

Supporting Information

Elution of Uranium and Transition Metals from Amidoxime-Based Polymer Adsorbents for Sequestering Uranium from Seawater

Horng-Bin Pan^a, Li-Jung Kuo^b, Chien M. Wai^{a*}, Naomi Miyamoto^a, Ruma Joshi^a, Jordana R. Wood^b, Jonathan E. Strivens^b, Christopher J. Janke^c, Yatsandra Oyola^c, Sadananda Das^c, Richard T. Mayes^c, Gary A. Gill^{b*}

^aDepartment of Chemistry, University of Idaho, Moscow, ID 83844, United States

^bMarine Sciences Laboratory, Pacific Northwest National Laboratory, Sequim, Washington 98382, United States

^cMaterials Science and Technology Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831, United States

*E-mail: cwai@uidaho.edu; *E-mail: gary.gill@pnl.gov

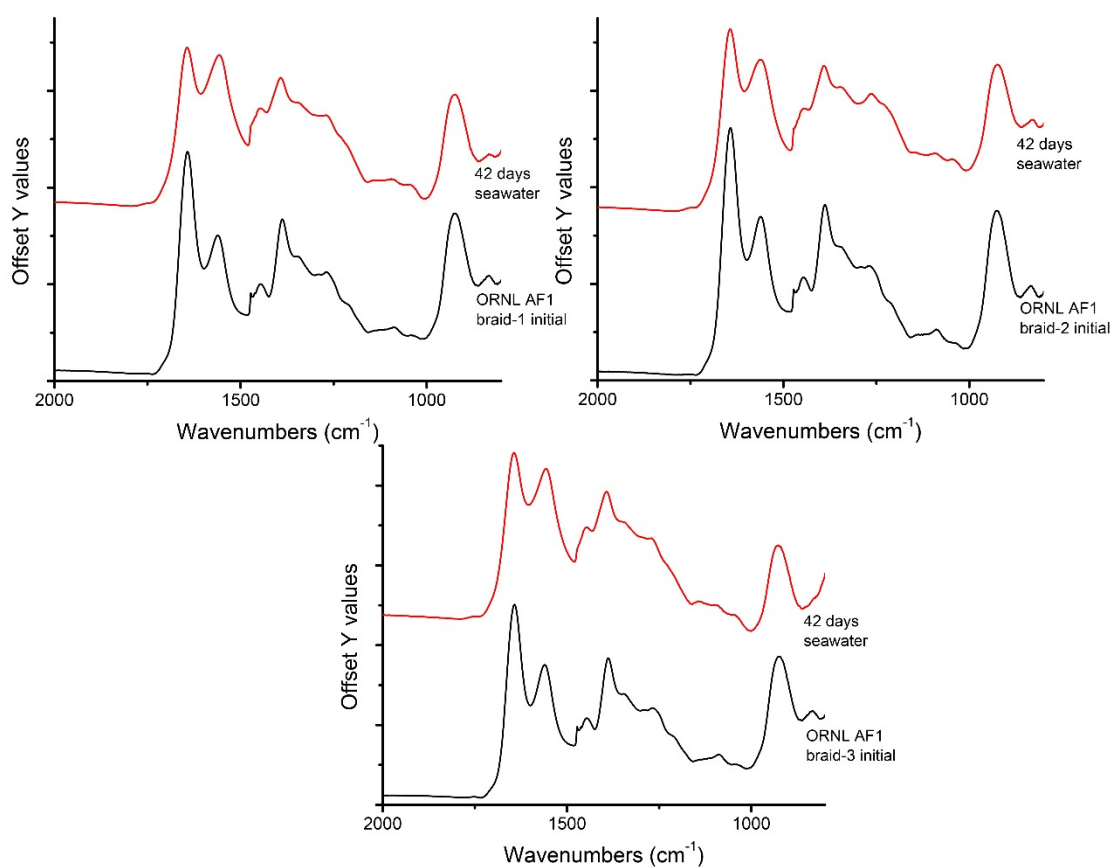


Figure S1. FTIR spectra of the three ORNL AF1 braided adsorbents after 42 days of seawater exposure. The spectra are normalized to the $-\text{CH}_2-$ asymmetrical stretching peak at 2918 cm^{-1} .

Table S1. Peak intensity of N–O stretching (928 cm^{-1}) and ratio of C=N/–COO[–] stretching (I_{1643}/I_{1559}) of the ORNL AF1 braided adsorbents after 42 days of seawater exposure. The peak intensities are normalized to –CH₂– asymmetrical stretching peak at 2918 cm^{-1} .

Description	IR peak ratio of I_{1643}/I_{1559}	IR peak intensity of I_{928}
ORNL AF1 braid-1 initial	1.355	0.511
ORNL AF1 braid-1 after 42 days seawater exposure	1.031	0.427
ORNL AF1 braid-2 initial	1.364	0.567
ORNL AF1 braid-2 after 42 days seawater exposure	1.124	0.431
ORNL AF1 braid-3 initial	1.286	0.552
ORNL AF1 braid-3 after 42 days seawater exposure	1.068	0.428

LC-MS analysis of the vanadium(V)–glutarimidedioxime complex

Figure S2 shows the LC chromatogram, acquired for solutions containing only glutarimidedioxime and vanadium (V) to glutarimidedioxime, at a molar ratio of 1:1. The peak at the retention time of 1.75 minute is due to glutarimidedioxime. At a molar ratio of vanadium(V) to glutarimidedioxime = 1:1 is observed at the retention time of 0.77 minute in the LC chromatogram.

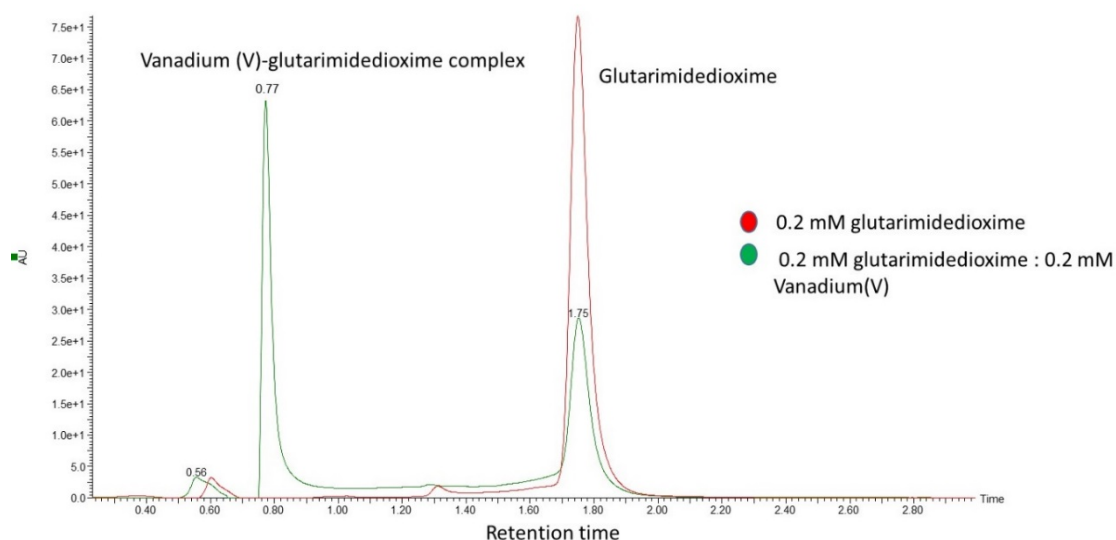


Figure S2. LC chromatogram of solutions containing only 0.2 mM glutarimidedioxime (red line) and 0.2 mM Na_3VO_4 and 0.2 mM glutarimidedioxime (green line) at pH 8.3 in 0.05 M NaCl.

Figure S3 shows the mass spectrum acquired for solutions containing glutarimidedioxime and vanadium (V) at the molar ratio of 1:1. According to the literature,¹ the peak observed at $m/z \sim 144$ can be assigned to protonated glutarimidedioxime. The peak observed at $m/z \sim 126$ results from the loss of water from protonated glutarimidedioxime. The base peak ($m/z \sim 266$) in the mass spectrum is the evidence of 1:1 vanadium: glutarimidedioxime complex. The peaks observed at $m/z \sim 248$, $m/z \sim 270$, $m/z \sim 292$, are due to $([\text{VO}_2 + \text{glutarimidedioxime} + \text{Na}]^+)$, $([\text{VO}_2 + \text{glutarimidedioxime} + 2\text{Na} - \text{H}]^+)$ and $([\text{VO}_2 + \text{glutarimidedioxime} + 3\text{Na} - 2\text{H}]^+)$, respectively. The peaks observed at $m/z \sim 140$, $m/z \sim 199$, $m/z \sim 257$, $m/z \sim 315$, and $m/z \sim 433$ are the positive clusters of sodium chloride because 0.05 M sodium chloride was used as a solvent for making our samples.

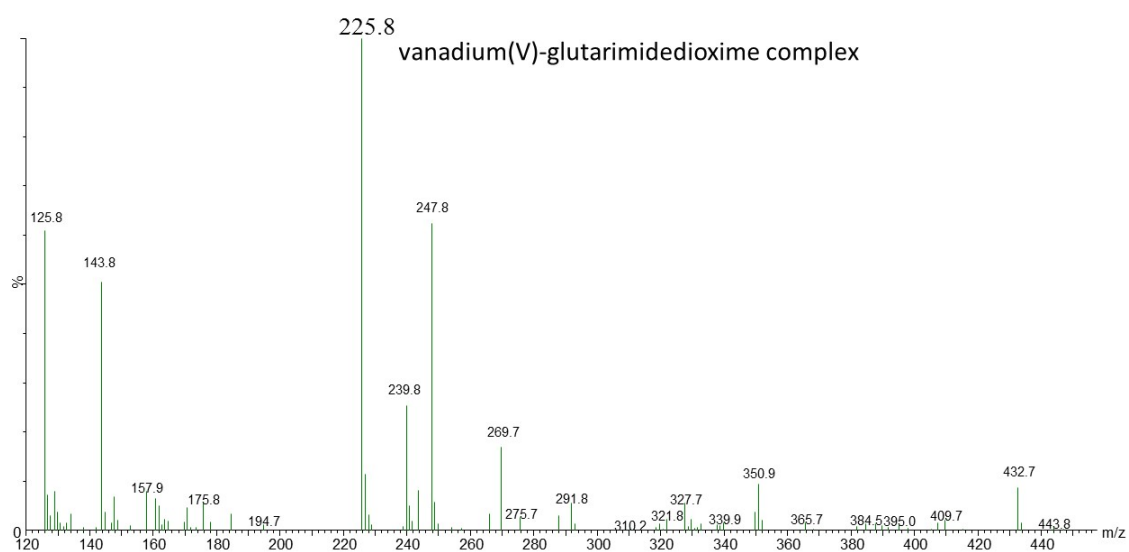


Figure S3. Positive-ion ESI mass spectrum of solutions containing 0.2 mM Na_3VO_4 and 0.2 mM glutarimidedioxime complex at pH 8.3 in 0.05 M NaCl

References:

- (1) Mustapha, A. M.; Pasilis, S. P., Probing uranyl(VI) speciation in the presence of amidoxime ligands using electrospray ionization mass spectrometry. *Rapid Commun. Mass Spectrom.* **2013**, *27*, 2135-2142.