Synthesis of geopolymers from fly and bottom ashes of a thermoelectrical power plant for metallic ions adsorption

Enrique C. Peres, Matias Schadeck Netto, Evandro S. Mallmann, Luis F. O. Silva, Edson L. Foletto & Guilherme L. Dotto

Abstract

A series of geopolymers were synthesized from fly and bottom ashes of a thermoelectrical power plant located in the Brazilian southern, aiming to add value for these wastes. The geopolymers were prepared in conventional and ultrasound-assisted ways and used to uptake Ag+, Co2+, Cu2+, and Ni2+ from aqueous solutions. All materials were characterized by infrared spectroscopy (FT–IR), X-ray diffraction (XRD), and N2 adsorption isotherms (BET and BJH methods). The results revealed that the geopolymers obtained from the conventional method presented slightly higher values of surface area and total pore volume. However, in some cases, the adsorption potential was better for the ultrasound synthesized materials. The geopolymers prepared from both methods presented good adsorption performance concerning Ag+ and Cu2+, Co2+ and Ni2+. The removal percentages were higher than 90%. In addition, the adsorption capacities were within the literature range. These findings show that the ultrasound technique is not essential to improve the geopolymers production process compared to the conventional process, which generated material with better performance for heavy metals adsorption. Besides, it was possible to aggregate value for fly and bottom ashes, generating promising adsorbent materials.

Keywords: Adsorption; Ash; Geopolymers; Heavy metals; Ultrasound