Supplementary Materials

Taguchi Orthogonal Optimization for the Oxidative Degradation of 2-Chlorophenol using Zero Valent Iron-Activated Persulfate

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Figure S13. Results of XRD analysis for (a) unwashed ZVI and (b) acid-washed ZVI in groundwater in the system of 2-CP/SPS (60 mM)/ZVI (60mM)

Table S1. Groundwater classification and value limitations of phenols and phenolic compounds [1]

Classification	Intended Beneficial Use	Concentration (mg/L)
Class A	Source of Potable Water and Other Domestic Use	< 0.001
Class B	Bathing and Other Primary Contact Recreation	< 0.001
Class C	Irrigation, Fish Culture, Livestock Watering	0.05

Table S2. Responses for means and S/N ratios

Level	Means			S/N ratios		
	Initial pH	SPS (mM)	ZVI (mM)	Initial pH	SPS (mM)	ZVI (mM)
1	91.79	82.95	91.07	39.24	38.36	39.16
2	92.43	91.27	94.42	39.30	39.20	39.49
3	88.53	98.53	87.26	38.89	39.87	38.78
Delta	3.90	15.58	7.16	0.41	1.51	0.71
Rank	3	1	2	3	1	2

Table S3. Characterization of field groundwater

Items	Value	Relative error range
pH	6.78	0.01
ORP (mV)	168.17	1.59
Dissolved Oxygen (mg/L)	4.06	0.06
Total Dissolved Iron (mg/L)	0.22	-
Fe^{2+} (mg/L)	0.15	0.01
Fe^{3+} (mg/L)	0.07	0.01
Cl^- (mg/L)	14.07	0.05
SO_4^{2-} (mg/L)	96.26	1.08
F^- (mg/L)	0.13	-
Na^+ (mg/L)	15.19	0.25
K^+ (mg/L)	1.51	0.01
Ca^{2+} (mg/L)	70.05	0.32
Mg^{2+} (mg/L)	14.10	0.03
Alkalinity (mg $CaCO_3$/L)	135.00	-
Hardness (mg $CaCO_3$/L)	236.50	1.50
Spiked 2-CP (mM)	1	-

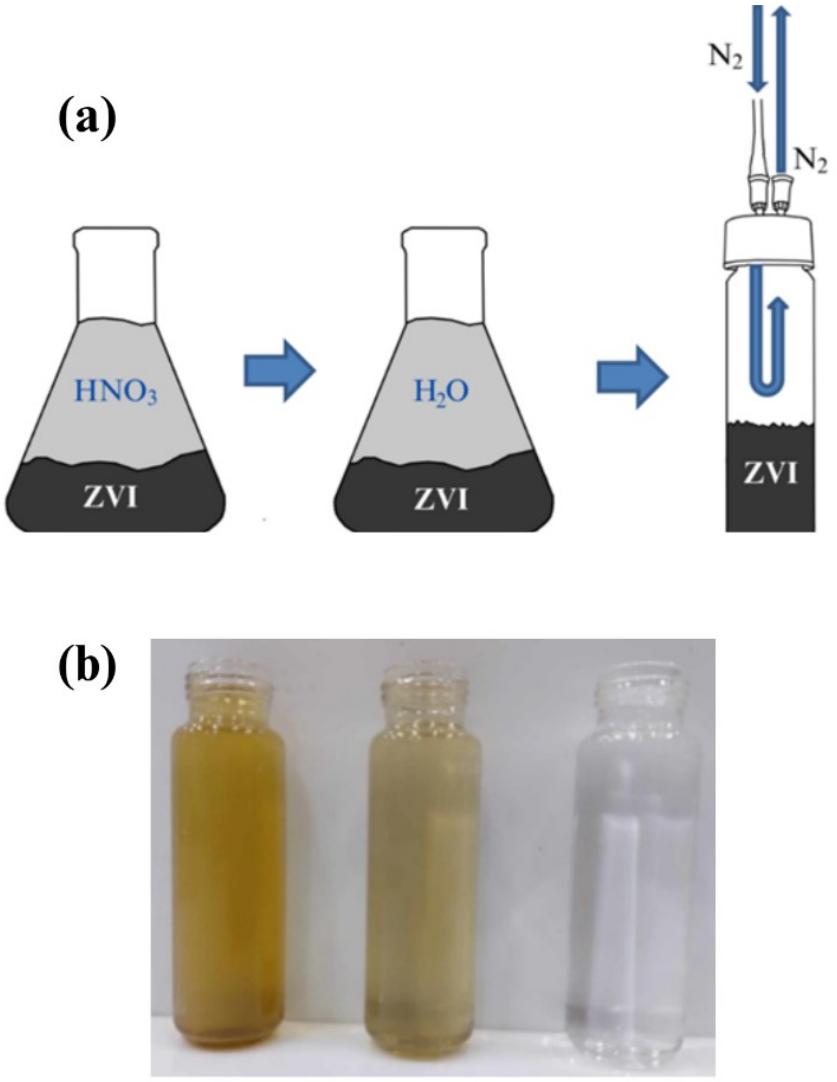
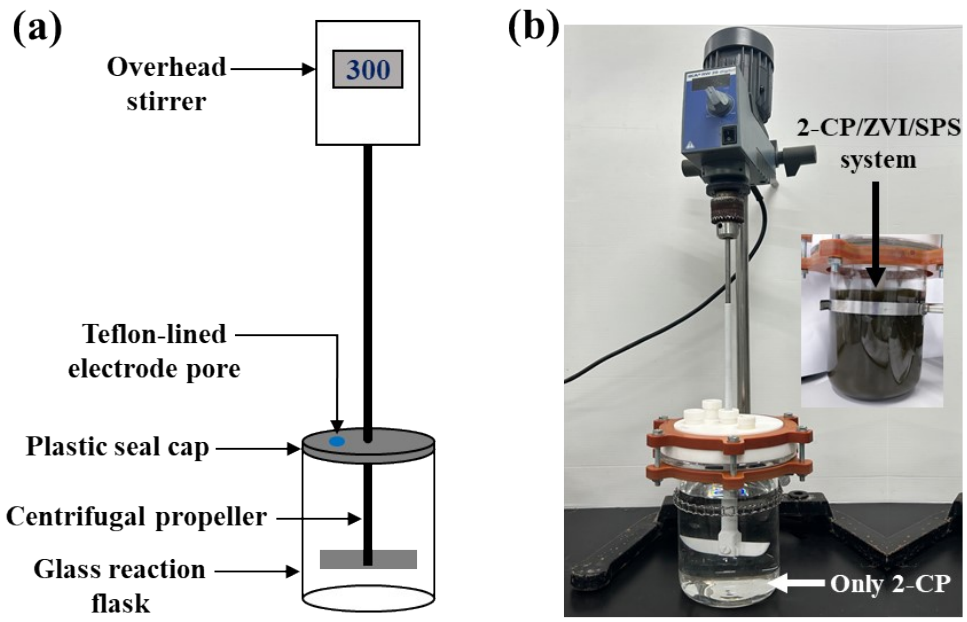


Figure S1. (a) Acid washing procedure on ZVI particles and (b) recovered acid and rinsing water from acid washing of ZVI until neutral pH.



A one-liter glass reaction flask with a Teflon-seal top cover was used for the 2-CP degradation experiment. An overhead stirrer (IKA, RW 20 digital) set at 300 rpm was used during the course of reaction for mixing in the system.

Figure S2. (a) Schematic experimental setup and (b) actual experimental setup.

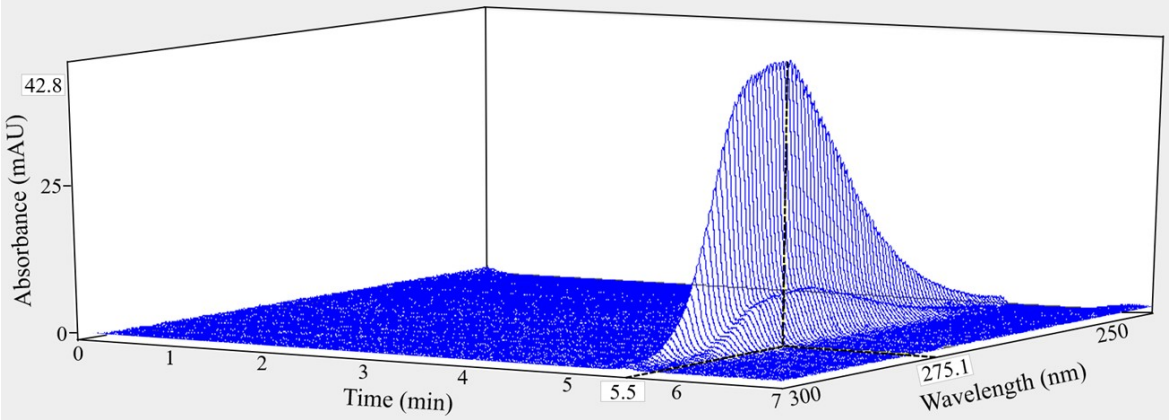


Figure S3. 3D full scan spectra of 2-CP using HPLC/PDA, for determination of wavelength (275 nm) and identification of retention time (5.5 min).

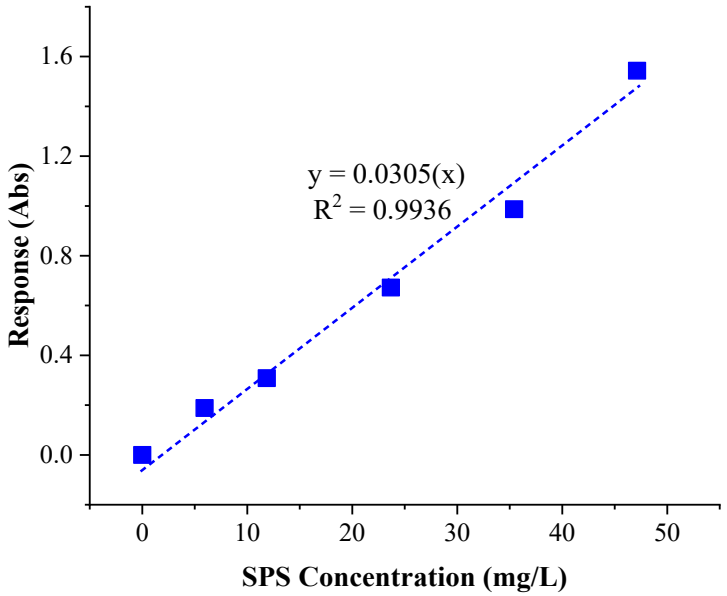


Figure S4. Example sodium persulfate concentration calibration curve using a spectrophotometry method at a wavelength of 400 nm.

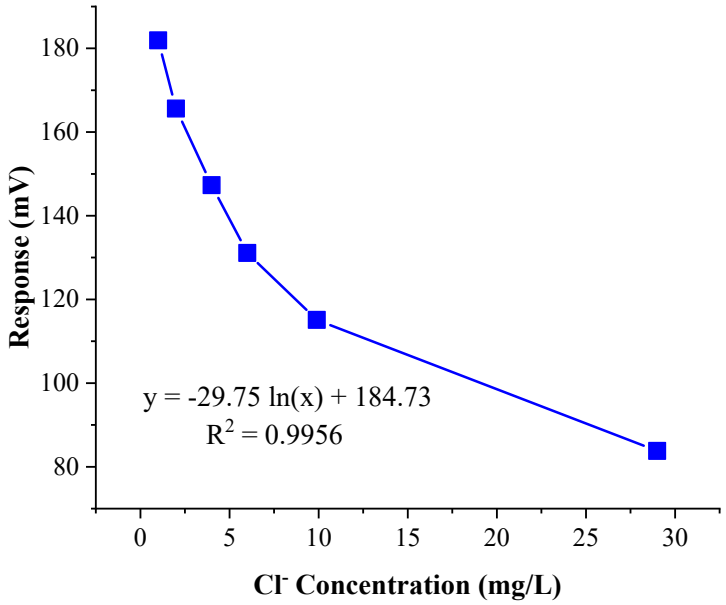


Figure S5. Sample logarithmic chloride ion concentration calibration curve.

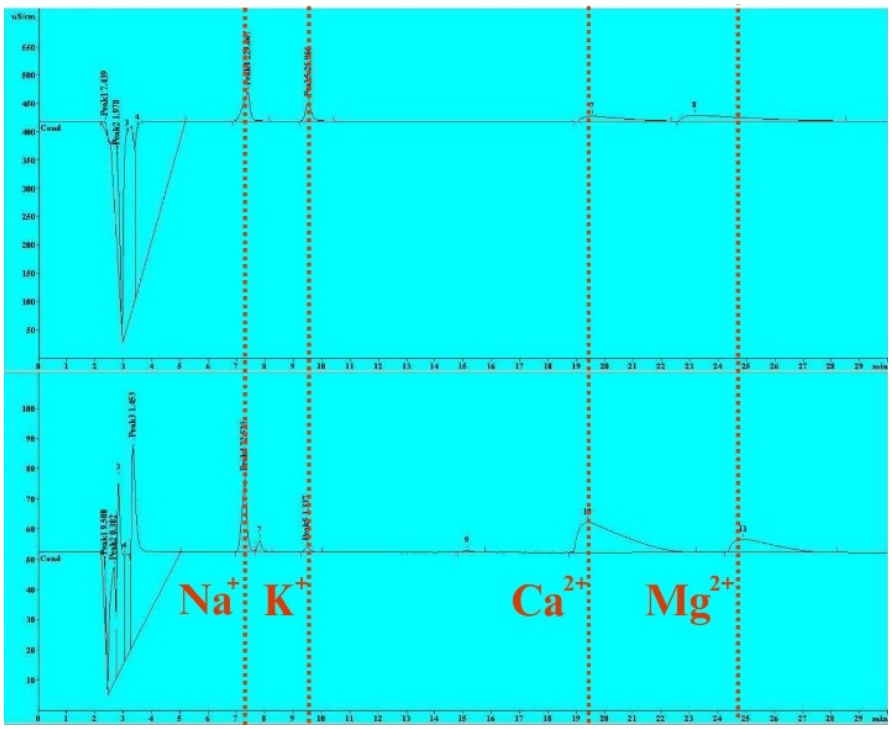


Figure S6. Ion chromatograph of standard (top) and groundwater sample (bottom) for groundwater cation determination.

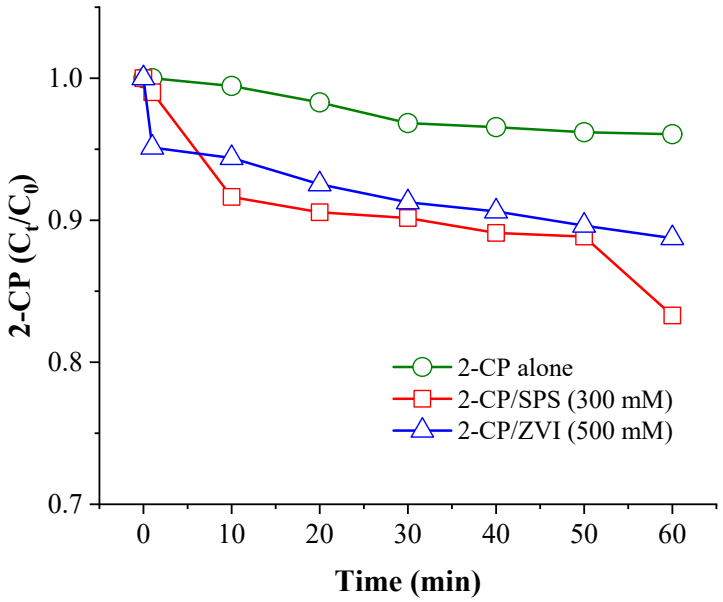


Figure S7. Control tests for 2-CP degradation.

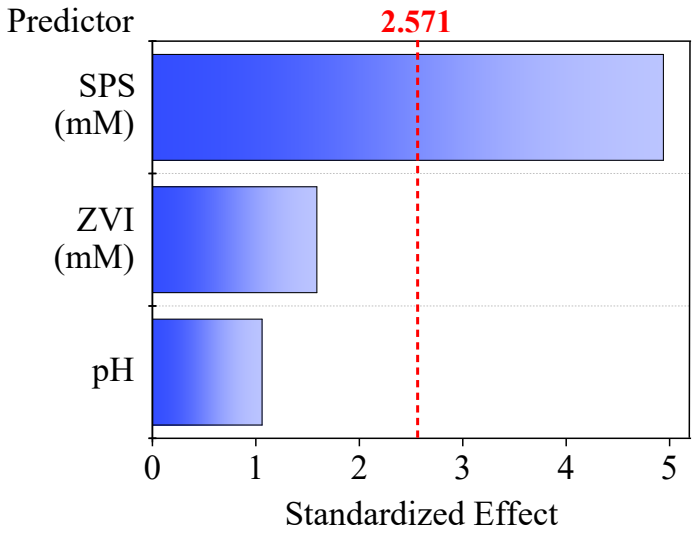


Figure S8. PARETO chart of the standardized effects for 2-chlorophenol degradation at

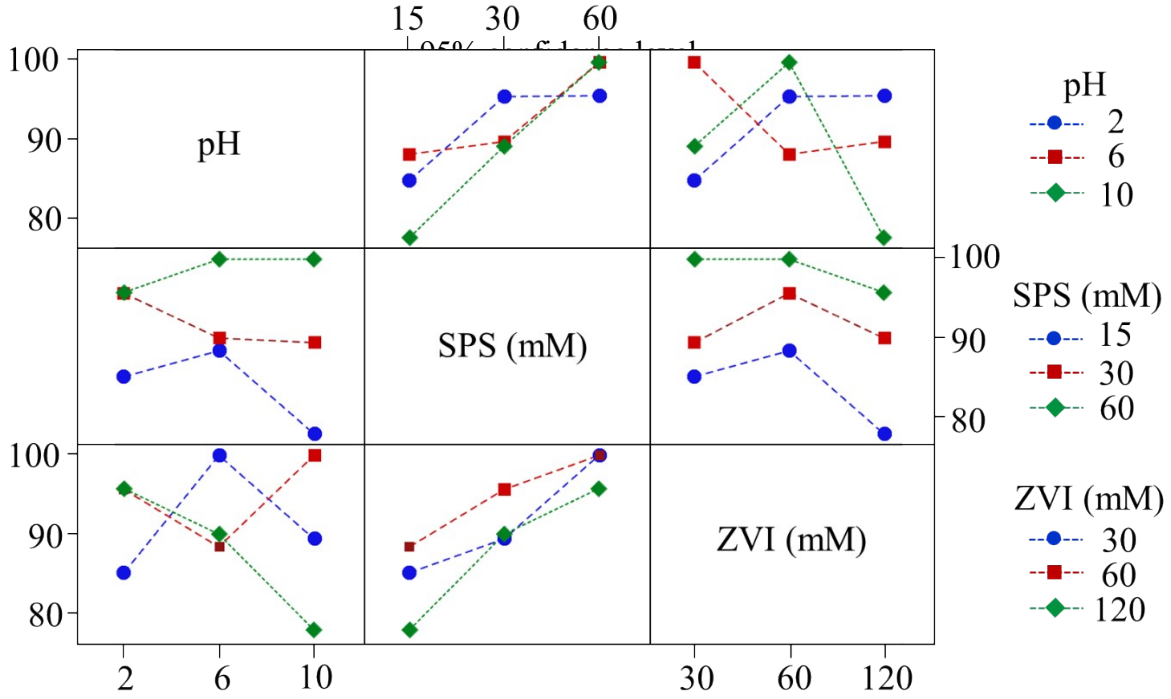


Figure S9. Interaction plot of different factors for 2-CP degradation from data means.

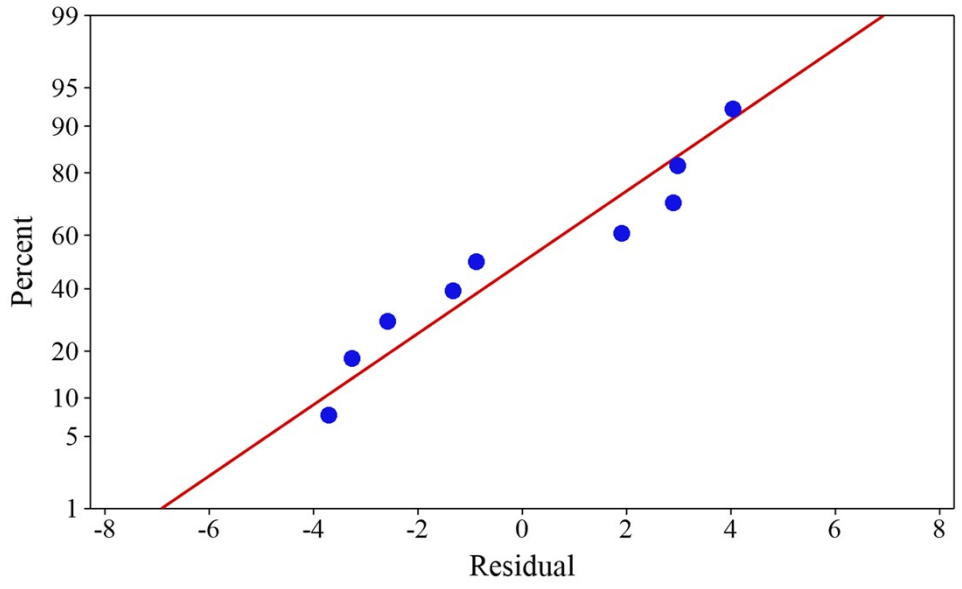


Figure S10. Normal probability plot for 2-CP degradation.

Figure S11. Groundwater monitoring well located in the Department of Environmental Engineering of National Chung Hsing University.

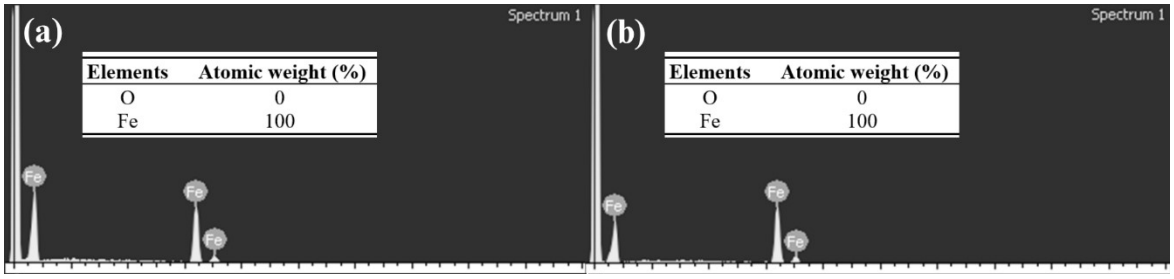
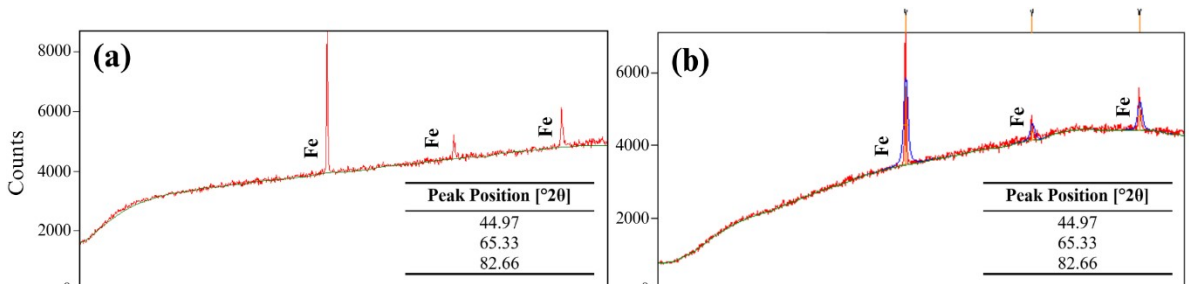


Figure S12. Results of EDS analysis for **(a)** unwashed ZVI and **(b)** acid-washed ZVI in groundwater in the system of 2-CP/SPS (60 mM)/ZVI (60mM)



Reference

[1] PDENR, Water Quality Guideline and General Effluent Standards of 2016. In DENR/2016-08, Republic of the Philippines - Department of Environmental and Natural Resources (PDENR).