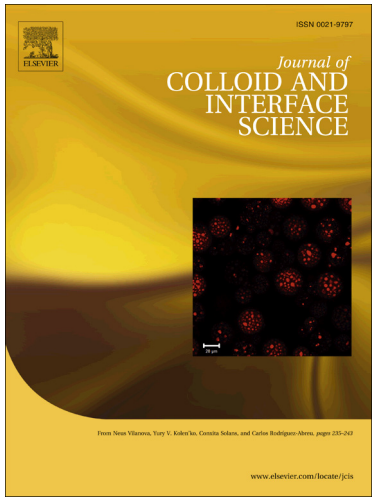

Regular Article

Synthesis and Characterization of Au-NPs Supported on Carbon Nanotubes: Application for the Ultrasound Assisted Removal of Radioactive UO_2^{2+} Ions Following Complexation with Arsenazo III: Spectrophotometric Detection, Optimization, Isotherm and Kinetic Study

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PII: S0021-9797(17)30541-6
DOI: http://dx.doi.org/10.1016/j.jcis.2017.05.022
Reference: YJCIS 22329

To appear in: *Journal of Colloid and Interface Science*

Received Date: 9 February 2017
Revised Date: 5 May 2017
Accepted Date: 8 May 2017

Please cite this article as: M.H. Omidi, F.N. Azad, M. Ghaedi, A. Asfaram, M.H.A. Azqhandi, L. Tayebi, Synthesis and Characterization of Au-NPs Supported on Carbon Nanotubes: Application for the Ultrasound Assisted Removal of Radioactive UO_2^{2+} Ions Following Complexation with Arsenazo III: Spectrophotometric Detection, Optimization, Isotherm and Kinetic Study, *Journal of Colloid and Interface Science* (2017), doi: http://dx.doi.org/10.1016/j.jcis.2017.05.022

Synthesis and Characterization of Au-NPs Supported on Carbon Nanotubes: Application for the Ultrasound Assisted Removal of Radioactive UO_2^{2+} Ions Following Complexation with Arsenazo III: Spectrophotometric Detection, Optimization, Isotherm and Kinetic Study

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Abstract

The present study devoted to description of efficient removal of radioactive UO_2^{2+} ions (U(IV)) via complexation with Arsenazo III (ARS III) accelerated by ultrasound-assisted adsorption onto the Au-NPs supported on carbon nanotubes (Au-NPs-CNTs), which were characterized by conventional techniques such as FESEM, EDS and XRD. Central composite design (CCD) employed to model contribution of parameters viz. pH (2.5-8.5), adsorbent mass (5-25 mg), UO_2^{2+} concentration (5-25 mg L^{-1}) and sonication time (1-5 min) onto response. The predicted results optimum conditions corresponding achievement of maximum UO_2^{2+} removal efficiency are pH 5.5, 20 mg of Au-NPs-CNTs, is highly applicability for removal of more than 98% 0f 25 mg L^{-1} of UO_2^{2+} following 5 min sonication. Through analysis of corresponding results based on evaluation according to UO_2^{2+} concentration were found significantly affect responds. ANOVA analysis revealed a high R^2 (0.9950) & AP (51.79) and low SD (0.6078) & CV% (0.6703) values of regression model equation which completely ensure accuracy of the quadratic model. Langmuir isotherm model was applicable for description of adsorption data with maximum monolayer adsorption capacity of 133.3 mg g^{-1} at 25 °C and pH 5.5. Dubinin–Radushkevich (D–R) isotherm model based on mean sorption energy (E) reveal high contribution of physisorption (1.17-3.78 kJ mol^{-1}) on adsorption process. Moreover, Pseudo-second-order kinetic model delivered a better correlation for the experimental data in comparison to the pseudo-first-order kinetic model and intraparticle diffusion mechanism.

Keywords: Arsenazo III; Au-NPs-CNTs; Kinetic and equilibrium isotherm studies; Optimization; Ultrasound assisted removal; Uranium ions.

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