

Fabrication and evaluation of activated carbon/ Fe_2O_3 nano-composite on the removal of strontium ions from water

Ahmad Kayvani Fard^{a,b}, Gordon Mckay^b, Hugues Preud'Homme^a, Viktor Kochkodan^a, Muataz A. Atieh^{a,b,*}

^a*Qatar Environment and Energy Research Institute, Hamad Bin Khalifa University, Qatar Foundation, PO Box 5825, Doha, Qatar, email: afard@qf.org.qa (A.K. Fard), hhomme@hbku.edu.qa (H. Homme), vkochkodan@hbku.edu.qa (V. Kochkodan)*

^b*College of Science and Engineering, Hamad Bin Khalifa University, Qatar Foundation, PO Box 5825, Doha, Qatar, email: gmckay@hbku.edu.qa (G. Mckay), Tel. +974-33199499, email: mhussien@hbku.edu.qa (M.A. Atieh)*

Received 30 June 2016; Accepted 10 March 2017

ABSTRACT

This work presents the characterization and application of activated carbon (AC) impregnated with different loadings of Fe_2O_3 nanoparticles for strontium removal from produced water. The initial strontium concentration, the strontium removal efficiency in aqueous media and the kinetics of strontium removal were analyzed by inductively coupled plasma mass spectrometer (ICP-MS). The characterization was performed using field emission scanning electron microscopy (FE-SEM) and Brunauer–Emmett–Teller (BET) surface analysis. Different experimental parameters such as adsorbent dosage, pH of the solution, agitation speed and contact time, were investigated for their effects on the adsorption of strontium from water. The optimum condition for maximum removal of the solute was observed to be 150 min of contact time with the sorbent, pH 7, 150 mg adsorbent dosage and 400 rpm rotational speed. Also it was observed that surface modification of AC with Fe_2O_3 nanoparticles enhanced their adsorption efficiency. AC loaded with 1% Fe_2O_3 could remove 93% of strontium while when the nanoparticles loading increased to 10%, the solute was completely removed from water. The results obtained are promising for the use of AC loaded with Fe_2O_3 nanoparticles in the pretreatment of produced water before the desalination process. Adsorption can be very efficient with low energy consumption and economic feasibility.

Keywords: Adsorption; Strontium; Desalination; Pre-treatment; Water treatment; Seawater

*Corresponding author.

Presented at the EDS conference on Desalination for the Environment: Clean Water and Energy, Rome, Italy, 22–26 May 2016.