Supporting information

Controllable synthesis of hierarchical mesoporous/microporous nitrogen-rich polymer networks for CO$_2$ and Cr (VI) ion adsorption

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Isosteric heat of CO$_2$ adsorption

To ascertain the strength of the interaction between CO$_2$ molecules and the MRT network, the isosteric heat of CO$_2$ sorption, Q$_{st}$, was calculated using CO$_2$ sorption isotherms measured at 273 and
298K. The $Q_{st}$ (kJ/mol) at a given surface loading ($q_e$) is calculated from the Clausius–Clapeyron equation as

$$\left(\frac{\partial (\ln P)}{\partial (1/T)}\right)_{q_e} = -\frac{Q_{st}}{R}$$

(1)

where $P$ is CO$_2$ partial pressure (Pa), $T$ is the absolute temperature (K), and $R$ denotes the universal gas constant, 8.314 J•mol$^{-1}$•K$^{-1}$.

**Figure S1.** Isosteric heats of adsorption for CO$_2$ calculated from the uptakes at 273 and 298 K for the MRT networks

**Equilibrium adsorption modeling for Cr (VI) adsorption**

The equilibrium adsorption isotherm is of importance in the design of adsorption systems. The
Langmuir adsorption model was often used to describe sorption of a solute from a liquid solution given as Eq. (2),

$$\frac{C_e}{q_e} = \frac{1}{bq_m} + \frac{C_e}{q_m}$$

where $C_e$ is the concentration of Cr(VI) in the solution at equilibrium (mg/L), $q_e$ is the amount of Cr(VI) adsorbed per unit mass of the MRT network (mg/g), $q_m$ indicates the monolayer adsorption capacity of Cr(VI)/unit masss of the MRT networks and $b$ is the Langmuir constant related to the energy of adsorption.

The Freundlich isotherm is mostly used to describe the adsorption of inorganic and organic components in solution. This fairly satisfactory empirical can be used for non ideal sorption that involves heterogeneous sorption and is expressed as Eq. (3),

$$q_e = K_f (C_e)^{1/n}$$

the logarithmic form is given as Eq. (4),

$$\log q_e = \log K_f + n \log C_e$$
Figure S2 Fitting of Langmiur (a) and Freundlich (b) isotherms
<table>
<thead>
<tr>
<th>Adsorbent</th>
<th>b (L/mg)</th>
<th>$q_e$ (mg/g)</th>
<th>$R_f$</th>
<th>$K_f$</th>
<th>$n$</th>
<th>$R_f$</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRT-1</td>
<td>0.075</td>
<td>94.78</td>
<td>0.986</td>
<td>13.02</td>
<td>2.30</td>
<td>0.991</td>
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<td>MRT-1.5</td>
<td>0.266</td>
<td>125.15</td>
<td>0.994</td>
<td>35.81</td>
<td>3.34</td>
<td>0.995</td>
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<td>MRT-2</td>
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<td>102.88</td>
<td>0.986</td>
<td>24.21</td>
<td>2.88</td>
<td>0.985</td>
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<tr>
<td>MRT-3</td>
<td>0.172</td>
<td>101.31</td>
<td>0.984</td>
<td>22.55</td>
<td>2.80</td>
<td>0.991</td>
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<tr>
<td>MRT-4</td>
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<td>98.32</td>
<td>0.983</td>
<td>18.45</td>
<td>2.56</td>
<td>0.990</td>
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