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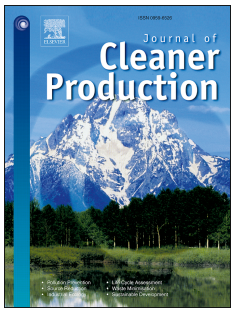

Durability and microstructure characteristics of alkali activated coal bottom ash geopolymer cement

İlker Bekir Topçu, Mehmet Uğur Toprak, Tayfun Uygunoğlu

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

İlker Bekir TOPÇU[1], Mehmet Uğur TOPRAK[1], Tayfun UYGUNOĞLU[2,*]

[1]Eskişehir Osmangazi University, Civil Engineering Department, 26480, Eskişehir, TURKEY
E-mail: ilkerbt@ogu.edu.tr Phone: +90 222 2393750/3217 Fax: +90 222 2393613
[2]Afyon Kocatepe University, Department of Civil Engineering, 03200, Afyonkarahisar, TURKEY, uygunoglu@aku.edu.tr, Phone: +90 272 2281423 Fax: +90 272 2281422

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 (Na_2O = 8, 12, 16 wt.% and 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 ^oC, 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.

[*]**Corresponding author**: Tayfun Uygunoğlu, Civil Engineering Department, Faculty of Engineering, Afyon Kocatepe University, 03200 Afyonkarahisar, Turkey. Tel: +90272 2281423; Fax: +90 272 2281422; e-mail: uygunoglu@aku.edu.tr