EGU21-16251
https://doi.org/10.5194/egusphere-egu21-16251
EGU General Assembly 2021

Supreme and selective capture of one of the most dangerous metal, URANIUM, by phosphonate-functionalized ordered mesoporous silica: surface chemistry matters the most

Dimitrios A. Giannakoudakis[1,2], Ioannis Anastopoulos[3,4], Mariusz Barczak[5], Evita Antoniou[3], Konrad Terpiłowski[5], Elmira Mohammadi Sigarikar[6], Mahmoud Shams[7], Emerson Coy[8], Aristeidis Bakandritsos[6], Ioannis A. Katsoyiannis[2], Juan Carlos Colmenares[1], and Ioannis Pashalidis[3]

[1]Institute of Physical Chemistry, Polish Academy of Sciences, Kasprzaka 44/52, 01-224, Warsaw, Poland
[2]Aristotle University, Department of Chemistry, Laboratory of Chemical and Environmental Technology, 54124, Thessaloniki, Greece
[3]Department of Chemistry, University of Cyprus, P.O. Box 20537, CY-1678 Nicosia, Cyprus
[4]Department of Electronics Engineering, School of Engineering, Hellenic Mediterranean University, Chania, Crete, 73100, Greece
[5]Institute of Chemical Sciences, Faculty of Chemistry, Maria Curie-Sklodowska University in Lublin, 20-031 Lublin, Poland
[6]Regional Centre of Advanced Technologies and Materials, Faculty of Science, Palacky University, Olomouc, Slechtitelu 27, 78371, Czech Republic
[7]Social Determinants of Health Research Center, Mashhad University of Medical Sciences, Mashhad, Iran
[8]NanoBioMedical Centre, Adam Mickiewicz University, Wszechnicy Piastowskiej 3, 61-614, Poznań, Poland

Designing of materials for effective uranium removal remains an open challenge. In the present work, we present a one-step co-condensation synthesis of a phosphonate functionalized ordered mesoporous silica (OMS-P). This novel material was characterized by various physicochemical methods (HR-TEM, SEM, N_2sorption, XPS, solid NMR, low-angle XRD, and FTIR) and its ability to remove U(VI) by adsorption from aqueous solutions was studied. The maximum adsorption capacity reached 345 mg/g in 10 minutes, the highest reported up to day for silicas at pH = 4 and almost four times higher than for the unfunctionalized silica. Even more interestingly, the coexistence of other cations, such as Eu(III), did not affect adsorption capacity and selectivity. The adsorption results were evaluated based on various theoretical models in order to conclude regarding the kinetics. Moreover, the main interactions responsible for the increased U(VI) removal efficiency and in general the role of surface chemistry were analyzed by spectroscopic characterizations of OMS-P before and after adsorption.