Accepted Manuscript

Uranium and europium sorption on amidoxime-functionalized magnetic chitosan micro-particles

Mohammed F. Hamza, Jean-Claude Roux, Eric Guibal

PII: S1385-8947(18)30371-1
DOI: https://doi.org/10.1016/j.cej.2018.03.029
Reference: CEJ 18636

To appear in: *Chemical Engineering Journal*

Received Date: 6 February 2018
Revised Date: 4 March 2018
Accepted Date: 5 March 2018

Please cite this article as: M.F. Hamza, J-C. Roux, E. Guibal, Uranium and europium sorption on amidoxime-functionalized magnetic chitosan micro-particles, *Chemical Engineering Journal* (2018), doi: https://doi.org/10.1016/j.cej.2018.03.029

Uranium and europium sorption on amidoxime-functionalized magnetic chitosan micro-particles

Mohammed F. HAMZA,[a,b] Jean-Claude ROUX,[a] Eric GUIBAL[a]

[(a)] C2MA, IMT Mines Ales, Univ. Montpellier, Alès, France

[(b)] Nuclear Materials Authority, POB 530, El-Maadi, Cairo, Egypt.

Abstract: Magnetic chitosan particles were successfully modified by amidoxime-grafting (as evidenced by FTIR analysis, SEM-EDX analysis, elemental analysis, X-ray diffraction (XRD), thermogravimetric analysis and titration). The effect of pH was investigated showing optimum sorption at pH 4 for U(VI) and pH 5 for Eu(III). Uptake kinetics are relatively fast: the equilibrium was reached within 60-90 min; and the kinetic profiles were preferentially fitted by the pseudo-second order rate equation. Sorption isotherms are equally fitted by the Langmuir and the Sips equations; under optimal conditions maximum sorption capacity reaches 1.5 mmol U g^{-1} and 2.47 mmol Eu g^{-1}. In bi-component solution, at pH close to 4.9, uranyl is enriched on the sorbent (higher selectivity coefficient) while maintaining high sorption capacities. The selectivity for Eu(III) sorption is higher at pH 2.3 but at the expense of a decrease in sorption capacities. Metal ions can be readily and fast desorbed using 0.5 M HCl solutions: 30-90 min are sufficient for achieving the complete desorption of U(VI) and about 95 % of Eu(III) desorption. Sorption and desorption performances are maintained almost constant over 5 cycles of sorption/desorption: the sorbent can be efficiently recycled. Uranium was successfully recovered from alkaline leachate of a sedimentary dolostone ore material.

Keywords: uranyl(VI); Eu(III); amidoximated-chitosan; sorption isotherms; uptake kinetics; desorption efficiency; sorbent recycling.