt.% = 8. The optimum atomic ratios for a compact microstructure were obtained for Si/Al between 3.5-4 and Si/Na close to 0.5. Following the sintering, the main reaction products (N-A-S-H gel) became more amorphous at 800 °C, attaining Si/Al and Si/Na atomic ratios of 4.54 and 0.98. Sodium carbonate formation was observed at 800 °C. Also, the strength loss of GC was only 6.77 % after 30 freeze-thaw cycles. The results show that durable geopolymer concrete without cement can be produced by using waste bottom coal ash. Therefore, the production of geopolymer concrete has a high environmental impact, decreasing waste material in addition to global warming.

Keywords: Coal bottom ash; Geopolymer; SEM-EDX; Compressive strength; Alkali oxides.

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