Electronic Supporting Information (ESI) for

Interior multi-cavities/surface engineering of alginate hydrogels with PEI for exceptionally efficient chromium removal in batch and continuous aqueous systems

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Fig. S1. FT-IR spectra of (a) CaCO$_3$, (b) CaCO$_3$@PDA and (c) CaCO$_3$@PDA@PEI;
Fig. S2. FT-IR spectra of (a) 0.7-HS-SA, (b) 0.7-HS-PDA@PEI-SA@PEI, (c) 0.7-HS-PDA@PEI-SA@PEI-Cr and (d) F-SA.
Fig. S3. XRD patterns of the CaCO$_3$ and 0.7-HS-PDA@PEI-SA@PEI.
Fig. S4. Nitrogen adsorption–desorption isotherms and BJH pore size distribution curves of (a) 0.7-CaCO$_3$@PDA@PEI-SA@PEI, (b) 0.7-HS-PDA@PEI-SA and (c) 0.7-HS-PDA@PEI-SA@PEI.
Before adsorption

After five recycling

Fig. S5. The photos of 0.7-HS-PDA@PEI-SA@PEI (before adsorption) and after five recycling.
Table S1 Textural characteristics of studied samples.

<table>
<thead>
<tr>
<th>Samples</th>
<th>Specific surface area (m² g⁻¹)</th>
<th>Total pore volumes (cm³ g⁻¹)</th>
<th>Average pore size (nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.7-CaCO₃@PDA@PEI-SA@PEI</td>
<td>20</td>
<td>0.12</td>
<td>17.3</td>
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<tr>
<td>0.7-HS-PDA@PEI-SA</td>
<td>41</td>
<td>0.26</td>
<td>25.2</td>
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<tr>
<td>0.7-HS-PDA@PEI-SA@PEI</td>
<td>32</td>
<td>0.14</td>
<td>16.6</td>
</tr>
</tbody>
</table>