

Valorization of CDWs through Geopolymerization.

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ABSTRACT

Construction and Demolition Wastes (CDWs) are one of the heaviest and most voluminous solid wastes worldwide with their deposition posing a significant environmental impact. An important part of the CDWs, such as masonry materials (e.g., bricks and tiles) are aluminosilicate sourced and can be valorized in the development of alternative building materials (geopolymers) with low environmental footprint. In the present study, brick and tile wastes were reused as raw materials for the preparation of geopolymers. The results of alkali dissolution tests which determine the Si and Al leachability showed that the brick wastes are stronger affected by the alkaline attack than the tile wastes. The optimization of the synthesis was performed by applying the Taguchi multifactorial design of experiments based on compressive strength of the final products. The mathematical processing of the results reveal that the factors with the highest contribution on the mechanical behavior of the specimens are the alkalinity (R/Al , R: Na or K) and the soluble silicon content ($[Si]/R_2O$) of the activation solutions. The optimum synthesis factors for the delivery of products with enhanced compressive strength values (41 MPa) are the following: $[Si]/R_2O=1$, $R/Al=1.0$, $Na/Na+K=0.5$, $T=90^\circ C$ and $t=72$ h.

Key Words: CDW, bricks, tiles, geopolymers, alkali activation, Taguchi