

# Supplementary files

## 2. Results and discussion

### 2.3. Photocatalytic performance

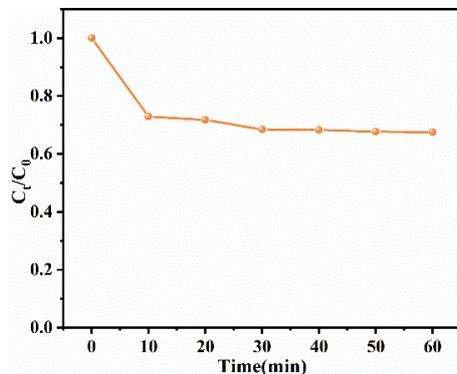


Figure S1. The adsorption curve of 1.5-ZCS/Bi<sub>4</sub>O<sub>5</sub>Br<sub>2</sub> under dark.

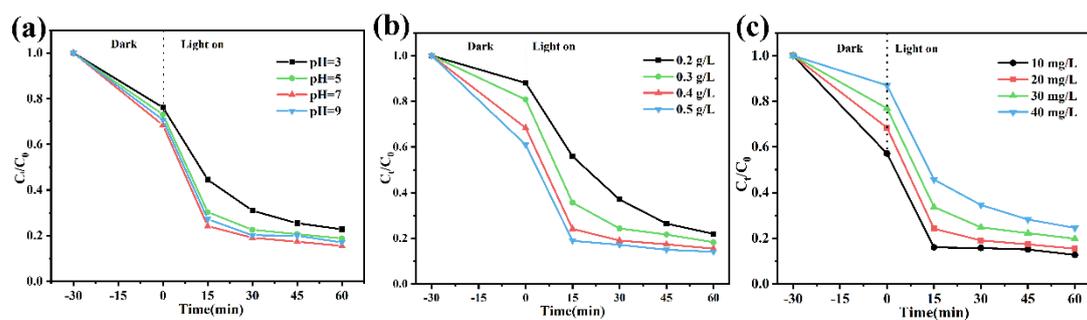
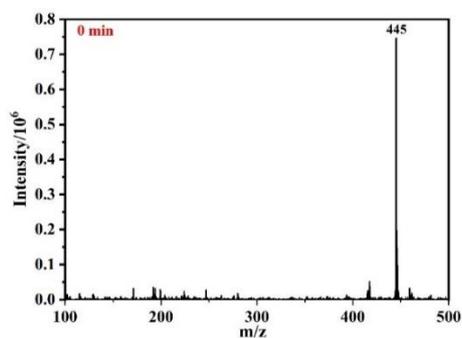
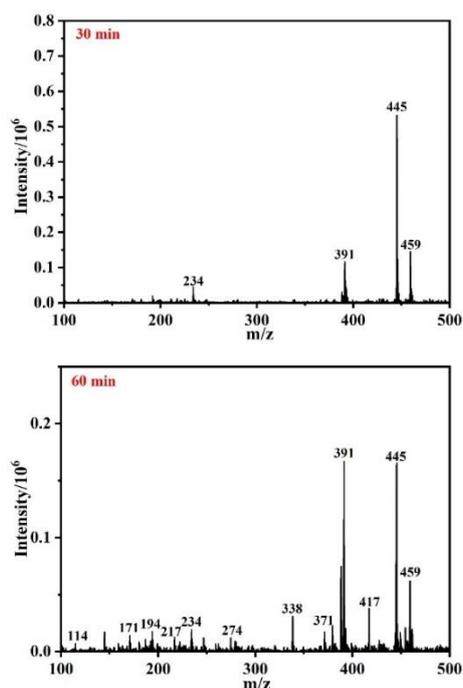


Figure S2. Effect of (a) initial pH of TCH solution, (b) catalyst dosage, and (c) pollutant concentration.

### 2.4. Analysis of possible degradation pathways





**Figure S3.** LC-MS spectra of TCH degradation process during different irradiation times: (a) 0 min, (b) 30 min, (c) 60 min.

### 3. Experimental section

#### 3.4. Characterization

The crystal structure of the composites was characterized by X-ray diffractometer (XRD, X' Pert PRO, Germany) with Cu K $\alpha$  radiation in the scanning range of 5-80°. The micro morphology and structure were characterized by scanning electron microscopy (SEM, ZEISS Gemini SEM 300, Germany) and transmission electron microscopy (TEM, JEOL JEM F200, Japan). The valence states of the elements were analyzed by using X-ray photoelectron spectrometer (XPS, Thermo fisher Scientific K-Alpha, America). Specific surface area and pore size datas of materials were tested using automated specific surface and porosity analyzer (BET, Micromeritics ASAP2460, America). The UV-vis diffuse reflectance spectra (DRS) were measured in the wavelength range of 200-800 nm on a Shimadzu solid spec-3700 UV-vis spectrophotometer. The Photoluminescence (PL, Perkin Elmer LS-55, America) spectra were obtained by a steady-state fluorescence spectrometer. The intermediates of TCH degradation were detected by liquid chromatography-mass spectrometry (LC-MS,

Shimadzu LC-MS-2020, Japan). Active radicals were monitored with an electron paramagnetic resonance (EPR, Bruker EMXplus-6/1, Germany) spectrometer.

Photoelectrochemical measurements were carried out on a CHI660E electrochemical workstation using the classical three-electrode system. Usually, 0.5 M Na<sub>2</sub>SO<sub>4</sub> solution was used as the electrolyte, Pt sheet and Ag/AgCl electrode were used as the counter electrode and reference electrode respectively. The working electrode was fabricated as follows: 10 mg of the sample and 20 μL of Nafion (Dupont, 5 wt%) solution were added to 1 mL of anhydrous ethanol and ultrasonicated for 30 min. Afterwards, 30 μL of the obtained suspension was coated on the conductive surface of ITO glasses (1.0 cm<sup>2</sup> coating area), dried at room temperature. The electrochemical impedance spectra (EIS) were recorded at an open-circuit potential with the frequency range fixed at 0.01~10<sup>5</sup> Hz. Mott Schottky curves were measured at the frequency of 1000 and 1500 Hz.