Supporting Information

Cu-doped $CoWO_4/WO_3$ heterojunction as peroxymonosulfate activator for rapid degradation of organic pollutants

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Characterizations

The powder X-ray diffraction (XRD) patterns were acquired on a Bruker D8 Advance diffractometer by using Cu Kα radiation (λ = 1.5406 Å). The Fourier-transform infrared (FT-IR) spectra were collected with a Bruker Equinox 55 spectrometer, KBr as the diluents. The elemental composition of the catalysts, corresponding to the valence state, and the valence band energy were analyzed by X-ray photoelectron spectroscopy (XPS, Thermo Scientific Escalab 250Xi) with Al-Kα (hν = 1486.6 eV) as the radiation source. The C 1s peak (binding energy = 284.8 eV) was used as a calibration standard. The photoluminescence (PL) spectra were measured with a PE LS 55 spectrofluorophotometer at excitation wavelength of 325 nm. The electrochemical impedance spectroscopy (EIS) and transient photocurrent (I–t) measurements were conducted using a CHI660E electrochemical workstation in a standard three-electrode configuration, comprising a catalyst-coated FTO glass as the working electrode, a platinum plate as the counter electrode, and an Ag/AgCl (saturated KCl) electrode as the reference. A 0.5 mol/L Na_2SO_4 aqueous solution was employed as the electrolyte, and all measurements were performed at room temperature (25 °C). EIS measurements were carried out in the frequency range from 0.1 Hz to 1 MHz with a sinusoidal AC amplitude of 5 mV. The transient photocurrent responses were recorded under chopped light irradiation at an applied bias of 0.25 V versus Ag/AgCl.

Supporting Figures

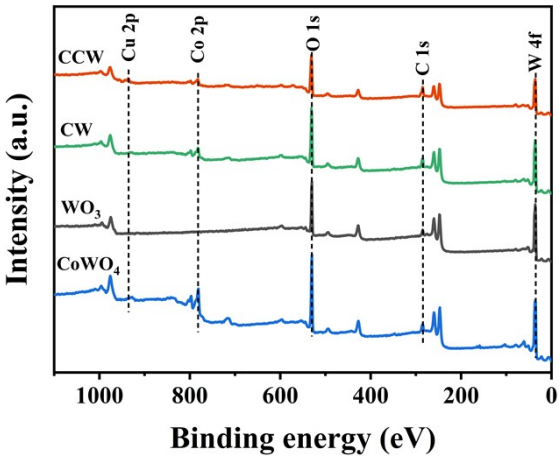

Fig. S1 The XPS spectra of the prepared $CoWO_4$, WO_3, CW, and CCW.

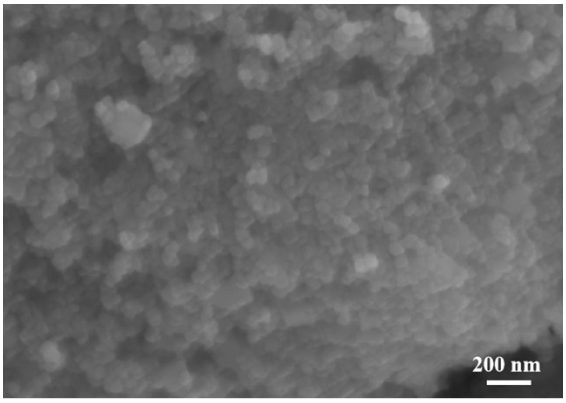

Fig. S2 The SEM images of CW.

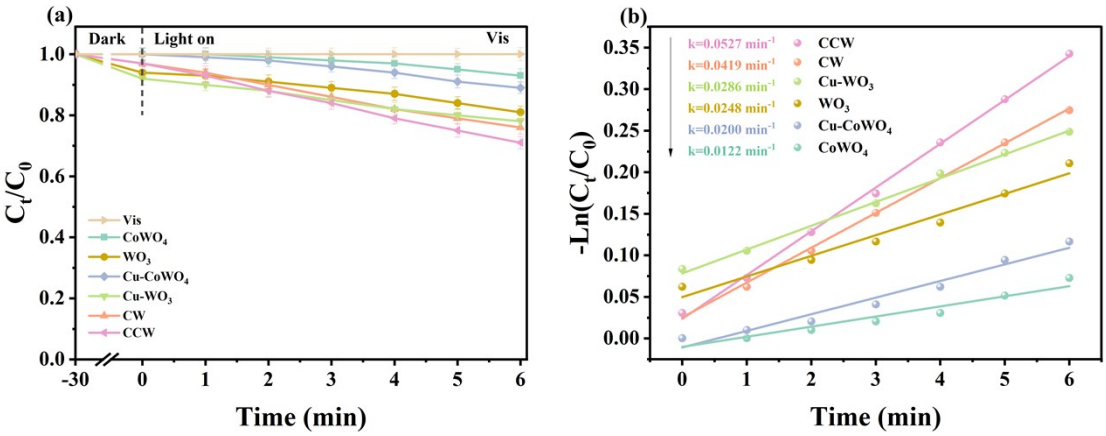

Fig. S3(a) TC degradation in Vis system. (b) Quasi-first-order dynamics of Vis systems.

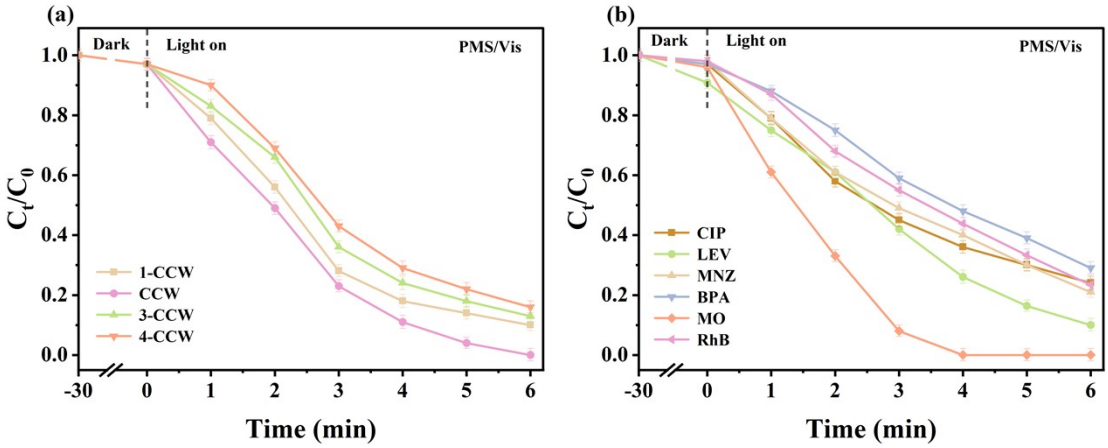

Fig. S4(a) The activity of CW with different copper doping amounts for TC degradation. (b) The performance of the CCW/PMS/Vis system in removing various pollutants.

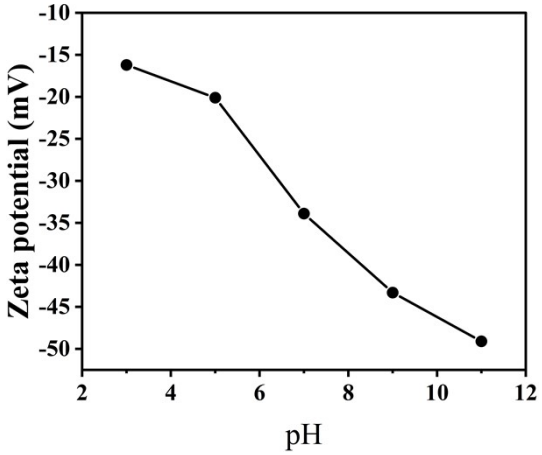

Fig. S5 Zeta potential-pH profiles of CCW.

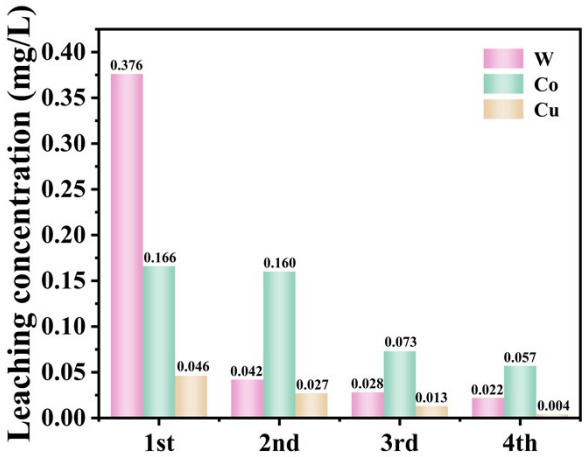

Fig. S6 Leached concentrations of W, Co, and Cu in the CCW/PMS/Vis system.

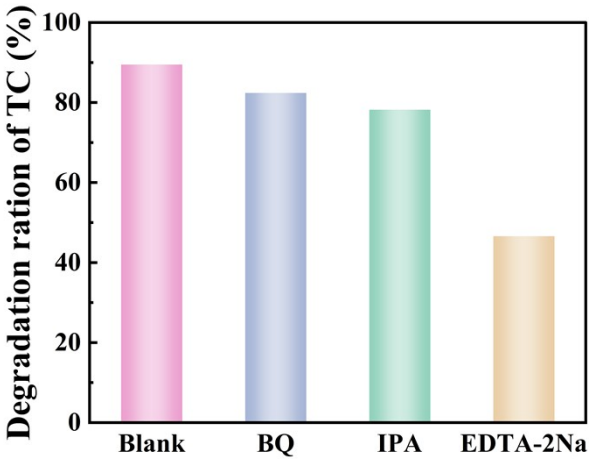

Fig. S7 Degradation efficiency of TC in the CCW/Vis system within 60 minutes under different radical scavengers.

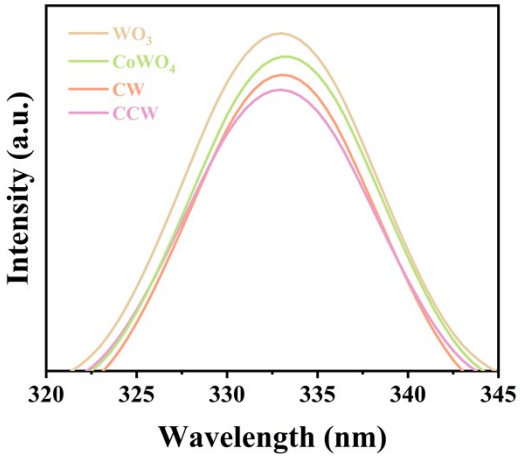

Fig. S8 The PL spectra of $CoWO_4$, WO_3, CW, and CCW.

Table S1 Comparison of CCW with other reported catalysts

Catalyst	Catalyst dosage (g/L)	PMS/PDS (mM)	Pollutant	Concentration of pollutant (mg/L)	Volume of pollutant (mL)	Degradation rate (%)	Degradation time (min)	Reference
CCW	0.4	1	TC	10	50	100 (Photocatalysis+PMS)	6	Our work
MoS_2@TCN-S	1	0.75	TC	10	50	94.3% (Photocatalysis+PMS)	120	[1]
Fe-BP-CCF	0.2	1	TC	10	50	75.5 (Photocatalysis+PMS)	60	[2]
Co_3O_4/Bi_4O_7/ Bi_2O_3(CBB)	0.5	0.7	TC	10	100	98.4 (Photocatalysis+PMS)	60	[3]
$CuBi_2O_4$/BiOBr	0.2	2	TC	10	100	90.3% (Photocatalysis+PMS)	35	[4]
CW/Co/BNQDs	0.2	1	TC	10	100	94.8% (Photocatalysis+PMS)	30	[5]
Mo_2C/MoO_X	-	1.7	TC	50	20	91.7% (Photocatalysis+PMS)	60	[6]
T/NC/MoS_2@Ag NFs-DD	-	2	TC	10	100	97.4% (Photocatalysis+PMS)	20	[7]

g-C_3N_4/$NiCo_2O_4$ (CNS-NCO)	0.2	1.2	TC	20	50	96.9% (Photocatalysis+PMS)	30	[8]
ZCCN-30%	0.2	1	TC	10	100	99% (Photocatalysis+PMS)	40	[9]
$MnFe_2O_4$/MoS_2	0.2	1	TC	10	-	92.9 % (PMS)	30	[10]
Fe_3O_4@PANI-p 600	0.4	4	TC	20	-	89.8 % (PMS)	90	[11]

Table S1 The content of TOC before and after reaction in the control experiment

Control experiment	**Before degradation**	**After degradation**
CCW	15.62 mg/L	10.9 mg/L

References

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