Supplementary Material

Zinc and sulfur functionalized biochar as a peroxydisulfate activator via deferred ultraviolet irradiation for tetracycline removal

Yixue Qin[a, b], Sheng Wang*[b], Bingbing Zhang[b,c], Weijie Chen[b,c], Mingze An[b], Zhao Yang[b], Hairong Gao[a, b], Shuhao Qin*[a, b]

a.College of Materials and Metallurgy, Guizhou University, Guiyang 550025, China

b.National Engineering Research Center for Compounding and Modification of Polymer Materials，Guiyang, 550014.

c.Resources and Environmental Engineering Department, Guizhou University, Guiyang 550025, China.

* Corresponding author at: College of Materials and Metallurgy, Guizhou University, Guiyang 550025, China.

E-mail address: 1191117410@qq.com (Sheng Wang), pec.shqin@gzu.edu.cn (Shuhao Qin).

Text S1 Determination of zinc content of SC-Zn, BC-Zn and reaction solutions

SC-Zn and BC-Zn need to be digested before zinc content determination, and the digestion method was as follows: SC-Zn and BC-Zn were first put into an oven at 80 °C for drying for 24 h, and the dried samples were passed through a 200-purpose standard sieve for later use. Accurately weigh 0.1g each of SC-Zn and BC-Zn into a 50 ml PTFE sample cup, add 8ml of 65%-68% HNO_3, wait for the white smoke to dissipate, then add 1ml of 40% H_2O_2, and finally add 2 ml of 30% HF, wait for 10min to cover the dissolution cup and put it into the digestion instrument for digestion (the digestion procedure was as follows: the first procedure: digestion at a temperature of 150 °C for 10min, after gradually increasing the temperature to 180 °C into the second procedure to digest at this temperature for 5 min, gradually increasing to 210 °C to the third procedure digestion for 30 min), after digestion, filtering, adding deionized water to be measured in a 100 ml volumetric flask, and the zinc content was determined with ICP-MS. The solution after the reaction of SC-Zn/PDS/UV (deferred) system and BC-Zn/PDS/UV (deferred) system was removed with a syringe for 7 ml, and then filtered with a 0.45 μm polyether sulfone resin (PES) filter to determine the zinc content. Each set of experiments was performed three times and the experimental error bars of the data were calculated.

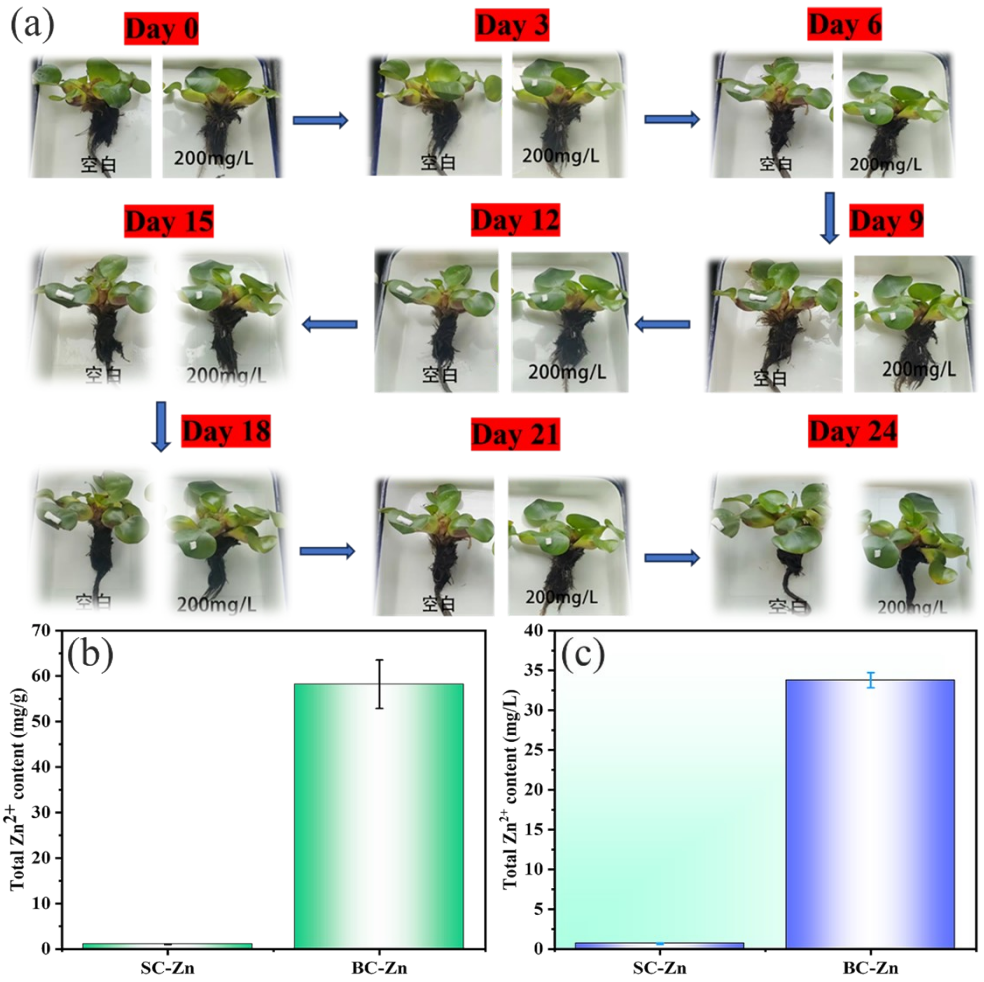

Fig. S1. (a) Photograph of the record of water hyacinth during $ZnSO_4$ enrichment process (experimental conditions: $ZnSO_4$: 0 mg/L, 200 mg/L, room temperature), (b) Zn^{2+} content of fresh SC-Zn and BC-Zn (c) the concentration of Zn^{2+} in the reaction solution after SC-Zn and BC-Zn remove TC (experimental conditions: catalyst: 0.3 g/L, PDS: 1.2 mM, TC: 250 mg/L, room temperature).

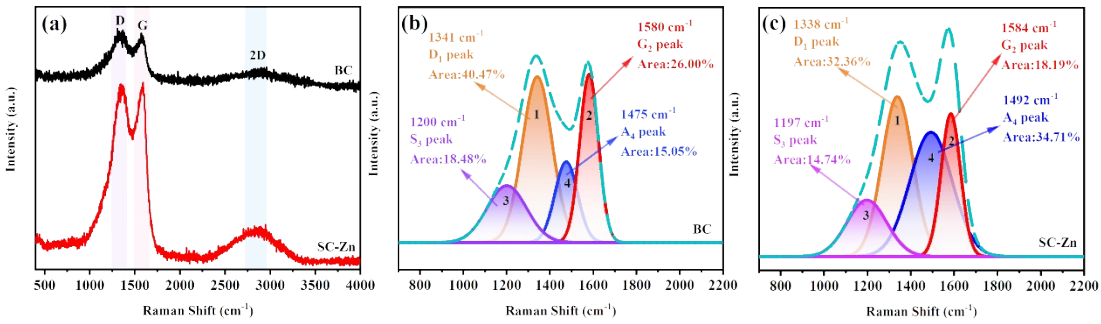

Fig. S2. (a) Raman general spectra and deconvoluted Raman spectra of (b) BC, (c) SC-Zn.

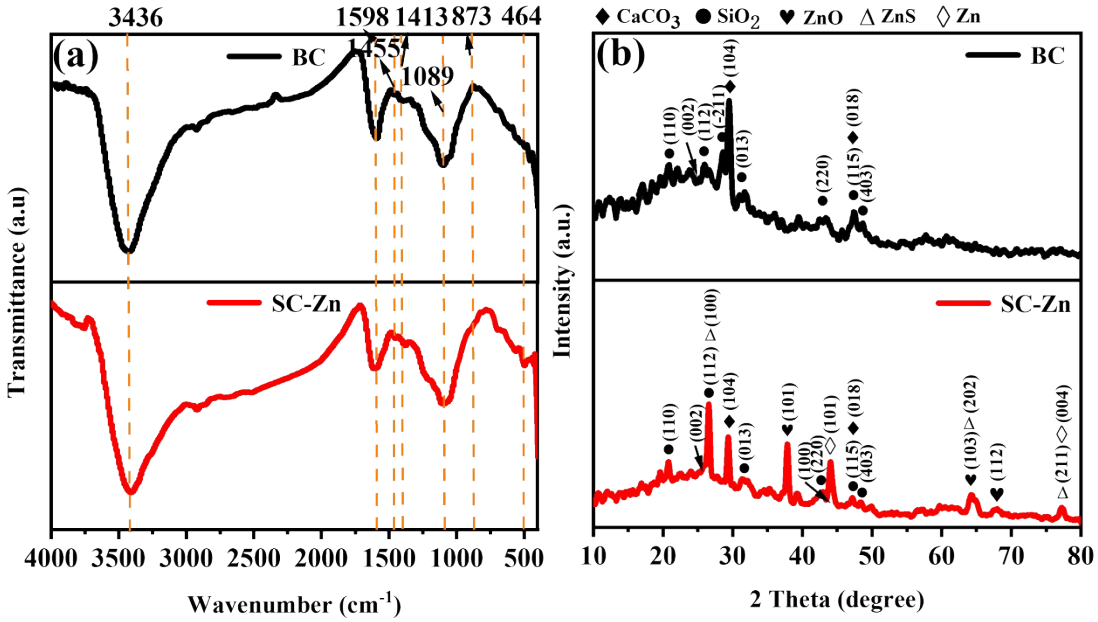

Fig. S3. (a) FTIR spectra of BC and SC-Zn and (b) XRD spectra of BC and SC-Zn.

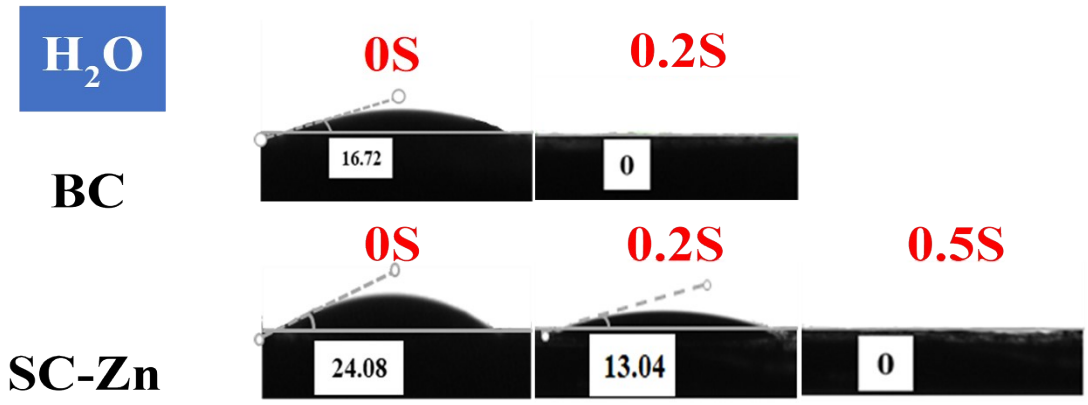

Fig. S4. Surface wetting behavior of BC and SC-Zn.

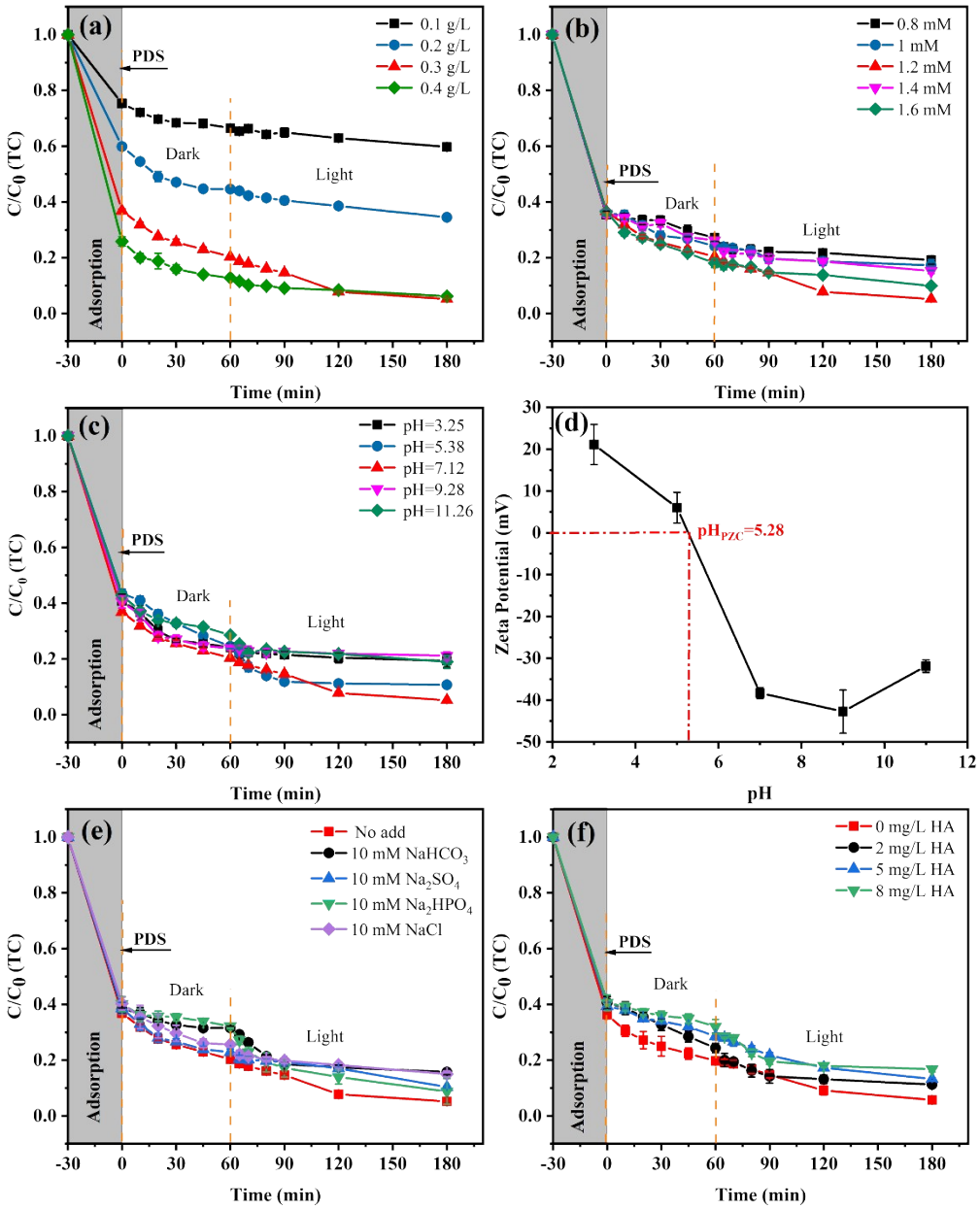

Fig. S5. Remove the influencing factors of TC (a) Catalyst dosage, (b) PDS dosage, (c) pH, (d) (pH_{pzc}), (e) Coexisting ions and (f) Natural organic matter. ((a) Experimental conditions: PDS:1.2 mM, TC:250 mg/L, T=25 ℃, pH=7.12, (b) SC-Zn: 0.3 g/L, TC:250 mg/L, T=25 ℃, pH=7.12, (c) SC-Zn:0.3 g/L, PDS:1.2 mM, TC:250 mg/L, T=25 ℃, (e) and (f) SC-Zn:0.3 g/L, PDS:1.2 mM, TC:250 mg/L, T=25 ℃, pH=7.12)

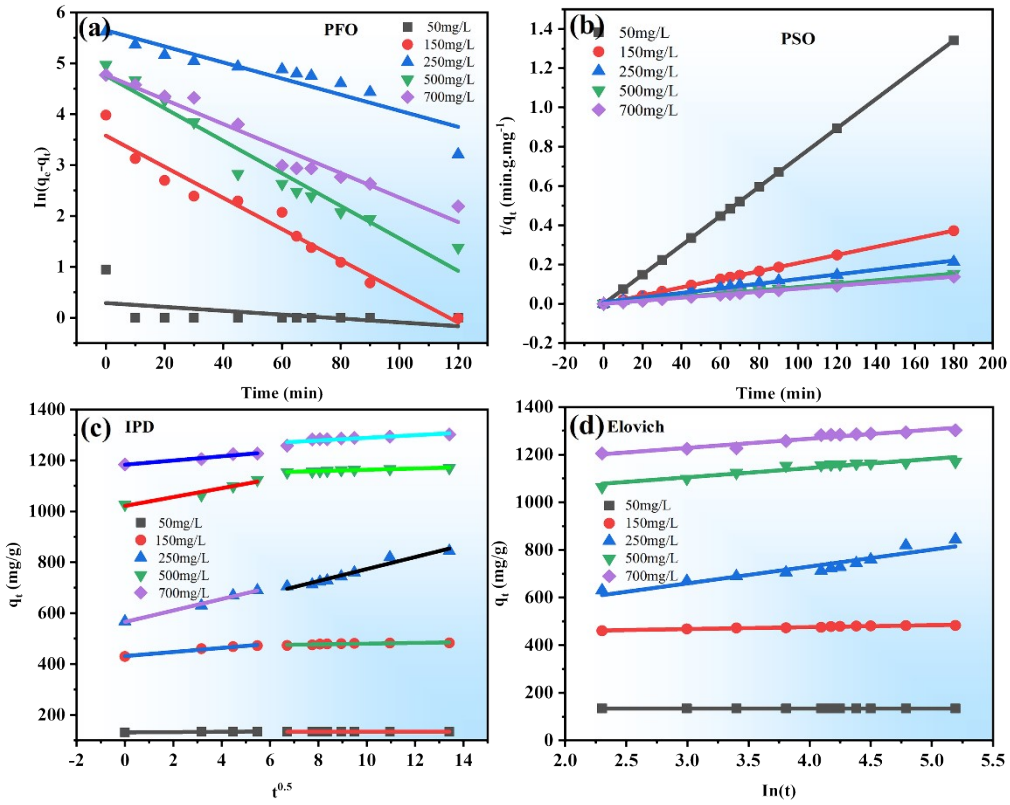

Fig. S6. Kinetic models (a) PFO, (b) PSO, (c) IPD, (d) Elovich.

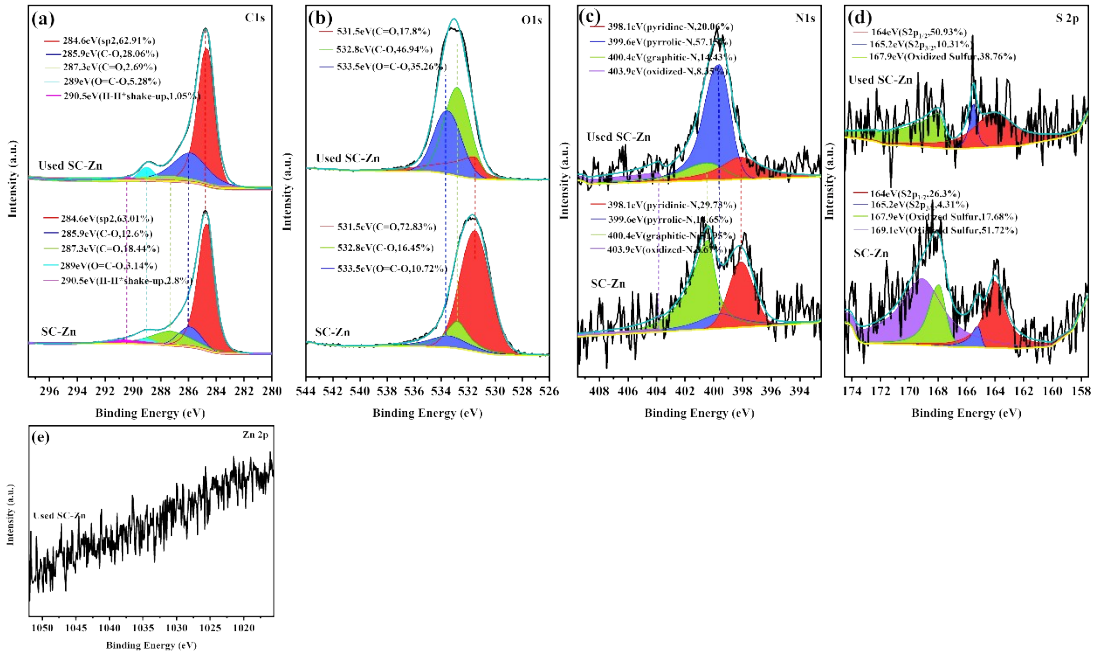

Fig. S7. XPS spectra after reaction (a) C1s, (b) O1s, (c) N1s, (d) S2p and (e) Zn2p.

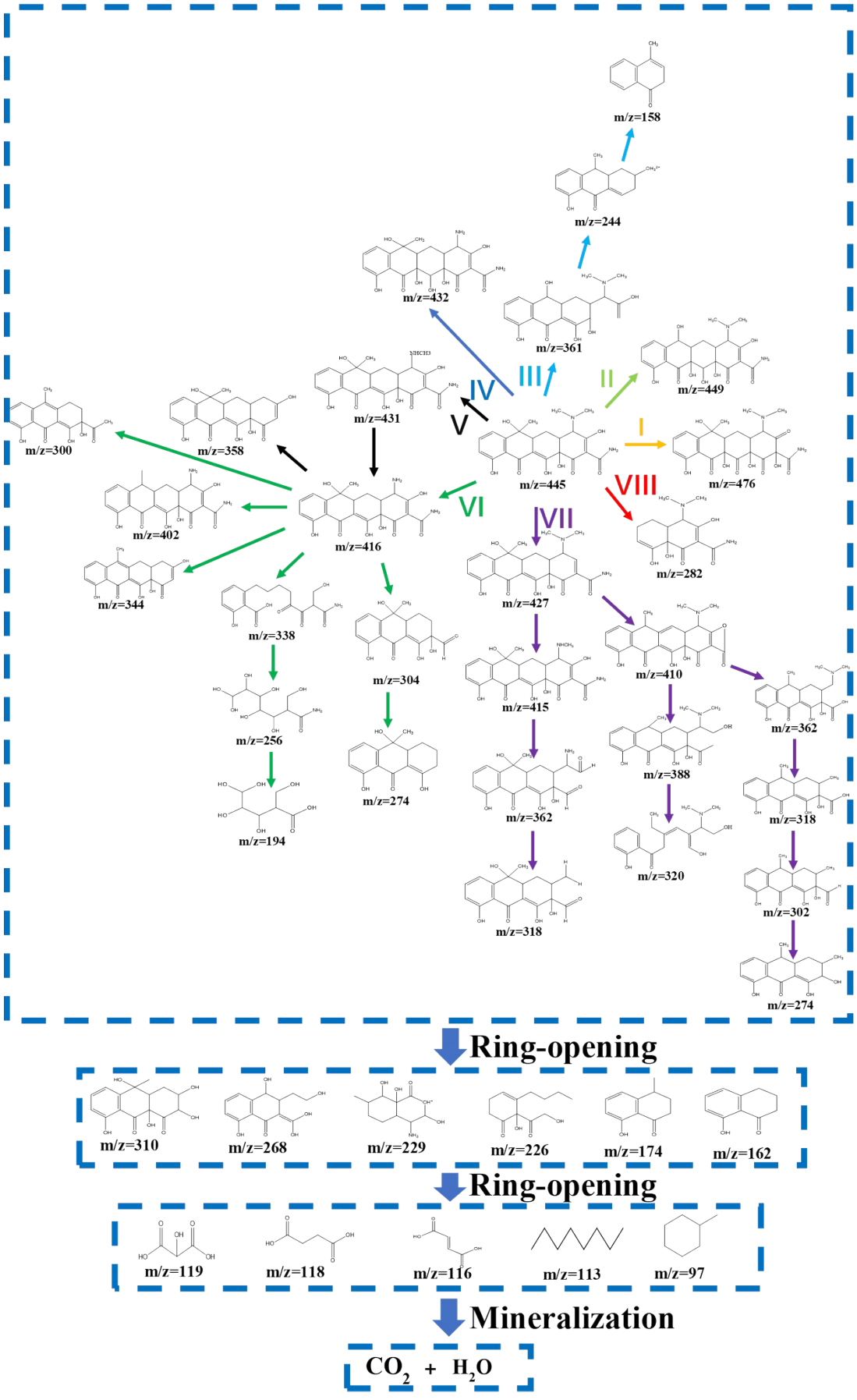

Fig. S8. TC degradation pathway inference

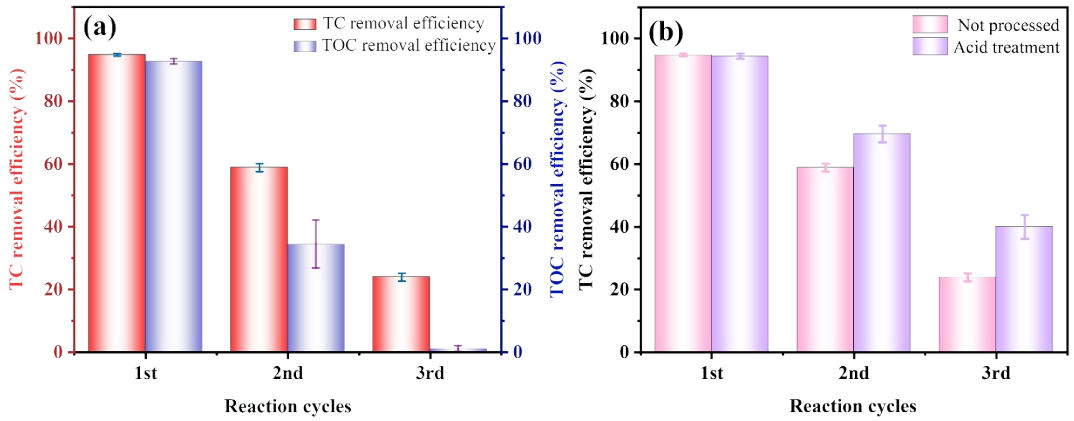

Fig. S9. Reusability and mineralization ability of (a) SC-Zn /PDS/UV (deferred) system and (b) diagram of SC-Zn catalyst activity recovery.

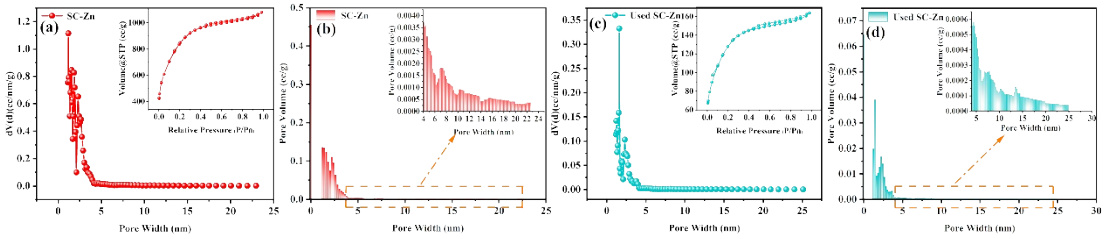

Table S1 Specific surface area, total pore volume and pore distribution tables for SC-Zn and Used SC-Zn

Catalysts	DFT		
	surface area (m^2/g)	Average pore diameter(nm)	Total pore volume(cc/g)
SC-Zn	2007.812	1.178	1.494
Used SC-Zn	303.603	1.614	0.228

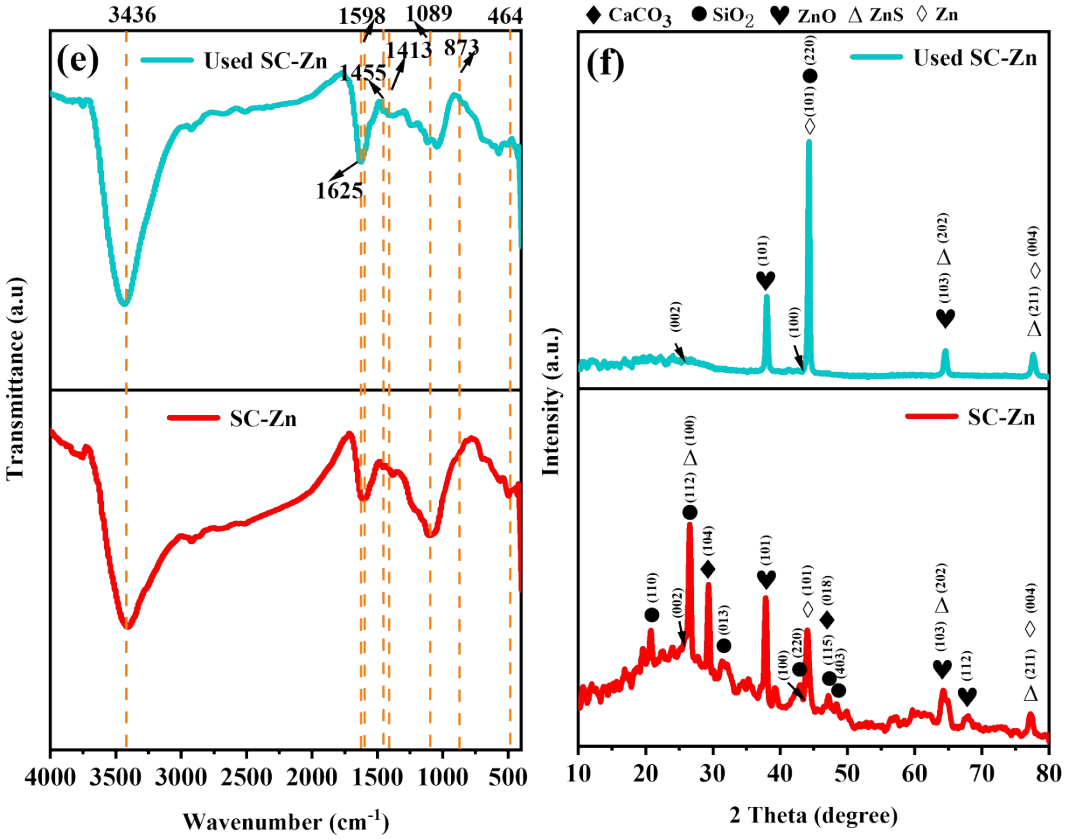

Fig. S10. N_2 adsorption-desorption isotherms (a) SC-Zn, pore size distributions (b) SC-Zn, (c) Used SC-Zn, (d) Used SC-Zn, (e) FTIR spectra of SC-Zn and Used SC-Zn, (f) XRD spectra of SC-Zn and Used SC-Zn.