Supporting Information

Complete degradation of 2,4-dichlorophenol in sequential sulfidated nanoscale zero-valent iron/peroxydisulfate system: Dechlorination, mineralization and mechanism

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Text S1 GC-MS method

The intermediate product samples of 2,4-DCP degradation process were analyzed by Gas chromatography-mass spectrometry (GC-MS) through liquid-liquid extraction pretreatment. 30 mL of samples and 10 mL of dichloromethane were mixed in a liquid separation funnel, and the pH of the mixed solutions was adjusted to 2.0, 7.0 and 12.0 by H_2SO_4 and HCl, respectively. After three oscillations of extraction, the underlying liquid is collected for subsequent use. The collected solution was evaporated and concentrated to 5 mL and filtered by 0.22 μm organic filter. The obtained solution was diluted and transferred to 2 mL injection bottle for testing. HP5 capillary column (30 m×0.25 mm×0.25 μm) was used for the chromatography. 2 μL of samples was injected within 2 min without diffluent. The scanning mass range was 60-400 amu, and the carrier gas flow rate was 1.0 mL·min^{-1}, and the solvent delay time was 7 min. The heating procedure of column temperature is as follows: Initial temperature 40°C, maintaining for 8 min; The temperature was raised to 260°C at a gradient of 20°C per minute and maintained for 20 min. The inlet temperature is 260°C, the ion source temperature is 230°C, and the electron energy is 70 eV. Due to the different charge-mass ratio of each chemical substance, the time of ion peak is different, and the corresponding chemical substance can be obtained by referring to the database comparison.
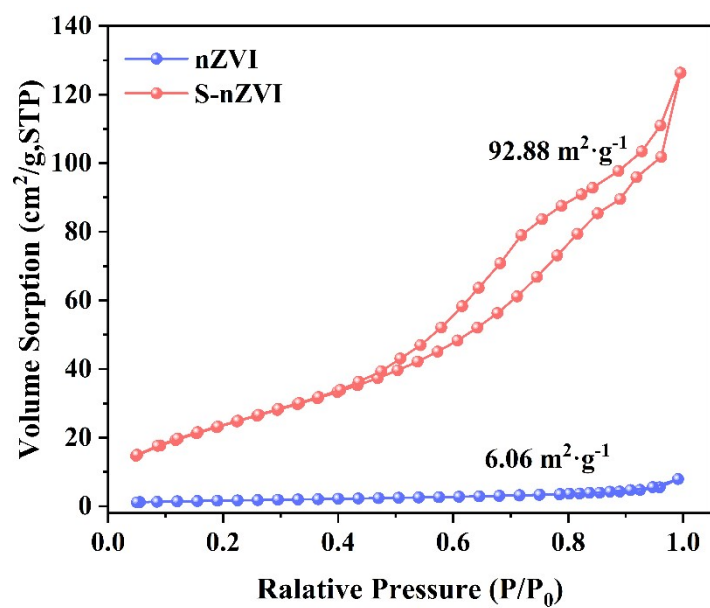
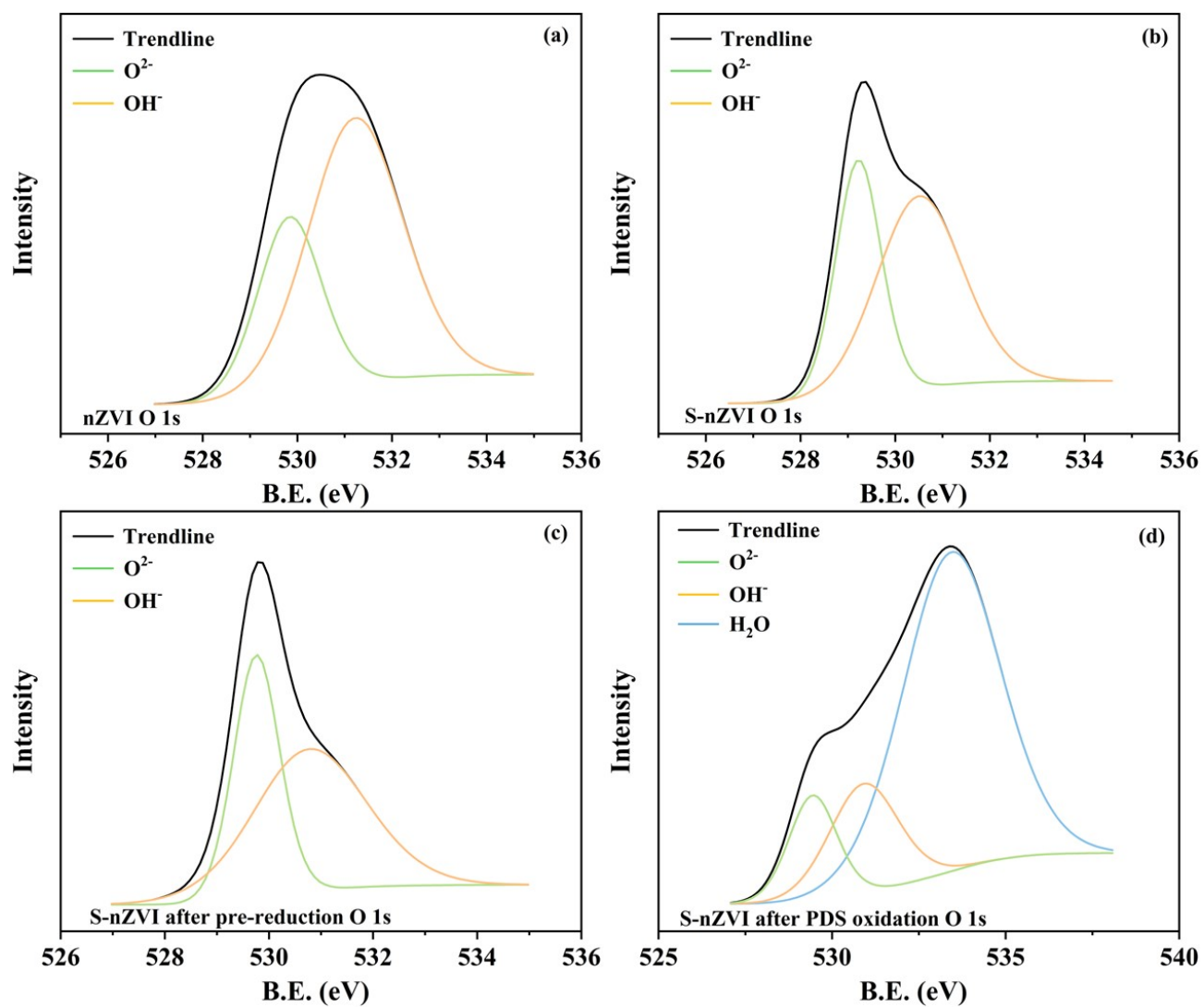**Figure S1.** The N_2 adsorption-desorption isotherms of nZVI and S-nZVI.

Figure S2. O (1s) high resolution of nZVI (a), S-nZVI (b), S-nZVI after pre-reduction (c), S-nZVI after PDS oxidation (d).
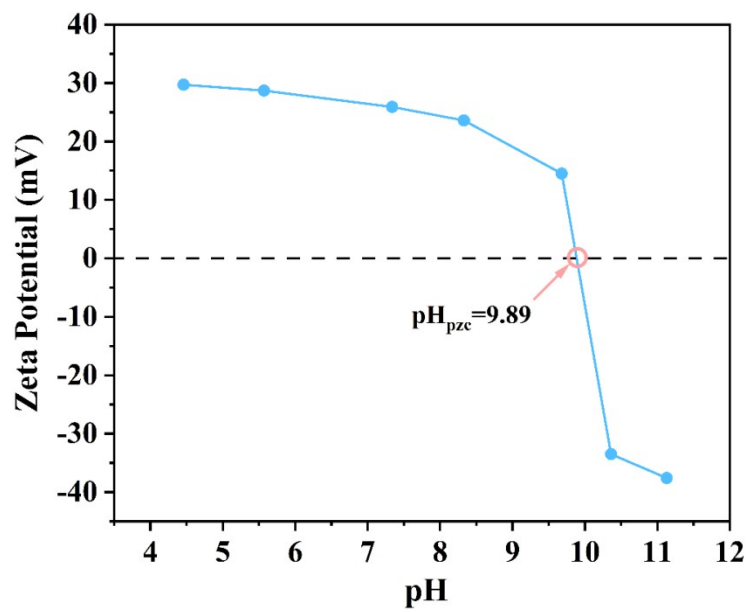
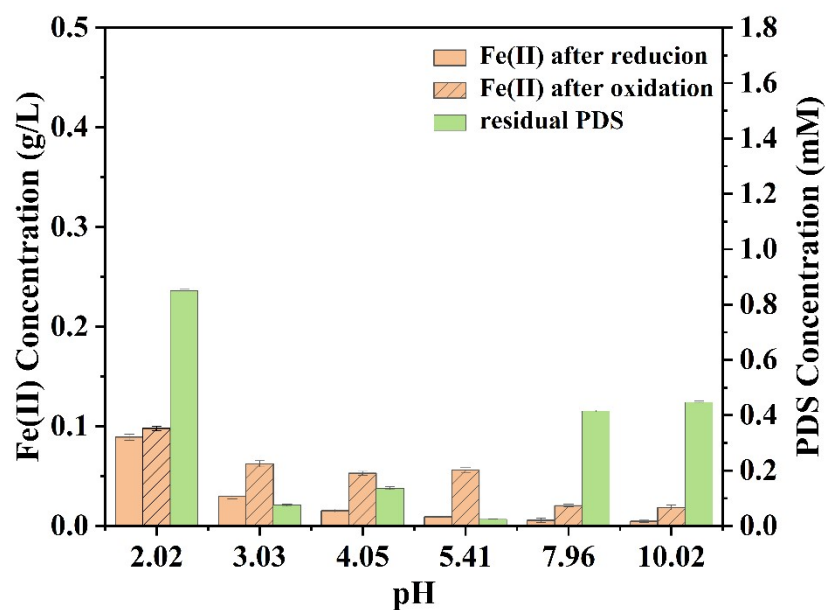**Figure S3. The Zeta potential of S-nZVI.**

Figure S4. Residual PDS concentration and Fe(II) concentration after reduction and oxidation under different pH value. (Reaction conditions: S-nZVI dosage= 2.5 g·L⁻¹, [PDS] = 1.8 mM, [2,4-DCP] = 10 mg·L⁻¹)
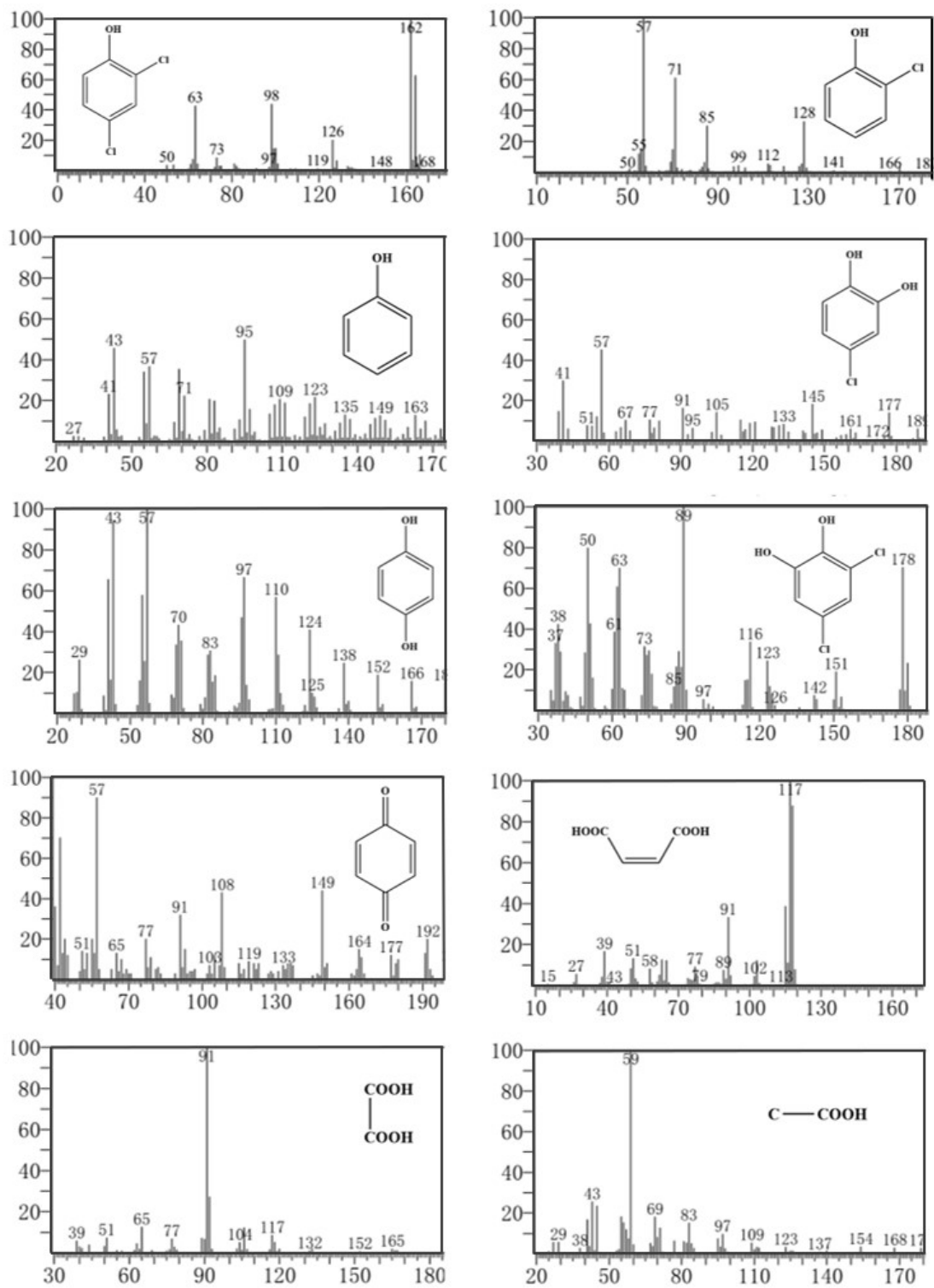
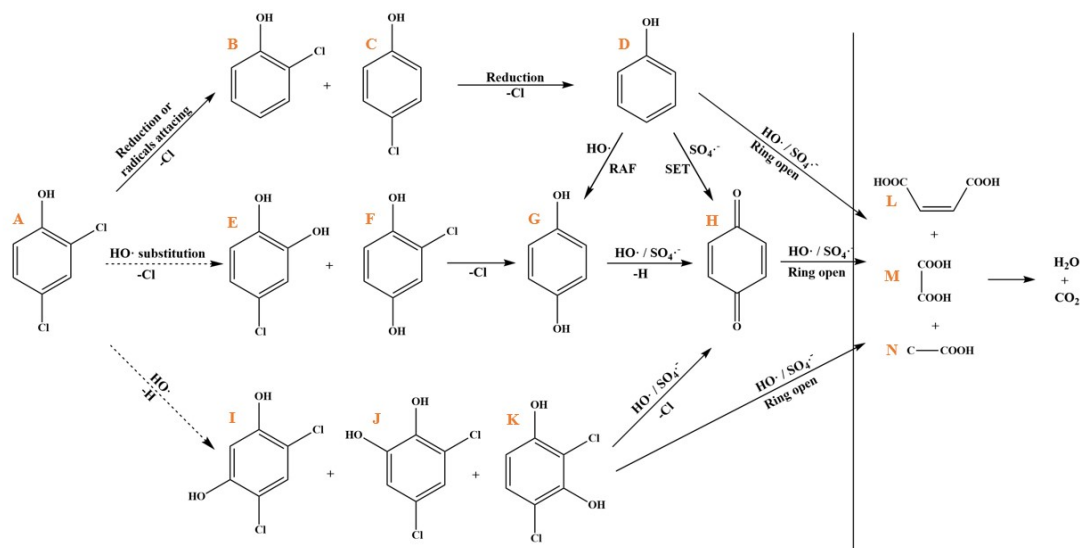**Figure S5.** The mass spectra of the intermediates of 2,4-DCP.

Figure S6. Degradation pathways of 2,4-DCP in sequential S-nZVI/PDS system.

Table S1. Preparation of S-nZVI with different Fe/S

Fe/S	40	60	80	100
$FeCl_3 \cdot 6H_2O$	3.3788 g	3.3788 g	3.3788 g	3.3788 g
$Na_2S_2O_4$	0.2720 g	0.1814 g	0.1360 g	0.1088 g
$NaBH_4$	1.8915 g	1.8915 g	1.8915 g	1.8915 g

Table S2. Water quality parameters of different water bodies.

Types	Milli-Q water	Tap water	Peach lake water
Initial pH	5.83	7.31	7.08
TOC ($mg \cdot L^{-1}$)	NA	5.75	19.06
Cl^- ($mg \cdot L^{-1}$)	NA	13.63	10.91
SO_4^{2-} ($mg \cdot L^{-1}$)	NA	28.47	16.37