

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.

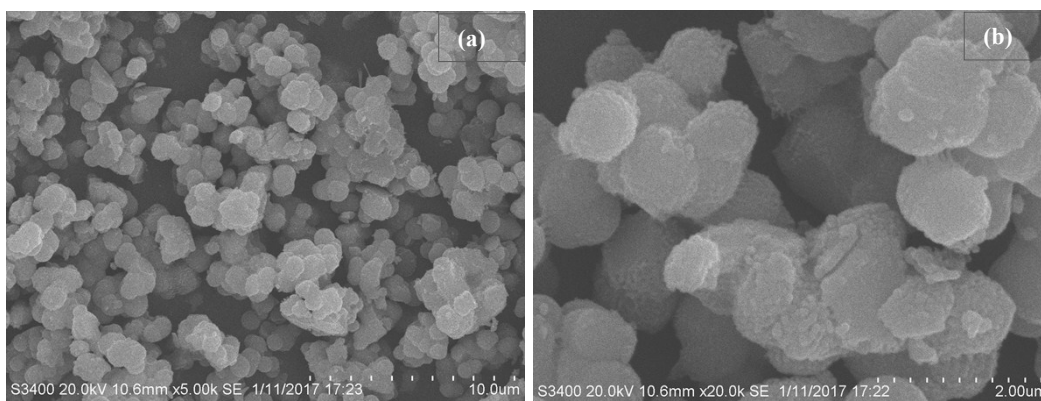


Fig. S1 SEM images of the chemosynthetic schwertmannite particles: $\times 2000$ (a) and $\times 20000$ (b).

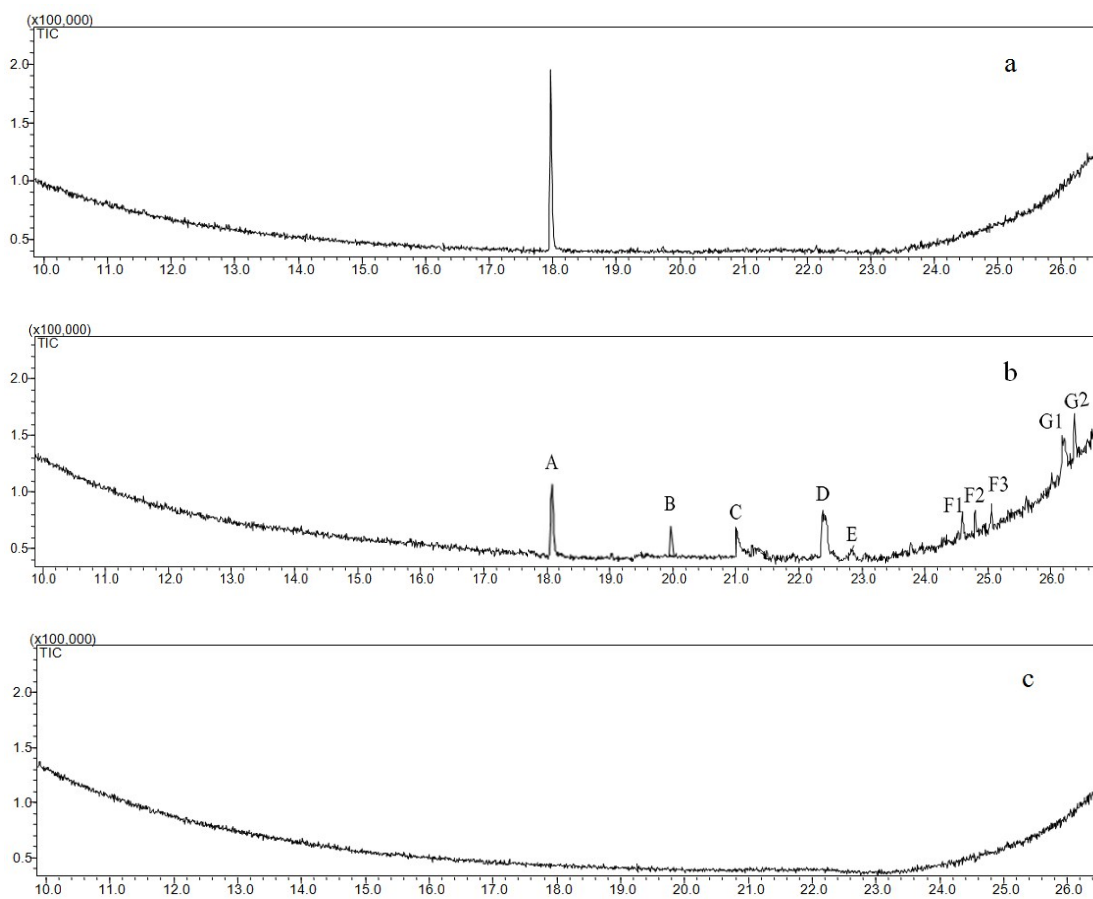


Fig. S2 GC-MS chromatograms of extracts of phenanthrene degradation catalyzed by biosynthetic schwertmannite after (a) 0 h, (b) 1 h and (c) 5 h reaction time. Experimental conditions: $[\text{phenanthrene}]_0 = 1 \text{ mg/L}$, $[\text{H}_2\text{O}_2]_0 = 200 \text{ mg/L}$, and solution initial $\text{pH} = 3.0$.

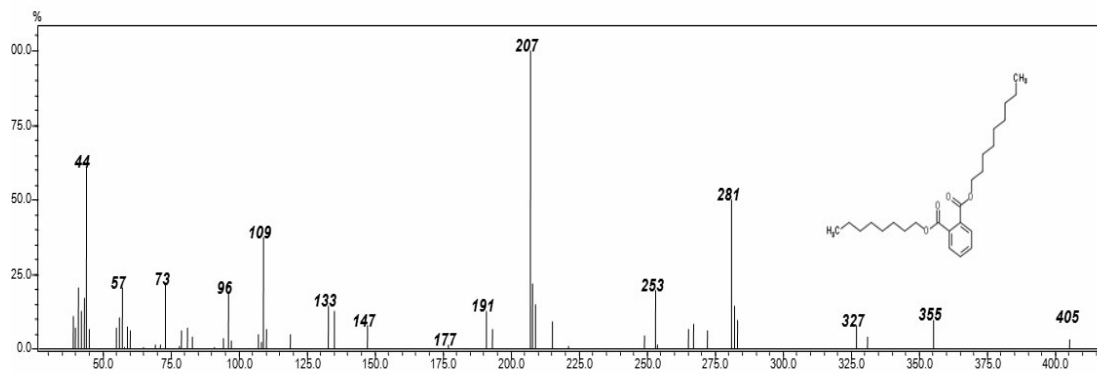


Fig. S3 Mass spectra of Product G (retention time of 26.192 or 26.342 min, $m/z = 405$).

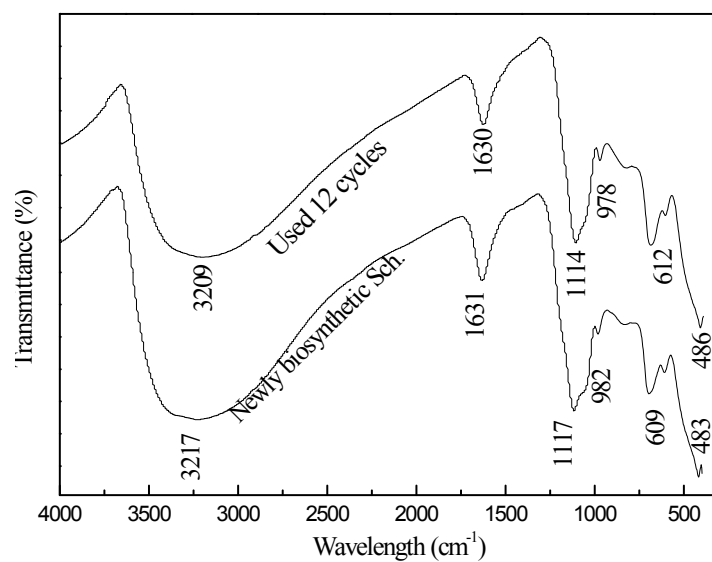


Fig. S4 FTIR analyses of newly biosynthetic schwertmannite and the schwertmannite after being used for 12 cycles. Experimental conditions were $[\text{phenanthrene}]_0 = 1 \text{ mg/L}$, $[\text{schwertmannite}]_0 = 1 \text{ g/L}$, $[\text{H}_2\text{O}_2]_0 = 200 \text{ mg/L}$, solution initial pH = 3.0, and reaction time of 12 h in each cycle.

Table S1 Binding energy of Fe 2p, and Fe²⁺ and Fe³⁺ surface concentration on the biosynthetic schwertmannite catalyst before and after phenanthrene degradation.

	Binding Energy (eV)				Fe ²⁺ surface concentration (%)	Fe ³⁺ surface concentration (%)
	Fe ²⁺		Fe ³⁺			
	2p _{1/2}	2p _{1/3}	2p _{1/2}	2p _{1/3}		
Before	710.9	724.4	712.5	726.1	41.8	58.2
After	711.3	724.7	712.9	725.9	54.5	45.5