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Use of drinking water sludge in the production process of zeolites

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Abstract This study reports the synthesis of zeolites A, X, and P, cancrinite, and sodalite using sludge generated in a drinking water plant. Two experimental steps were carried out: (1) fusion and (2) hydrothermal treatment. Crystallization was achieved by means of a 2^3 experimental design with central point with the following factors: temperature, time, and solid/liquid ratio. The sludge presented Si and Al contents ($SiO_2/Al_2O_3 = 1.7$) which allow the synthesis of zeolites with high cation exchange capacity. The content of organic matter was considerable (loss on ignition 26.1 %), but is eliminated in the fusion step at 550 °C. This process also permits the conversion of the initial aluminosilicates into zeolite precursors (sludge–NaOH mix of 1:0.785 g/g). Hydrothermal treatment then permits the crystallization of the aforementioned zeolites. These materials showed high cation exchange capacities as compared to other commercial and experimentally synthesized zeolites, and can be used in the removal of heavy metals such Cd^{2+}, Pb^{2+}, Cu^{2+}, Fe^{2+}, and ammonium present in water, providing an interesting new option in wastewater treatment and remediation of soils.

Keywords Sludge · Drinking water plants · Zeolite · Ion exchange

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