Text S1 Characterization and electrochemical measurement methods

The Fourier-transform infrared spectrum (FTIR, Nicolet 6700) was employed to detect the functional groups on the surface of SBCs. The defect degrees of the biochar samples were analyzed by Raman spectroscopy (LabRam HR Evolution). The surface morphological characteristics and surface element distribution of catalysts were investigated via (SEM-EDS, Zeiss Gemini 300). The crystal structures of SBCs were investigated via X-ray diffraction (XRD, Empyrean). The X-ray photoelectron spectrometry (XPS) was performed using a Thermo Scientific ESCALAB 250Xi. The specific surface area and pore structure parameters was obtained from the Brunauer-Emmett-Teller (BET, ASAP2460). The pH_{zpc} of sludge-based biochar was analyzed using a Zetasizer Nano ZSP type zeta potential meter from Malvern Instruments Ltd, UK. The EPR (JES-FA200) was employed to perform free radical trapping experiments, including the spin trapping of •OH and $O_2^{\bullet-}$ with 5,5-Dimethyl-1-pyrroline N-oxide (DMPO) in aqueous solution and methanol solution, respectively while the capture of $^1O_2$ with 2,2,6,6-Tetramethyl-4-piperidinol (TEMP) in aqueous solution.

Electrochemical measurement: All the electrochemical measurements were conducted at room temperature in a standard three-electrode electrochemical cell with a Ag/AgCl (4 M KCl) reference electrode, a platinum wire counter electrode and a catalyst-modified glassy carbon working electrode and the electrolyte was a solution of 0.1 M Na_2SO_4. First, 10 mg of catalyst was added to 970 uL of water and ethanol, followed by 30 μL of Nafion solution and sonicated for 15 min. 5 μL of the resulting sample was added dropwise to a clean glassy carbon electrode and dried at room temperature. This process was repeated twice to allow the catalyst to be uniformly loaded onto the glassy carbon electrode and subsequently used for testing. Chronoamperometries were carried out at the bias of 0.0 V (vs. Ag/AgCl) with 0.1 M Na_2SO_4 as supporting electrolyte.

Text S2 The detailed procedures of the catalyst stability test experiments and desorption experiments

Desorption experiments: After the completion of the adsorption experiment, the used catalyst was collected by magnets, dried and sonicated with 50 mL of methanol for 20 min, after which samples were taken to detect the concentration of desorbed SMX.

Text S3 Experimental procedures and analysis methods

Typical experimental method for degradation: The SMX stock solution (100 mg

L^{-1}) was initially concentrated in a beaker and diluted to 5 mg L^{-1} with deionized water. A 250 mL triangular conical flask was added with 100 mL of SMX solution, taking the time of adding the periodate and catalyst as the reaction point zero, followed immediately by placing the triangular flask in a shaking chamber set at 25 °C and 150 rpm. All other compounds to be added for the experiment were prepared in advance with the stock solution and diluted in the triangular flask with SMX to the corresponding concentrations.

The concentration of SMX was determined using an Agilent Technologies 1260 Infinity high-performance liquid chromatograph (HPLC) with an Agilent ZORBAX SB-C18 4-Pack. The details of the HPCL methods was as follow: mobile phases: 0.1% formic acid and acetonitrile (40:60 V/V); injection volume: 10 μL; flow rate: 0.7 mL/min; detector wavelength: 270 nm; retention time: 2.75 min.

The first-order ratio constant was calculated according to Eqs. (1):

$$\ln (C_e/C_0) = k_{obs}t \quad (1)$$

where C_e is the SMX concentration at reaction time t; C_0 is the initial concentration of SMX; k_{obs} is the first-order ratio constant (min^{-1}).

The acute ecotoxicity test: Different solutions (deionized water, 1 mM of periodate solution, 5 ppm SMX solution, solution before and after reaction, 10 mL) were added to petri dishes covered with filter paper. Twenty *Lactuca* seeds were placed in each Petri dish (three parallel sample sets).

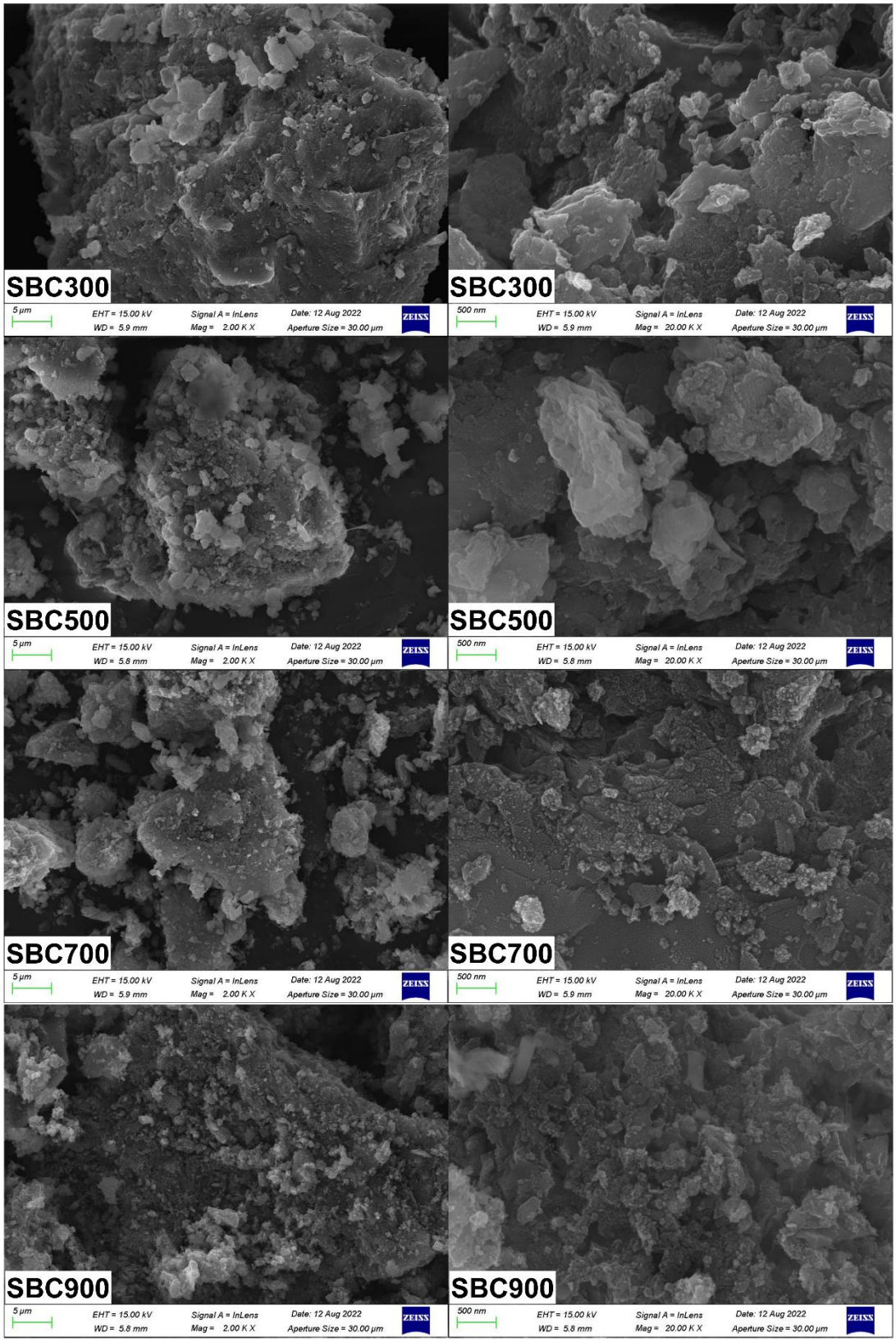

Figure S1. The SEM images of SBCs.

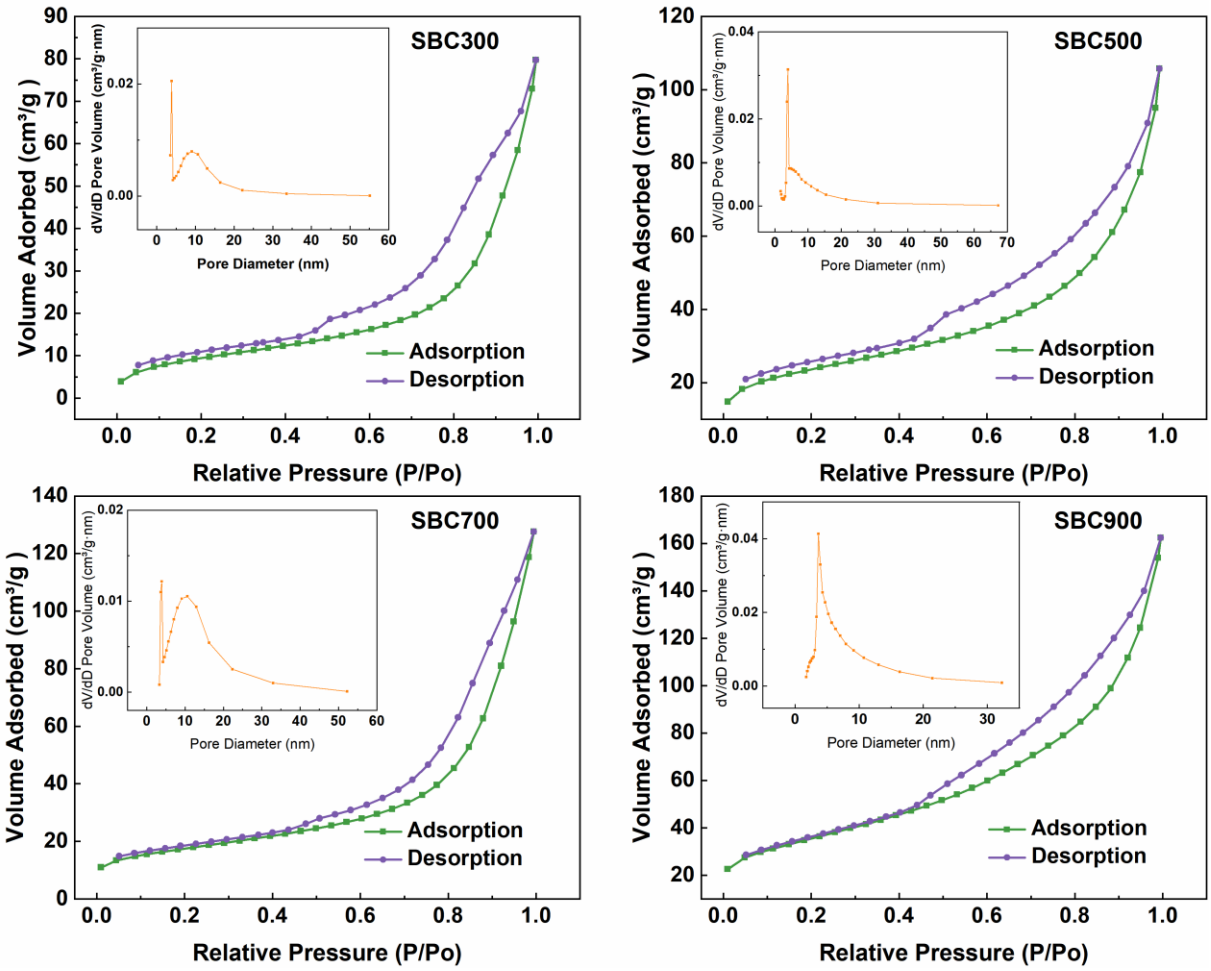

Figure S2. N_2 adsorption and desorption curves of SBCs.

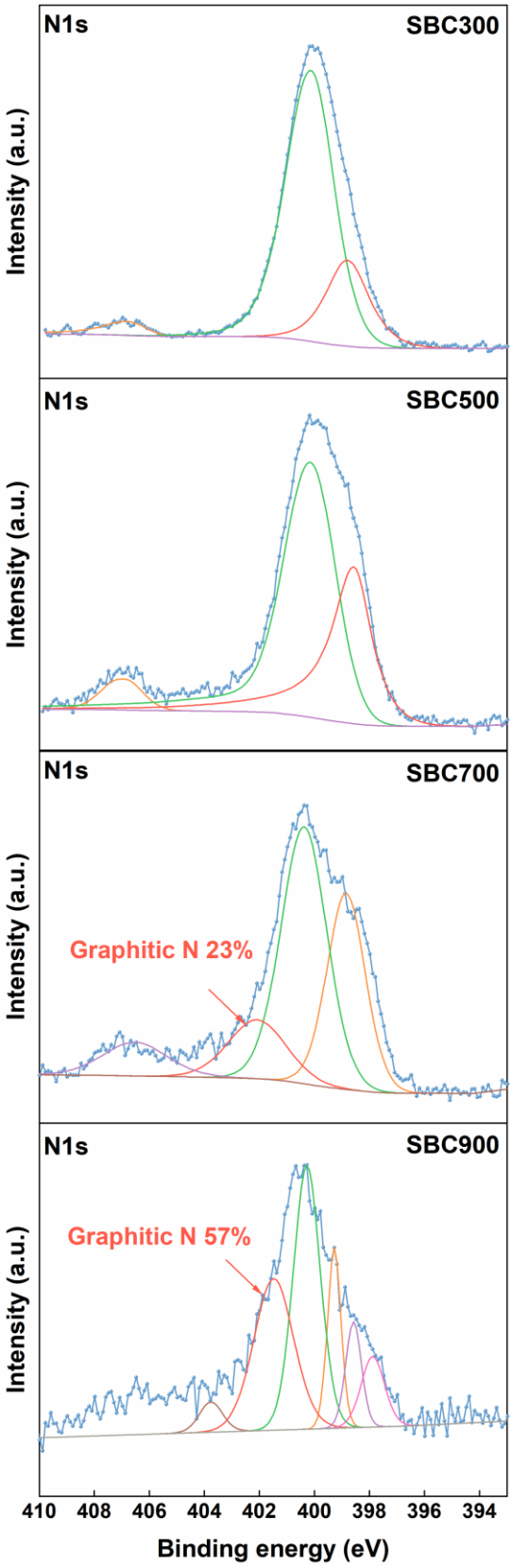

Figure S3. The XPS spectra (N1s) of SBCs.

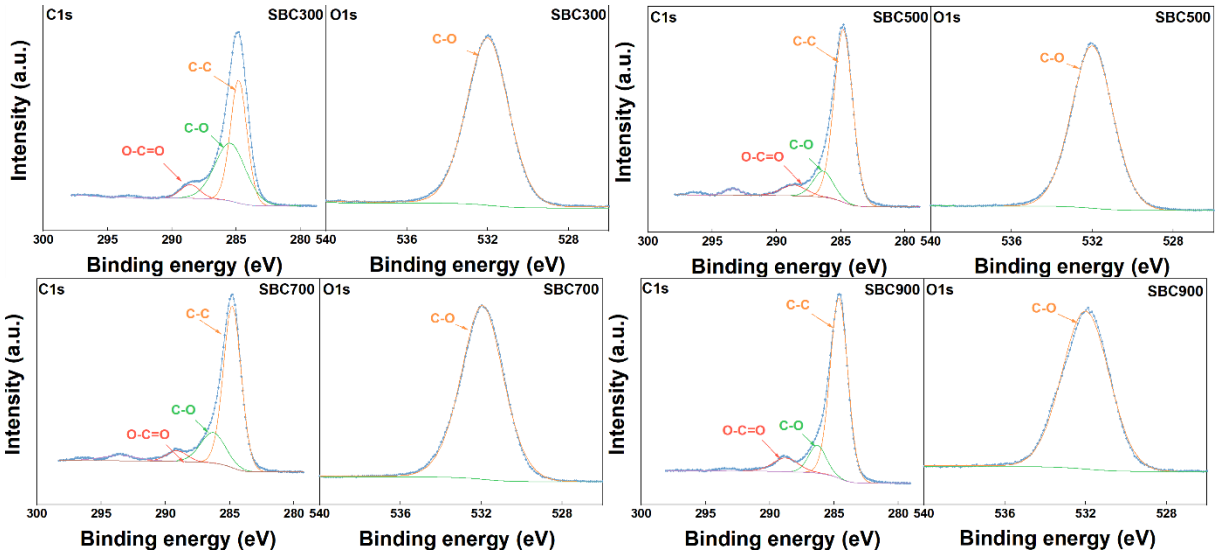

Figure S4. The XPS spectra (C1s and O1s) of SBCs.

Table S1. The degradation rate of SMX at different systems.

System	SBC300/PI	SBC500/PI	SBC700/PI	SBC900/PI
$k(min^{-1})$	0.0028	0.0219	0.1846	0.3714
R^2	0.5483	0.7798	0.9921	0.7968

Table S2. Desorption experiment data of SBCs

	Adsorption amount (mg g^{-1})	Desorption rate	Desorption amount (mg g^{-1})	Degradation rate
SBC500/PI	1.229	47.1%	0.545	55.66%
SBC700/PI	2.840	33.1%	0.440	84.51%
SBC900/PI	4.809	37.1%	0.180	96.26%

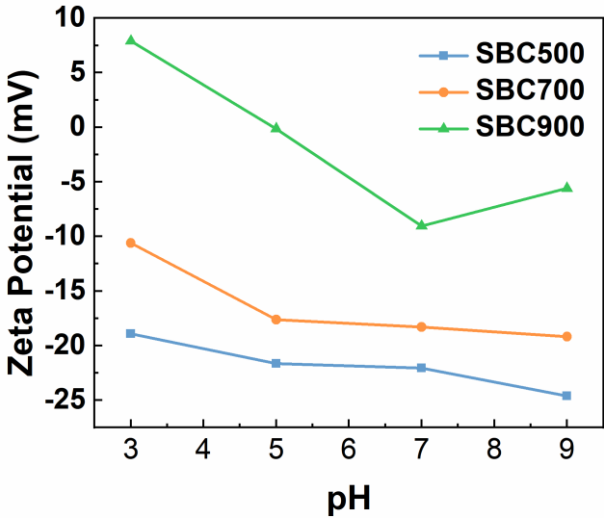

Figure S5. The Zeta potential of SBCs.

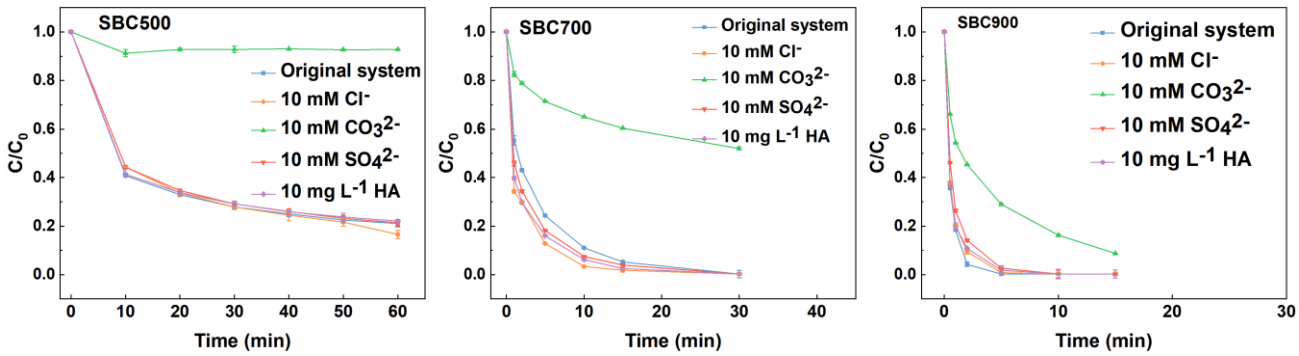

Figure S6. The background species on the degradation of SMX in the SBCs/PI system.

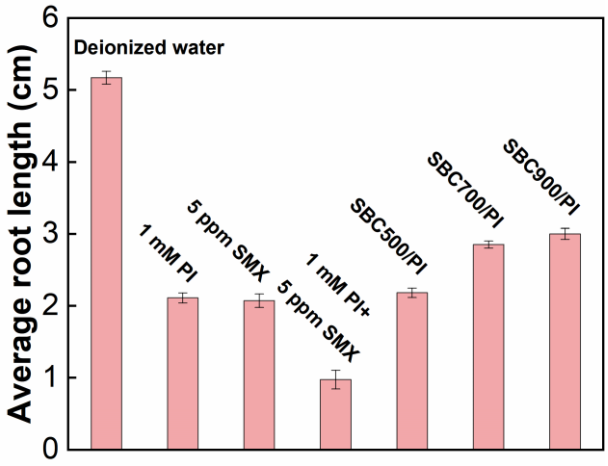

Figure S7. The biotoxicity test of the SBCs/PI system.