Desalination and Water Treatment
www.deswater.com

38 (2012) 114–120
January

doi: 10/5004/dwt.2012.2323

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Uranium preconcentration from seawater using phosphate functionalized poly(propylene) fibrous membrane

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Received 9 December 2010; Accepted 12 April 2011

ABSTRACT

The poly(ethylene glycol methacrylate phosphate) macroporous membranes (PEGMP-membrane) were prepared by grafting of ethylene glycol methacrylate phosphate onto the poly(propylene) fibrous sheets using UV-irradiation and electron beam. The PEGMP-membrane samples thus prepared were characterized in terms of water uptake capacity, uranium uptake efficiency under seawater conditions, uranium distribution in the membrane samples, desorption and reusability of the membrane for uranium preconcentration. The uranium sorption capacity of the PEGMP membrane was found to be appropriate (1.4×10^{-3} mol/g) for using it in adsorptive mode for preconcentration of uranium from the lean aqueous feed. The functional group density based on the gravimetrically measured weight of PEGMP anchored in the membrane sample was calculated to be 3.2×10^{-3} mol/g. The comparison of expected functional group density and uranium uptake capacity seems to suggest that UO_2^{2+} forms complex with EGMP units in 1:2 proportion in the membrane. The uranium could be desorbed from PEGMP-membrane quantitatively (>95%) by equilibration in well-stirred 0.5 M Na_2CO_3 for 10 min. The membrane could be reused without any conditioning for uranium re-sorption. The studies carried out in the present work indicated potential applications of the PEGMP-membrane for adsorptive preconcentration of uranium from seawater and other natural waters.

Keywords: Ethylene glycol methacrylate phosphate; Fibrous poly(propylene) membrane; Adsorption; Preconcentration; Uranium; Seawater

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Proceedings of DAE-BRNS Biennial Symposium on Emerging Trends in Separation Science and Technology, Kalpakkam, India, March 1–4, 2010