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Supplementary Data

Factors affecting *p*-nitrophenol removal by microscale zero-valent iron

coupling with weak magnetic field (WMF)

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Fig. S1 Time courses of aquatic PNP degradation by various ZVI samples (i.e., Guoyao, Sigma, HT1, YF1, HT2, and YF2) with and without WMF. Reaction conditions: $[PNP]_0 = 10 \ \mu\text{M}$, $[Fe^0]_0 = 100 \ \text{mg/L}$, $[NaAc-HAc] = 0.10 \ \text{M}$ (pH 4.0), rpm = 500, and T = 20 ± 1 °C.



Fig. S2 Time courses of Fe(II) release during PNP removal by various ZVI samples (i.e., Guoyao, Sigma, HT1, YF1, HT2, and YF2) with and without WMF. Reaction conditions: $[PNP]_0 = 10 \ \mu\text{M}, [Fe^0]_0 = 100 \ \text{mg/L}, [NaAc-HAc] = 0.10 \ \text{M} (pH 4.0), rpm = 500, and T = 0.10 \ \text$

 20 ± 1 °C.



Fig. S3 Zero-order rate constants ($k_{Fe(II) obs}$, mg L⁻¹ min⁻¹, empty symbols) and normalized specific reaction rate constants ($k_{Fe(II) release SA}$, mg m⁻² min⁻¹, filled symbols) of Fe(II) release during PNP removal by ZVI without (left ordinate) and with (right ordinate) WMF. Reaction conditions: [PNP]₀ = 10 μ M, [Fe⁰]₀ = 100 mg/L, [NaAc-HAc] = 0.10 M (pH 4.0), rpm = 500, and T = 20 ± 1 °C.



Fig. S4 Effects of pH on Fe(II) release during PNP removal by ZVI with and without WMF. Reaction conditions: $[PNP]_0 = 10 \ \mu\text{M}$, $[ZVI_{Guoyao}]_0 = 100 \ \text{mg/L}$, rpm = 500, and T = 20 ± 1

°C. Solid and dashed lines represent simulative results.



Fig. S5 Effects of initial ZVI loading on PNP degradation by ZVI (a) and Fe(II) release during these processes (b) with and without WMF. Reaction conditions: $[PNP]_0 = 10 \ \mu M$, $[NaAc-HAc] = 0.10 \ M \ (pH 4.0), rpm = 500, and T = 20 \pm 1 \ ^{\circ}C$. Solid and dashed lines

represent simulative results



Fig. S6 Effects of initial PNP concentration on PNP degradation by ZVI (a) and Fe(II) release during these processes (b) with and without WMF. Reaction conditions: $[ZVI_{Guoyao}]_0$ = 100 mg/L, [NaAc-HAc] = 0.10 M (pH 4.0), rpm = 500, and T = 20 ± 1 °C. Solid and

dashed lines represent simulative results



Fig. S7 Effects of magnetized time on Fe(II) release during PNP removal by ZVI. Reaction conditions: $[ZVI_{Guoyao}]_0 = 100 \text{ mg/L}, [PNP] = 10 \mu\text{M}, [NaAc-HAc] = 0.10 \text{ M} (pH 4.0), rpm$ = 500, T = 20 ± 1 °C.



Fig. S8 Effects of sulfate (a), chloride (b), nitrate (c), and perchlorate on PNP removal by ZVI and Fe(II) release during these processes. Reaction conditions: $[ZVI_{Guoyao}]_0 = 100$ mg/L, $[PNP] = 10 \ \mu\text{M}$, $[NaAc-HAc] = 0.10 \ \text{M}$ (pH 4.0), rpm = 500, T = 20 ± 1 °C. Solid

and dashed lines represent simulative results

Name	$SSA~(m^2~g^{-1})$
Guoyao	0.15
Sigma-Aldrich (Sigma)	0.088
Haotian 1 (HT1)	0.137
Yunfu 1 (YF1)	0.141
Haotian 2 (HT2)	0.991
Yunfu 2 (YF2)	1.077

Table S1 Surface area of ZVI preparations used in this study

Table S2 Summary of pseudo-first-order rate constants for PNP removal in the presence of

anion with or without WMF	

Concentration of anions	$k_{\rm obs}$ (min ⁻¹) with WMF	$k_{\rm obs}$ (min ⁻¹) without WMF
Anion (0 mM)	0.0130	0.0024
Sulfate (1 mM)	0.0136	0.0047
Sulfate (10 mM)	0.0156	0.0055
Sulfate (50 mM)	0.0179	0.0061
Chloride (1 mM)	0.0123	0.0026
Chloride (10 mM)	0.0125	0.0041
Chloride (50 mM)	0.0142	0.0044
Nitrate (1 mM)	0.0127	0.0027
Nitrate (10 mM)	0.0131	0.0026
Nitrate (50 mM)	0.0145	0.001
Perchlorate (1 mM)	0.0121	0.0019
Perchlorate (10 mM)	0.0114	0.0014
Perchlorate (50 mM)	0.0115	0.0014

Name	MW	Chemical structure	MS mode
PNP	139	O ₂ N-OH	(-)ESI
P1 (p-nitrosophenol)	122	ОЛ-ОН	(-)ESI
P2 (p-aminophenol)	110	H ₂ N OH	(+)ESI
P3 (p-nitrocatechol)	154	O ₂ N OH	(-)ESI
P4 (p-nitropyrogallol)	152	0 ₂ N	(-)ESI
P5 (o-nitrobenzoquinone)	170	O ₂ N OH OH OH	(-)ESI

Table S3 Summary of PNP and intermediates detected for PNP removal by ZVI with WMF.