Supplementary Information

**On-site generation of reactive oxidative radicals from dithionite treated oxic soil slurry**

Abdullateef Omeiza Ibrahim, Yao Huang, Hui Liu[[1]](#footnote-1)\*, Nasiru Abba Mustapha

*State Key Laboratory of Biogeology and Environmental Geology and School of Environmental Studies, China University of Geosciences, Wuhan 430074, P.R. China*



Fig. S1 Effect of different concentrations of ethanol (a) and tert-butanol (b) on the degradation of benzoic acid in the dithionite/soil slurry system. Soil dosage: 5 g/100 mL, dithionite: 20 mM; sodium benzoate: 5 μM, temperature: 25 oC; shaking speed 220 rpm.

To further reveal the application potential of the dithionite treatment in pollutant removal, benzoic acid with a lower concentration of 5μM as model pollutant, and the roles of HO• and SO4•─ were further distinguished by using radical scavenging experiments. Figure S1 shows the degradation profiles of benzoic acid in the soil slurry treated with 10 mM dithionite, in the absence and presence of ethanol and tert-butyl alcohol with different concentrations. Without dithionite, the soil could not degrade or adsorb benzoic acid. In the presence of 10 mM dithionite without any scavengers, the benzoic acid was degraded by 75% after 120 min. The degradation was progressively inhibited in the presence of ethanol and the inhibition effect was enhanced at increasing concentration of ethanol. When 5000 μM ethanol was added, only 24% of benzoic acid was degraded at 120 min (Fig. S1a). The addition of tert-butanol at the same concentration as ethanol did not show any obvious inhibition on the degradation (Fig. S1b). Since tert-butyl alcohol can selectively scavenge HO• over SO4•─ (kTBA,SO4•− = while ethanol can scavenge both HO• and SO4•─[[2](#_ENREF_2)], it could be inferred from the result that SO4•─ rather than HO• radical may be the predominant radical responsible for benzoic acid degradation. This is in agreement with Song et al [[3](#_ENREF_3)] who recently reported that SO4•─ was the predominant radical for atrazine degradation in a Fe(II)/O2/dithionite system. SO4•─ is particularly important in soil remediation due to the higher half-life, wider operational pH range and higher stoichiometric efficiency as compared to hydroxyl radical [[4](#_ENREF_4), [5](#_ENREF_5)].

**References**

1. Zhang P, Yuan S. Production of hydroxyl radicals from abiotic oxidation of pyrite by oxygen under circumneutral conditions in the presence of low-molecular-weight organic acids. Geochim Cosmochim Acta 2017;218:153-66.

2. Liang C, Su H-W. Identification of sulfate and hydroxyl Radicals in thermally activated persulfate. Industrial & Engineering Chemistry Research. 2009;48:5558-62.

3. Song W, Li J, Fu C, Wang Z, Zhou Y, Zhang X, Yang J, Wang K, Liu Y, Song Q. Establishment of sulfate radical advanced oxidation process based on Fe2+/O2/dithionite for organic contaminants degradation. Chem Eng J 2021;410:128204.

4. Guerra-Rodríguez S, Rodríguez E, Singh DN, Rodríguez-Chueca J. Assessment of Sulfate Radical-Based Advanced Oxidation Processes for Water and Wastewater Treatment: A Review. Water. 2018;10.

5. Sies H. Strategies of antioxidant defense. European Journal of Biochemistry. 1993;215:213-9.

1.  Corresponding author: Tel: +86 15927501778; fax: +86 27 87436235.

 Email address: hliu2009@cug.edu.cn (H. Liu) [↑](#footnote-ref-1)