Supporting Information

Photoelectrochemical mesurement

Photoelectrochemical experiments were conducted by adopting the traditional three-electrode system, where the platinum sheet was used as the counter electrode and the Ag/AgCl electrode as the reference electrode. The working electrode preparation process was as follows: 5 mg of catalyst was dispersed in 0.8mL DMF with sustained ultrasound to form the uniform suspension, then 20 μL of the suspension was dropwise added onto a FTO glass electrode (illumination area，0.5cm*0.5 cm) and dried naturally at the room temperature. The photocurrent measurement was accomplished on a CHI 660D electrochemical workstation (Shanghai, China), with UV lamp as the light source and the shutter devices as the timing switch of light on/off, and the electrolyte was 0.2 mol/L Na_2SO_4. The Nyquist plots were performed with sinusoidal perturbation amplitude of 10 mV and frequency range from 100 MHz to 0.01 Hz in dark.

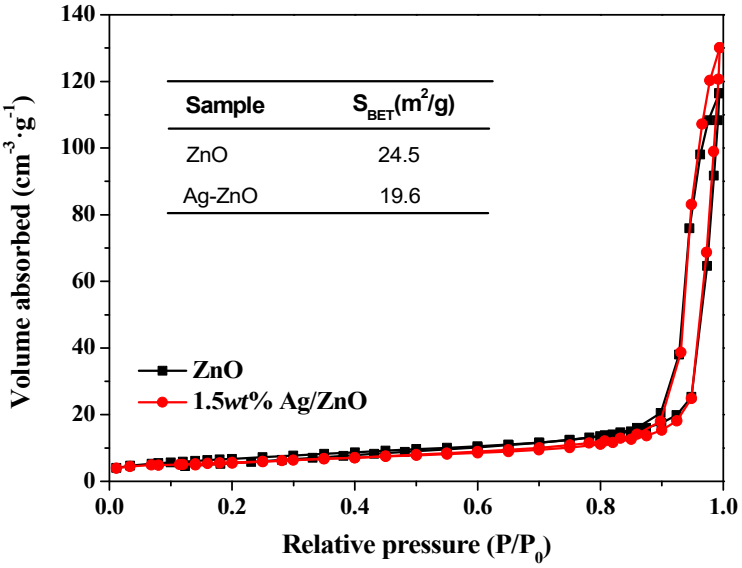

Figure S1. The N_2 adsorption-desorption isotherms for ZnO and 1.5 wt% Ag-ZnO

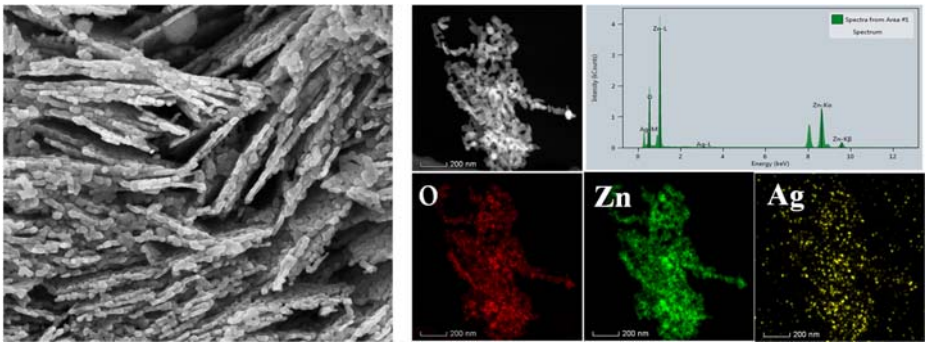

Figure S2. SEM imageand EDX spectrum for 1.5 wt% Ag-ZnO after reaction

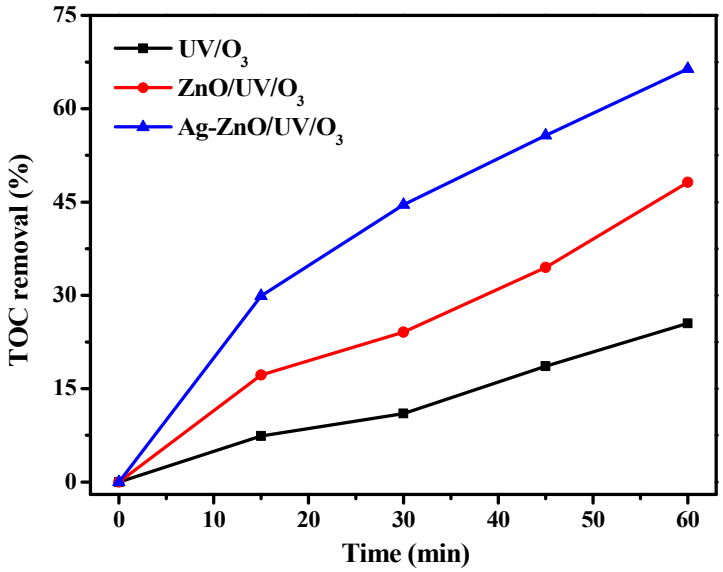

Figure S3. Mineralization of tetracycline hydrochloride in different oxidation processes, Gaseous [O_3]: 10 mg/L; O_3 flow rate: 50 mL/min; catalyst dosage: 0.5 g/L; tetracycline hydrochloride: 80 mg/L

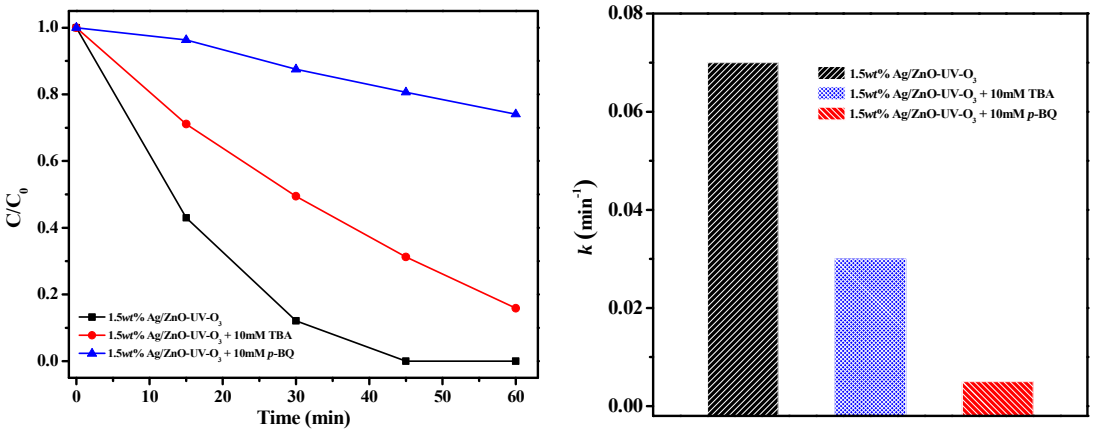

Figure S4. Radical trapping experiments in photocatalytic ozonation process using 1.5 *wt*% Ag/ZnO as a catalyst. Reaction conditions: $[Phenol]_0$ = 50 mg/L; catalyst loading =0.5 g/L; ozone flow rate=50 mL/min; ozone concentration=10 mg/L.

Table S1. Recent reports on ZnO-based catalyst for phenol removal

Catalysts	Measurement conditions	Performance	Ref
ZnO	Catalyst dosage: 1.0 g/L; [phenol]: 100 mg/L; Ozone dosage: 0.50 mg/min; Reaction time: 60 min	Degradation: 66%	*Bulletin of the Korean Chemical Society, 2012, 33, 215-220*
Pt-SiO_2-ZnO	Catalyst dosage: 1.0 g/L; [phenol]: 100 mg/L; Light source: 150-Watts mercury lamp; Reaction time: 60 min;	Degradation: 100%	*International Journal of Photoenergy, 2012, 103672*
Fe_3O_4/ZnO	Catalyst dosage: 0.325 g/L; Reaction time: 150 min; Light source: 575 W metal halide lamp	Degradation: 82% (k=0.0057 min-1)	*Chemical Engineering Journal, 2014, 244, 327-334*
Ag_2SO_4/ZnO	Catalyst dosage: 0.5 g/L; [phenol]: 40 mg/L. Reaction time: 300 min; Light source: 80 W outdoor lamp	Degradation: 35% (k=0.01 min^{-1})	*Desalination and Water Treatment, 2015, 1072954*
ZnO@SiO_2	Catalyst dosage: 0.5 g/L; [phenol]: 50 mg/L. Reaction time: 120 min; Light source: 48 W UV-C lamp	Degradation: 94%	*Environmental Science and Pollution Research, 2017, 24, 12655-12663*
BiOI/ZnO	Catalyst dosage: 1.0 g/L; [phenol]: 25 mg/L. Reaction time: 120 min; Light source: 500 W xenon lamp	Degradation: 98% (k=0.03 min^{-1})	*Journal of Colloid and Interface Science, 2017, 494, 130-138*
Ag-ZnO/MWCNT	Catalyst dosage: 1.0 g/L; [phenol]: 100 mg/L. Reaction time: 60 min; Light source: UV-A Lamp	Degradation: 81%	*Materials Science in Semiconductor Processing, 2018, 83, 175-185*
Ag-ZnO	Catalyst dosage: 1.5 g/L; [phenol]: 50 mg/L. Reaction time: 120 min; Light source: 24 W, 365 nm	Degradation: 99% (k=0.048 min^{-1})	*Applied Catalysis B: Environmental, 2018, 225, 197-206*
ZrO_2-ZnO	Catalyst dosage: 1.0 g/L; [phenol]: 50 mg/L. Reaction time: 120 min; Light source: Ultra-Vitalux lamp, 300W	Degradation: 74% Mineralization: 51%	*Journal of Nanomaterials, 2019, 1015876*
Ag-ZnO	Catalyst dosage: 0.5 g/L; [O_3]: 10 mg/L; O_3 flowrate: 50 mL/min;; [phenol]: 50 mg/L. Reaction time: 60 min; Light source: 18 W G6 T5, 365 nm	Degradation: 100% (k=0.07 min^{-1}) Mineralization: 62%	*This study*

Table S2 ICP analysis of Ag/ZnO samples

Samples	0.5*wt*% Ag/ZnO	1.0wt% Ag/ZnO	1.5wt% Ag/ZnO	2.0wt% Ag/ZnO	2.5wt% Ag/ZnO
Ag loading amount (*wt*%)	0.45	0.93	1.41	1.87	2.32