USE OF SODA LIME GLASS WASTE AS SILICA SUPPLIER IN FLY ASH BASED GEOPOLYMERS

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Geopolymers have been primarily proposed for the construction industry as a substitute for Portland cement considering the lower CO2 emissions associated with their production. The relatively high compressive strength and chemical inertness of geopolymers, in addition to the possibility to incorporate in the network hazardous waste materials, increase the current interest in this technology. Geopolymers are usually composed of an aluminosilicate source activated with a solution of sodium silicate and sodium hydroxide. The present study evaluates the feasibility of using waste glass as silica source instead of water glass in geopolymer production, using sodium hydroxide as the only non-waste material.The samples were developed changing the SiO2/Al2O3 molar ratio and the molarity of the sodium hydroxide solution.
Fig. 1 shows that the compressive strength tends to rise as the molarity of the solution as well as the SiO2/Al2O3 molar ratio increase. The compressive strength values, around 45 MPa, are comparable to those of traditional Portland cement and they are remarkable considering the high amount of waste glass (70% wt.) incorporated in the matrix . SEM pictures demonstrated the formation of a compact matrix indicating the high reaction degree of the raw materials.

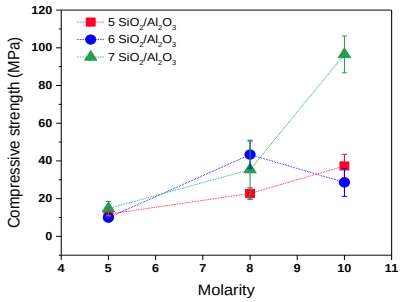

Figure 1 –Compressive strength of the samples, after 28 days.

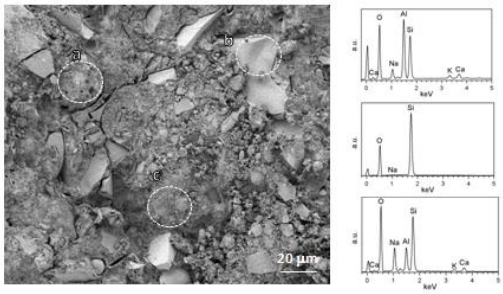

Figure 2 –SEM image and EDX spectra of geopolymers fabricated with 6 SiO_2/Al_2O_3 molar ratio and 8 NaOH molarity.

In Fig. 2 the EDX analysis for sample with 8 NaOH molarity and 6 SiO2/Al2O3 molar ratio, shows that the relative height of peaks related to Al and Si is consistent with a Si/Al molar ratio as expected from the formation of a geopolymer material.The results from leaching tests verified the excellent chemical stability of the present samples, confirming the capacity to produce a valuable robust and chemically durable product from waste materials. Moreover different processing technology such as 3D printing and machinability were evaluated to obtain a more versatile material to expand the range of possible applications

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