Supplementary information for

Heterogeneous Fenton-like Degradation of Phenanthrene Catalyzed by Schwertmannite Biosynthesized Using Acidithiobacillus ferrooxidans

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This supporting information contains a 7-page document, including the detailed descriptions of the preparation of chemosynthetic schwertmannite and chemosynthetic goethite, 4 figures, 1 tables and this cover page.
**Text S1.** Preparation of chemosynthetic schwertmannite and chemosynthetic goethite

Chemosynthetic schwertmannite was prepared using the chemically oxidative synthesis method. Briefly, 1.80 mL of 30% (v/v) H₂O₂ was added into 150 mL of 160 mmol/L FeSO₄·7H₂O solution. The flasks were then incubated for 24 h at 180 rpm and 28 °C in a rotary shaker. Then the precipitates formed in the flasks were collected through filtering with Whatman No. 4 filter paper and dried at 50°C to a constant weight. Chemosynthetic goethite was prepared in the laboratory according to the followed method. Firstly, the pH of a 0.2 M Fe(NO₃)₃ solution was adjusted to 11.0 with 0.2 M NaOH and then incubated at 180 rpm and 22°C for 48 h in a rotary shaker. After heating in a water bath at 90 °C for 16 h followed by repeated rinsing of the solids with deionized water, the solids were dried for 16 h at 70 °C to a constant weight.
**Fig. S1** SEM images of the chemosynthetic schwertmannite particles: \( \times 2000 \) (a) and \( \times 20000 \) (b).
Fig. S2 GC-MS chromatograms of extracts of phenanthrene degradation catalyzed by biosynthetic schwertmannite after (a) 0 h, (b) 1 h and (c) 5 h reaction time. Experimental conditions: [phenanthrene]₀ = 1 mg/L, [H₂O₂]₀ = 200 mg/L, and solution initial pH = 3.0.
Fig. S3 Mass spectra of Product G (retention time of 26.192 or 26.342 min, $m/z = 405$).
Fig. S4 FTIR analyses of newly biosynthetic schwertmannite and the schwertmannite after being used for 12 cycles. Experimental conditions were [phenanthrene]₀ = 1 mg/L, [schwertmannite]₀ = 1 g/L, [H₂O₂]₀ = 200 mg/L, solution initial pH = 3.0, and reaction time of 12 h in each cycle.
Table S1 Binding energy of Fe 2p, and Fe$^{2+}$ and Fe$^{3+}$ surface concentration on the biosynthetic schwertmannite catalyst before and after phenanthrene degradation.

<table>
<thead>
<tr>
<th></th>
<th>Binding Energy (eV)</th>
<th>Fe$^{2+}$ surface concentration (%)</th>
<th>Fe$^{3+}$ surface concentration (%)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>2p$_{1/2}$</td>
<td>2p$_{1/3}$</td>
<td>2p$_{1/2}$</td>
</tr>
<tr>
<td>Before</td>
<td>710.9</td>
<td>724.4</td>
<td>712.5</td>
</tr>
<tr>
<td>After</td>
<td>711.3</td>
<td>724.7</td>
<td>712.9</td>
</tr>
</tbody>
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