Supporting Information for

Uranium sorption with functionalized mesoporous carbon materials

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Table of Contents

1 – Characterization of materials (BET and TGA) Pages S1-S5
   1.1 - MC-Starting material Page S2
   1.2 - MC-CA Page S2
   1.3 - MC-Ph-AO Page S2
   1.4 - MC-PhCOOH Page S2
   1.5 - MC-Ph-AO/PhCOOH Page S3
   1.6 - MC-Ph-O-PO(OH)2 Page S3
   1.7 – MC-Ph-CH2-COOH Page S3
   1.8 - MC-CA/PhCOOH Page S3
   1.9 - MC-COOH Page S4
   1.10 - MC-O-PO(OH)2 Page S4
   1.11 – MC-bis(PO(OH)2) Page S4
   1.12 – MC-u-PO(OEt)2 Page S4
   1.13 - MC-u-PO(OH)2 Page S5
   1.14 – MC-PhOH Page S5
   1.15 – MC-Ph-PO(OEt)2 Page S5
   1.16 - MC-Ph-PO(OH)2 Page S5

2 – Composition of the artificial seawater Page S6
3 – U sorption capacity with respect to functional group loading Pages S6-S7
4 – Freundlich and Temkin isotherms Pages S7-S8
5 – Pseudo-first order kinetics of MC-O-PO(OH)2 Pages S8-S9
1. Characterization of materials (BET and TGA):

1.1 MC Starting Material:

1.2 MC-CA:

1.3 MC-Ph-AO:

1.4 MC-PhCOOH:
1.5 MC-Ph-AO/PhCOOH:

1.6 MC-Ph-O-PO(OH)₂:

1.7 MC-Ph-CH₂-COOH:

1.8 MC-CA/PhCOOH:
1.9 MC-COOH:

![Graphs and data plots for MC-COOH]

1.10 MC-O-PO(OH)_2:

![Graphs and data plots for MC-O-PO(OH)_2]

1.11 MC-bis(PO(OH))_2:

![Graphs and data plots for MC-bis(PO(OH))_2]

1.12 MC-u-PO(OEt)_2:

![Graphs and data plots for MC-u-PO(OEt)_2]
Figure S1: Thermogravimetric analysis curves, nitrogen adsorption isotherms, and pore size distributions of functionalized mesoporous carbon materials.
2. Composition of artificial seawater

Table S1: Composition of artificial seawater

<table>
<thead>
<tr>
<th>Salt</th>
<th>Molecular weight</th>
<th>Solution (g/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NaCl</td>
<td>58.44</td>
<td>23.926</td>
</tr>
<tr>
<td>Na₂SO₄</td>
<td>142.04</td>
<td>4.008</td>
</tr>
<tr>
<td>KCl</td>
<td>74.55</td>
<td>0.738</td>
</tr>
<tr>
<td>NaHCO₃</td>
<td>84.01</td>
<td>0.196</td>
</tr>
<tr>
<td>MgCl₂.6H₂O</td>
<td>203.33</td>
<td>10.831</td>
</tr>
<tr>
<td>CaCl₂.2H₂O</td>
<td>147.02</td>
<td>1.519</td>
</tr>
</tbody>
</table>


3. U sorption capacity with respect to functional group loading

Table S2: Sorption capacity in mg of U/mmol of organic moiety

<table>
<thead>
<tr>
<th>Ligands</th>
<th>Acid Condition (mg/mmol)</th>
<th>Seawater Condition (mg/mmol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L-CA</td>
<td>7.14</td>
<td>7.40</td>
</tr>
<tr>
<td>L-Ph-AO</td>
<td>7.22</td>
<td>2.40</td>
</tr>
<tr>
<td>L-CA/PhCOOH</td>
<td>34.6</td>
<td>9.60</td>
</tr>
<tr>
<td>L-Ph-AO/PhCOOH</td>
<td>35.4</td>
<td>4.83</td>
</tr>
<tr>
<td>L-Ph-COOH</td>
<td>48.9</td>
<td>31.9</td>
</tr>
<tr>
<td>L-Ph-CH₂-COOH</td>
<td>17.1</td>
<td>3.20</td>
</tr>
<tr>
<td>L-COOH</td>
<td>7.22</td>
<td>9.60</td>
</tr>
<tr>
<td>L-Ph-OH</td>
<td>4.21</td>
<td>1.31</td>
</tr>
<tr>
<td>L-Ph-O-PO(OH)₂</td>
<td>23.8</td>
<td>5.23</td>
</tr>
<tr>
<td>L-O-PO(OH)₂</td>
<td>228</td>
<td>178</td>
</tr>
<tr>
<td>L-bis(PO(OH)₂)</td>
<td>92.1</td>
<td>6.89</td>
</tr>
<tr>
<td>L-u-PO(OEt)₂</td>
<td>4.80</td>
<td>4.77</td>
</tr>
<tr>
<td>L-u-PO(OH)₂</td>
<td>18.4</td>
<td>6.40</td>
</tr>
<tr>
<td>L-Ph-PO(OEt)₂</td>
<td>12.3</td>
<td>10.76</td>
</tr>
<tr>
<td>L-Ph-PO(OH)₂</td>
<td>90.0</td>
<td>43.75</td>
</tr>
</tbody>
</table>
Figure S2: Sorption capacity in mg of U/mmol of organic moiety. Sorption in acidic water is in red, seawater simulant in blue.

4. Freundlich and Temkin Isotherms

Figure S3: Sorption isotherms displayed in their linearized format and fit by the Freundlich model.
Figure S4: Sorption isotherms displayed in their linearized format and fit by the Temkin model.

5. Pseudo-first order kinetics of MC-O-PO(OH)$_2$

In acidic water:

Figure S5: Pseudo-first order kinetics of MC-O-PO(OH)$_2$ in acidic water.

$R^2 = 0.94866$
Slope = $-0.35259 \pm 0.03088$
Intercept = $4.50044 \pm 0.21285$
In artificial seawater:

Figure S6: Pseudo-first order kinetics of MC-O-PO(OH)$_2$ in seawater.

\[ R^2 = 0 \]
\[ \text{Slope} = -0.04296 \pm 0.06136 \]
\[ \text{Intercept} = 0.7683 \pm 0.73173 \]