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Integrated synthesis and characterization of some porous polyacrylamide-based composites for cationic sorption from aqueous liquid wastes

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ABSTRACT

Three types of polymeric–inorganic composite cation-exchangers were synthesized by impregnation of inorganic precipitates of tin(IV) silicate and tin(IV) antimonate with different ratios into polyacrylamide matrices to form polyacrylamide stannic silicate (PAmSnSi), polyacrylamide stannic antimonate (PAmSnSb), and polyacrylamide stannic silicoantimonate (PAmSnSiSb) hybrid composites. These materials were characterized by X-ray powder diffraction, FTIR, SEM, BET surface area, DTA, and TGA. They possessed high surface areas with mesoporous texture; PAmSnSi, PAmSnSb, and PAmSnSiSb exhibited type IV-H4, IV-H3, and IV-H2 N_2-adsorption, respectively. They showed improved chemical stabilities which was in the order of PAmSnSb > PAmSnSi > PAmSnSiSb in HNO_3, while their stability order in HCl was PAmSnSi > PAmSnSb > PAmSnSiSb. The effect of experimental parameters such as temperature, concentration, and pH on the properties of material has been studied. Distribution behaviors for radioactive aqueous $^{134}Cs^{+}$, $^{60}Co^{2+}$, and $^{90}Sr^{2+}$ as well as Cd^{2+} ions on the three composite ion exchangers were investigated to understand the cation-exchange performance of the materials; some binary separations were predicted and compared.

Keywords: Porous materials; Synthesis; Characterization; Sorption and radioactive waste

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