Supplementary Materials

Synergistic activation of persulfate by Cu(II) and Fe(III) enhanced with catechin for chloramphenicol removal in soil

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Text S1. Chemicals and reagents

(+)-Catechin (CAT, ≥ 98%), Ferric perchlorate ($Fe(ClO_4)_3$, 98%), Copper sulfate ($CuSO_4$, 99%) was obtained from Merck company (Germany). Chloramphenicol (CAP, 98.0%), Methanol (MeOH, 99.9%), Sodium persulfate ($Na_2S_2O_8$, 99%) were obtained from J&K Scientific Co., Ltd. (Beijing, China). Isopropanol (IPA, 99.9%), Tert-butanol (TBA, ≥ 98%), Sodium bromide (NaBr, 99.0%) were provided by Aladdin Biochemical Technology Co., Ltd. (Shanghai, China). The water used in all the experiments was produced by a laboratory purification system (HHitech, China) and the resistivity was 15-18.2 MΩ·cm.

Text S2. The pretreatment of the soil

Soil samples were collected from Suzhou River bank in Shanghai. The large gravel particles, animal and plant remains were removed first. Then, the soil was crushed into

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small and uniform particles, cleaned with organic solvent and calcined to ensure that it did not contain organic matter and absorb other organic contaminants.

In order to ensure that the soil did not contain any organic pollutants which might disturb the detection of the target pollutant, extractions with acetone and dichloromethane were performed and the extracts were analyzed by GC-MS. The results showed the soil samples did not contain some other organic compounds in the amount which might affect the research.

For determination of the physical and chemical parameters of the soil (Table S1), the particle size distribution of soil was detected by laser particle size analyzer, Zeta potential was measured with JS94H micro-electrophoresis apparatus and the pH was measured in the mixture of water and soil with the ratio 2:1. The soil organic matters (SOM) were determined by the mass loss after 4h calcination in muffle furnace. The total carbon (TC), total organic carbon (TOC) and inorganic carbon (IC) were analyzed by a total organic carbon analyzer with solid sampler (TOC-L CPH, Shimadzu, Japan). The soil was digested with hydrofluoric acid, nitric acid and perchloric acid at 120℃, and the ICP-MS was used to measure the total iron, manganese and copper in the soil.

Table S1 The physical and chemical parameters of the soil

Fine sand (500-100μm)	9.1%
Silty (5-50μm)	75.1%
Fine silt (1-5μm)	12.7%
Colloid（<1μm）	3.1%
Zeta potential(mV)	-24.98

pH	7.75
Soil organic Matter content (SOM)	2.96%
Total carbon (TC)	0.73%
Inorganic carbon（IC）	0.14%
Total iron (mg/kg)	19.65
Total manganese (mg/kg)	0.38
Total copper (mg/kg)	0.02
Total soluble iron (mg/kg)	1.19

Text S3. The CAP extraction procedure

To improve the CAP extraction efficiency, 4.5 mL of methanol and 0.5 mL of EDTA-Mcllvaine buffer (0.1 M) were added to the soil suspension in brown glass vials [S1]. Water was added to make the volume reach 20 ml and then the brown glass vials were shaken continuously for 1 h at 500 rpm. After centrifugation and filtration, the liquid samples were analyzed by HPLC to determine the CAP concentration. The results showed that the recovery rate of the CAP extraction procedure was stabilized between 90 % - 92 %.

[S1] Á. Grande-Martínez, D. Moreno-González, F.J. Arrebola-Liébanas, A. Garrido-Frenich, A.M. García-Campaña, Optimization of a modified QuEChERS method for the determination of tetracyclines in fish muscle by UHPLC-MS/MS, J. Pharmaceut. Biomed. 155 (2018) 27-32.

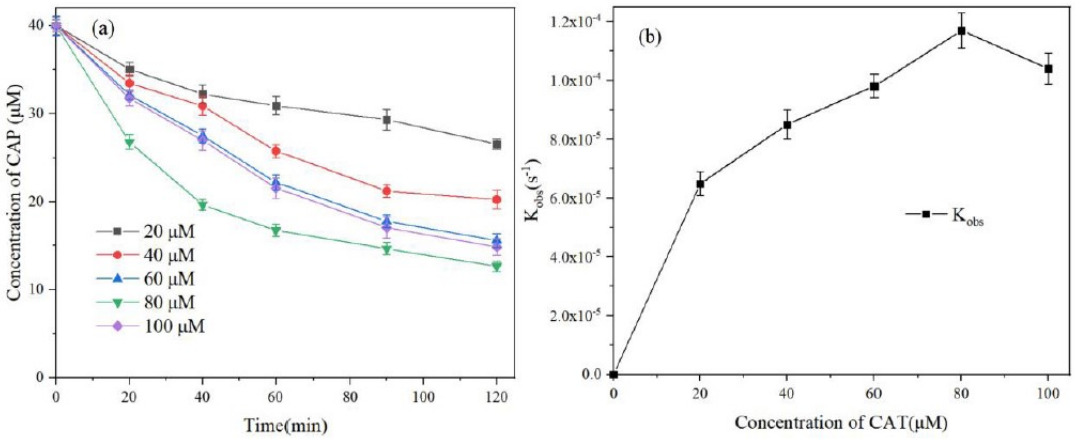

Fig. S1 CAP degradation concentration (a) and CAP degradation rate constant (b) in Cu(II)/CAT/PS system. ($[Cu(II)]_0$ = 200 μM, $[PS]_0$ = 1.0 mM, pH = 6.5)

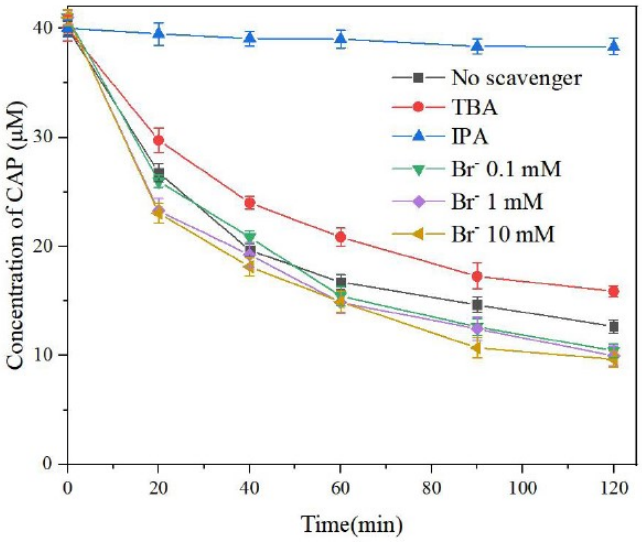

Fig. S2 Effects of different quenchers on CAP degradation in Cu(II)/CAT/PS system. ($[Cu(II)]_0$ = 200 μM, $[CAT]_0$ = 80 μM, $[PS]_0$ = 1.0 mM, pH = 6.5)