

Mesoporous silica/polyacrylamide composite: preparation by UV-graft photopolymerization, characterization and use as Hg II adsorbent

Ali Saad^{a,b,c*}, Idriss Bakas^{c,d}, Jean-Yves Piquemal^c, Sophie Nowak^c,
Manef Abderrabba^{a,*} Mohamed M. Chehimi^{c,e*}

- ^{a)} Laboratory of Materials, Molecules and Applications, IPEST, University of Carthage, Sidi Bou Said road, B.P. 51 2070, La Marsa, Tunisia.
^{b)} Faculté des Sciences de Tunis, Université El Manar, PO Box 248, El Manar II, 2092, Tunis, Tunisia
^{c)} Univ Paris Diderot, Sorbonne Paris Cité, ITODYS, UMR 7086, CNRS, F-75013 Paris, France.
^{d)} Laboratoire AQUAMAR, Equipe Matériaux Photocatalyse et Environnement, Faculté des Sciences, Université Ibn Zohr, B.P. 8106 Cité Dakhla, Agadir, Morocco
^{e)} Université Paris Est, ICMPE (UMR7182), CNRS, UPEC, F-94320 Thiais, France

Abstract

MCM-41 ordered mesoporous silica was prepared, aminosilanized and grafted with polyacrylamide (PAAM) through in-situ radical photopolymerization process. The resulting composite, denoted PAAM-NH₂-MCM-41, the calcined and silanized reference MCM-41_S were characterized by Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), thermogravimetric analysis (TGA), X-ray photoelectron spectroscopy (XPS), transmission electron microscopy (TEM), scanning electron microscopy (SEM) and N₂ physisorption at 77K. These complementary techniques brought strong supporting evidence for the silanization process followed by PAAM grafting. The surface composition was found to be PAAM-rich as judged by XPS. The composite was then employed for the uptake of Hg(II) from aqueous solutions. Adsorption was monitored versus pH, time, and temperature. The maximum adsorption capacity at 25°C and pH 5.2 was 177 mg/g. Kinetically, the equilibrium was reached within 60 min for a 100 mg/L mercury solution. The adsorption of Hg(II) on PAAM-NH₂-MCM-41 composites followed second order kinetics. Thermodynamic parameters suggested that the favorable adsorption process is exothermic in nature and the adsorption is ascribed to a decrease in the degree of freedom of adsorbed ions which results in the entropy change.

This work conclusively shows that mesoporous silica-polymer hybrid metal ion adsorbents (with robust silica-polymer interface) can be prepared in a simple way by in situ radical photopolymerization in the presence of aminosilanized silica acting as a support and a macro-hydrogen donor simultaneously.

Keywords: Mesoporous silica, polymer, composites, grafting, organic–inorganic hybrids, adsorption, mercury removal.

Corresponding authors:

Ali Saad: *ali.saad8803@gmail.com*

Manef Abderrabba: *abderrabbamanef@gmail.com*

Mohamed M. Chehimi: *chehimi@icmpe.cnrs.fr*

Download English Version:

<https://daneshyari.com/en/article/5347900>

Download Persian Version:

<https://daneshyari.com/article/5347900>

[Daneshyari.com](https://daneshyari.com)