Accepted Manuscript

Desulfurization: Critical step towards enhanced selenium removal from industrial effluents

Lucian C. Staicu, Nadia Morin-Crini, Grégorio Crini

PII: S0045-6535(16)31875-6

DOI: 10.1016/j.chemosphere.2016.12.132

Reference: CHEM 18588

To appear in: *ECSN*

Received Date: 14 September 2016

Revised Date: 21 December 2016

Accepted Date: 26 December 2016

Please cite this article as: Staicu, L.C., Morin-Crini, N., Crini, G., Desulfurization: Critical step towards enhanced selenium removal from industrial effluents, *Chemosphere* (2017), doi: 10.1016/j.chemosphere.2016.12.132.

Desulfurization: critical step towards enhanced selenium removal from industrial effluents

Lucian C. Staicu[1,2,*], Nadia Morin-Crini[1], Grégorio Crini[1]

[1]*Université de Bourgogne Franche-Comté, UFR Sciences & Techniques, UMR Chrono-environnement 6249, Besançon, France*

[2]*University Politehnica of Bucharest, Faculty of Applied Chemistry and Materials Science, Bucharest, Romania*

Abstract

Selenium (Se) removal from synthetic solutions and from real Flue Gas Desulfurization (FGD) wastewater generated by a coal-fired power plant was studied for the first time using a commercial iron oxide impregnated strong base anion exchange resin, Purolite® FerrIX A33E. In synthetic solutions, the resin showed high affinity for selenate and selenite, while sulfate exhibited a strong competition for both oxyanions. The FGD wastewater investigated is a complex system that contains Se (~1200 µg L^{-1}), SO_4^{2-} (~1.1 g L^{-1}), Cl^- (~9.5 g L^{-1}), and Ca^{2+} (~5 g L^{-1}), alongside a broad spectrum of toxic trace metals including Cd, Cr, Hg, Ni, and Zn. The resin performed poorly against Se in the raw FGD wastewater and showed moderate to good removal of several trace elements such as Cd, Cr, Hg, and Zn. In FGD effluent, sulfate was identified as a powerful competing anion for Se, having high affinity for the exchange active sites of the resin. The desulfurization of the FGD effluent using $BaCl_2$ led to the increase in Se removal from 3% (non-desulfurized effluent) to 80% (desulfurized effluent) by combined precipitation and ion exchange treatment. However, complete desulfurization using equimolar $BaCl_2$ could not be achieved due to the presence of bicarbonate that acts as a sulfate competitor for barium. In addition to selenium and sulfate