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Efficient adsorbent for immobilization of caesium on contaminated areas

Aleksy Vasiliev, Kenneth Seaton and Iulia Little
East Tennessee State University, USA

The objective of this work is the synthesis of a novel superacidic mesoporous adsorbent for immobilization of radioactive caesium-137 in contaminated waters and soils. The project is based on the hypothesis that heteropolyacid-containing porous materials can selectively adsorb caesium due to the presence of highly acidic adsorption sites in their structure. Silica gel containing embedded phosphotungstic acid was synthesized by co-condensation with tetraethoxysilane in acidic media using the sol-gel technique. Pluronic 123 was added as a pore-forming agent. Content of tungsten in the obtained sample was 7.7%. The material was mesoporous with BET surface area above 1000 m²/g, however, it also contained micropores. Presence of bands of Keggin's structure in the FT-IR spectra at absence of XRD patterns of crystalline HPAs confirmed their fine incorporation into silica network. SAXS study and TEM imaging showed highly agglomerated particles with disordered porous structure at the average pore size of 16 nm. This material was studied in the adsorption of caesium ions from aqueous solutions. Isotherms of caesium adsorption were obtained at various temperatures. These data demonstrated a possibility to use the adsorbent in different climatic conditions. The selectivity of the adsorbent was studied at the competitive adsorption of caesium in the presence of potassium ions. High effectiveness of this material makes it potentially applicable for cleanup of contaminated areas after a nuclear incident.

Biography

Aleksy Vasiliev has completed his PhD from the Institute of Bioorganic Chemistry & Petrochemistry in Ukraine. His main field of expertise is materials chemistry, in particular, chemistry of mesoporous and microporous materials. He continued his professional career in the National Technological University in Argentina, and further moved to Rutgers University. Currently, he is working as an Associate Professor in East Tennessee State University.

vasiliev@etsu.edu

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