

## Accepted Manuscript

Uranium extraction using magnetic nano-based particles of diethylenetriamine-functionalized chitosan: Equilibrium and kinetic studies

Mohammad G. Mahfouz, Ahmed A. Galhoum, Nabawia A. Gomaa, Sayed S. Abdel-Rehem, Asem A. Atia, Thierry Vincent, Eric Guibal

PII: S1385-8947(14)01257-1  
DOI: <http://dx.doi.org/10.1016/j.cej.2014.09.061>  
Reference: CEJ 12679

To appear in: *Chemical Engineering Journal*

Received Date: 10 July 2014  
Revised Date: 16 September 2014  
Accepted Date: 17 September 2014

Please cite this article as: M.G. Mahfouz, A.A. Galhoum, N.A. Gomaa, S.S. Abdel-Rehem, A.A. Atia, T. Vincent, E. Guibal, Uranium extraction using magnetic nano-based particles of diethylenetriamine-functionalized chitosan: Equilibrium and kinetic studies, *Chemical Engineering Journal* (2014), doi: <http://dx.doi.org/10.1016/j.cej.2014.09.061>

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1            **Uranium extraction using magnetic nano-based particles of diethylenetriamine-**  
2            **functionalized chitosan: Equilibrium and kinetic studies**

3            **Mohammad G. Mahfouz,<sup>a</sup> Ahmed A. Galhoum,<sup>a,b</sup> Nabawia A. Gomaa,<sup>a</sup>**  
4            **Sayed S. Abdel-Rehem,<sup>c</sup> Asem A. Atia,<sup>d</sup> Thierry Vincent,<sup>b</sup> and Eric Guibal<sup>b</sup>**

5            <sup>a</sup>Nuclear Materials Authority, P.O. Box 530, El-Maadi, Cairo, Egypt.

6            <sup>b</sup>Ecole des Mines Alès, Centre des Matériaux des Mines d'Alès, 6 avenue de Clavières, Alès  
7            cedex, France.

8            <sup>c</sup>Chemistry Department, Faculty of Science, Ain Shams University, Egypt.

9            <sup>d</sup>Chemistry Department, Faculty of Science, Menoufia University, Egypt

11           **Abstract**

12           Magnetic nano-based particles of diethylenetriamine-functionalized chitosan have been  
13           synthesized before being characterized by elemental analysis, FT-IR spectroscopy, XRD, AFM,  
14           TEM and VSM analysis. Uranium adsorption (from synthetic solutions) has been investigated in  
15           batch systems. The effects of different experimental parameters such as initial solution pH  
16           (controlled with sulfuric acid), equilibration time, initial uranium concentration and temperature  
17           on sorption performance have been determined. The nano-based particles, with size in the range  
18           10-30 nm, are super-paramagnetic. The kinetic data can be efficiently modelled using the pseudo-  
19           second-order equation. The Langmuir and the Dubinin–Radushkevich (D–R) equations fit well  
20           sorption isotherms. The value of activation energy ( $E_{DR} = 8.39$  kJ/mol) indicates that the process  
21           is associated to chemical interactions (rather than pure physical sorption). In addition the values  
22           of thermodynamic parameters ( $\Delta G^{\circ}$  and  $\Delta H^{\circ}$ ) show that the process is spontaneous and  
23           exothermic. The positive value of  $\Delta S^{\circ}$  means that the randomness of the system increased with  
24           sorption. Finally, the adsorbent can be efficiently regenerated and recycled for at least 5 cycles  
25           using acidified urea as the eluent.

27           **Keywords:** Adsorption; uranium(VI); magnetic amine-functionalized chitosan nano-based  
28           particles; kinetics; isotherms.

31           **\*Corresponding authors:**

32           **Email address:** Eric.Guibal@mines-ales.fr (Eric Guibal) & Galhoum\_nma@yahoo.com (A.  
33           Galhoum)

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