Supplementary Information

Enhanced Electro-peroxymonosulfate Activation by Carbon Nanotube Filter with Functionalized Polyelectrolyte

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**Test S1.** Specific information of tap water and lake water.

<table>
<thead>
<tr>
<th>Samples</th>
<th>pH</th>
<th>DO (mM)</th>
<th>TOC (mg/L)</th>
<th>Conductivity (µs/cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tap water</td>
<td>7.61</td>
<td>0.21</td>
<td>1.75</td>
<td>515.69</td>
</tr>
<tr>
<td>Lake water</td>
<td>7.83</td>
<td>0.19</td>
<td>88.90</td>
<td>675.25</td>
</tr>
</tbody>
</table>

**Test S2.** Experimental processes of several pollutants.

The prepared PDDA-CNT nanohybrid filter was installed to serve as a cathode, meanwhile a perforated titanium plate was made as an anode. The voltage used in experiments was provided by the DC power (DH1766A-1, China). The flow rate was controlled by an Ismatec ISM833C peristaltic pump (Switzerland). 50 mL of 10 mg/L four typical organic compounds dissolution including 1.5 mM PMS passed through PDDA-CNT nanohybrid filter and then returned, respectively. Effluent samples (3 mL), include congo red, methylene blue and tetracycline were collected and analyzed at given time intervals by UV-vis spectrophotometer (UV-2600, Japan), respectively. Bisphenol A was detected using high-performance liquid chromatography (HPLC, Thermofisher, USA).
**Test S3.** Energy consumption.

The electric energy consumption (kWh/m$^3$) was calculated using the equation:

\[
\text{Energy consumption} = \frac{\text{applied voltage (V) } \times \text{ current (A) } \times \text{ retention time (h)}}{\text{solution volume (m}^3\text{)}}
\]
**Test S4.** Comparison of the performance of proposed system with reported electrocatalytic filtration systems.

<table>
<thead>
<tr>
<th>Materials</th>
<th>Pollutants</th>
<th>Operating parameters</th>
<th>Removal efficiency</th>
<th>Energy consumption</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molecular imprinting-TiO$_2$@SnO$_2$-Sb (A)</td>
<td>2,4-dichlorophenoxyacetic acid (1 mg/L)</td>
<td>3 V 240 7.0</td>
<td>62.4%</td>
<td>0.58 Wh/L</td>
<td>1</td>
</tr>
<tr>
<td>Sb-SnO$_2$/carbon membrane (A)</td>
<td>Tetracycline (50 mg/L)</td>
<td>3 V 480 7.0</td>
<td>96.5%</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>CNT-polyvinyl alcohol (A)</td>
<td>Cr (VI) (1 mg/L)</td>
<td>7 V 360 6.0</td>
<td>86.5%</td>
<td>1.48 kWh/m$^3$</td>
<td>3</td>
</tr>
<tr>
<td>Nanoparticulate zero-valent iron/CNT</td>
<td>Betablocker metoprolol (0.2 μmol/L)</td>
<td>1 V 0.1 -</td>
<td>97.0%</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>PDDA-CNT (C)</td>
<td>Congo red (10 mg/L)</td>
<td>-1 V 40 7.0</td>
<td>100%</td>
<td>0.026 kWh/m$^3$</td>
<td>This work</td>
</tr>
</tbody>
</table>

Note: A: anode C: cathode.
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References

