

Electronic supplementary information:

Cu_{1.8}S-passivated carbon dots for enhancing photocatalytic activity

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1. Experimental details

Synthesis of CDs: 25 mL of DMF solution was transferred into 50 mL Teflon-lined stainless autoclave and subsequently heated at 200 °C in oven for 5 h. After cooling down to room temperature naturally, the carbon dot solution of DMF was obtained.

Preparation of Cu_{1.8}S-passivated CDs: 60 mg of Cu(acac)₂ and 200 μL of 1-hexadecanethiol (HDT, >85%) were added into 18 mL of DMF solution containing CDs. The blending solution was heated at 80 °C under stirring for 0.5 h, and then was transferred into 50 mL Teflon-lined stainless autoclave again. After heating at 200 °C for 3 h and cooling down to room temperature naturally, Cu_{1.8}S-passivated CDs was obtained. The unreacted solution was removed by reduced pressure distillation.

Preparation of One-pot sample: 60 mg of Cu(acac)₂ and 200 μL of HDT were added into 18 mL of DMF solution. The blending solution was heated at 80 °C under stirring for 0.5 h, and then was transferred into 50 mL Teflon-lined stainless autoclave again. After heating at 200 °C for 3 h and cooling down to room temperature naturally,

Cu_{1.8}S-passivated CDs was obtained. The unreacted solution was removed by reduced pressure distillation.

Characterizations

The X-ray diffraction (XRD) patterns of the materials were recorded on a Rigaku D/Max 2550 X-ray diffractometer with Cu K α radiation. The sample solution was dropped onto Mo grids covered with an amorphous carbon film to prepare specimen for transmission electron microscopy (TEM) observation which were performed in a FEI Tecnai G2 F20 microscope with a field-emission gun operating at 200 kV. X-ray photoelectron spectroscopy (XPS) data of all samples was collected by a Kratos AXIS 165 multitechnique electron spectrometer having an Al K α X-ray source for determining the composition and chemical bonding configurations. Fluorescence spectroscopy and absorption were collected on a Hitachi F4500 fluorescence spectrophotometer and a Shimadzu UV-2550 UV-vis spectrometer, respectively. The electron spin resonance (ESR) signals of superoxide anion radical (O^{2•-}) were measured on a Bruker model ESR JES-FA spectrometer by spin-trap reagent 5,5-dimethyl-1-pyrroline-N-oxide (DMPO) in air-saturated aqueous solution.

Photocatalysis experiment

Photocatalysis was performed according to our previous reports. 50 μ L of the sample, (CDs, Cu_{1.8}S-passivated CDs or one-pot sample) were added into the solution containing 1 mM TBBQ or TA in a quartz cell with an inner cell edge length of about

2 cm and a small capped opening at the top. Before illumination, the cell was constantly stirred for 30 min in the dark to ensure the establishment of an adsorption–desorption equilibrium. After that the cell was irradiated with light from a 300 W xenon lamp placed 35 cm away. The light intensity reaching the cell was about 100 mW cm⁻². Visible and IR light were obtained by using cutoff filters to remove light of $\lambda < 420$ nm. UV-vis absorption and fluorescence spectra of the samples were taken before and after every certain time of irradiation by removing the cap to withdraw the solution.

2. Supporting results

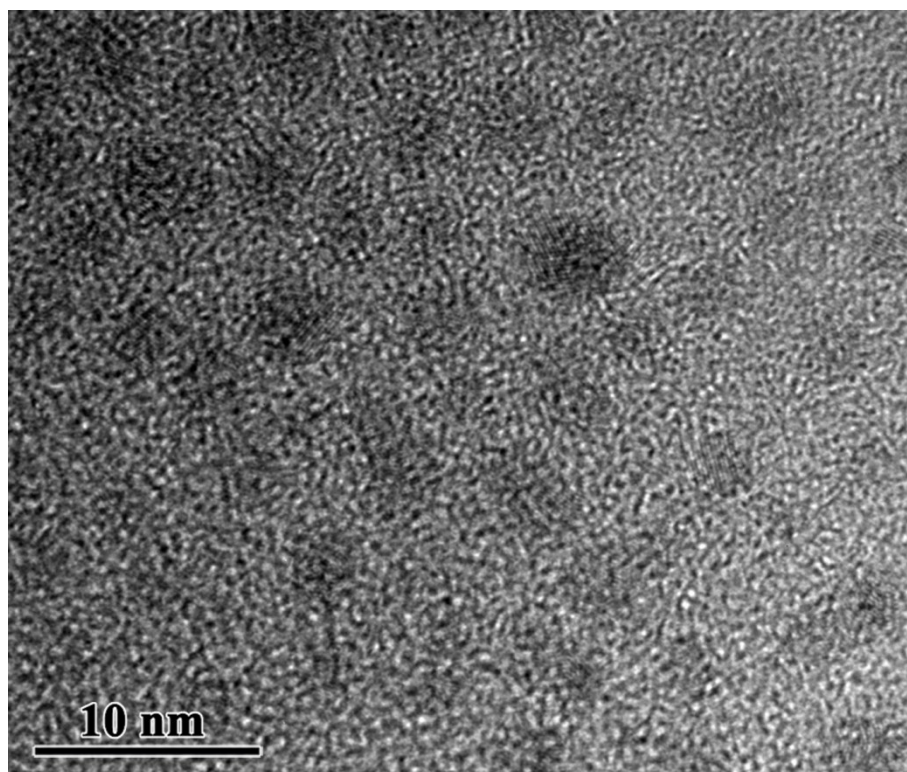


Figure S1 HRTEM image of CDs

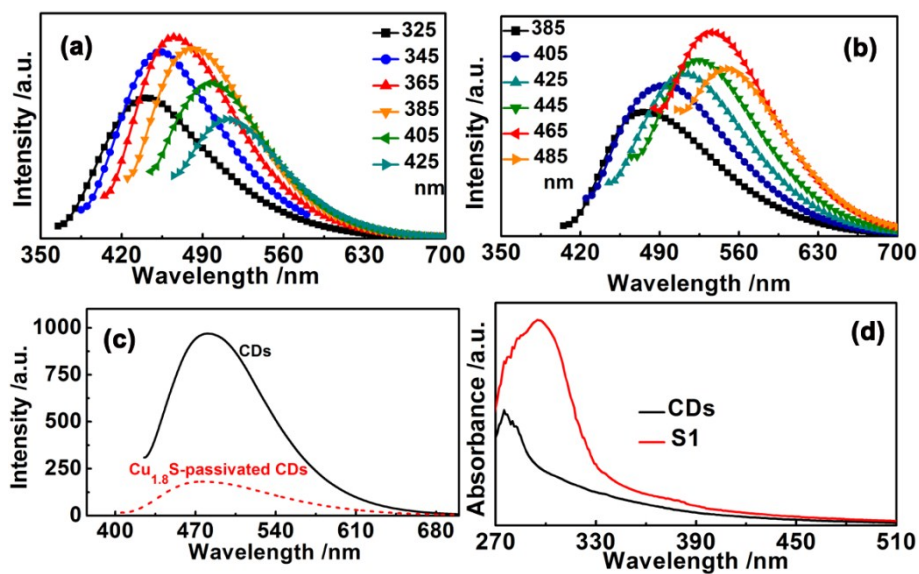


Figure S2 PL spectra of the CDs (a) and Cu_{1.8}S-passivated CDs (b) under the different wavelength excitations; (c) PL spectrum comparisons between the CDs and Cu_{1.8}S-passivated CDs at the same wavelength excitation and concentration; (d) UV-Vis absorption spectra of the CDs and Cu_{1.8}S-passivated CDs.

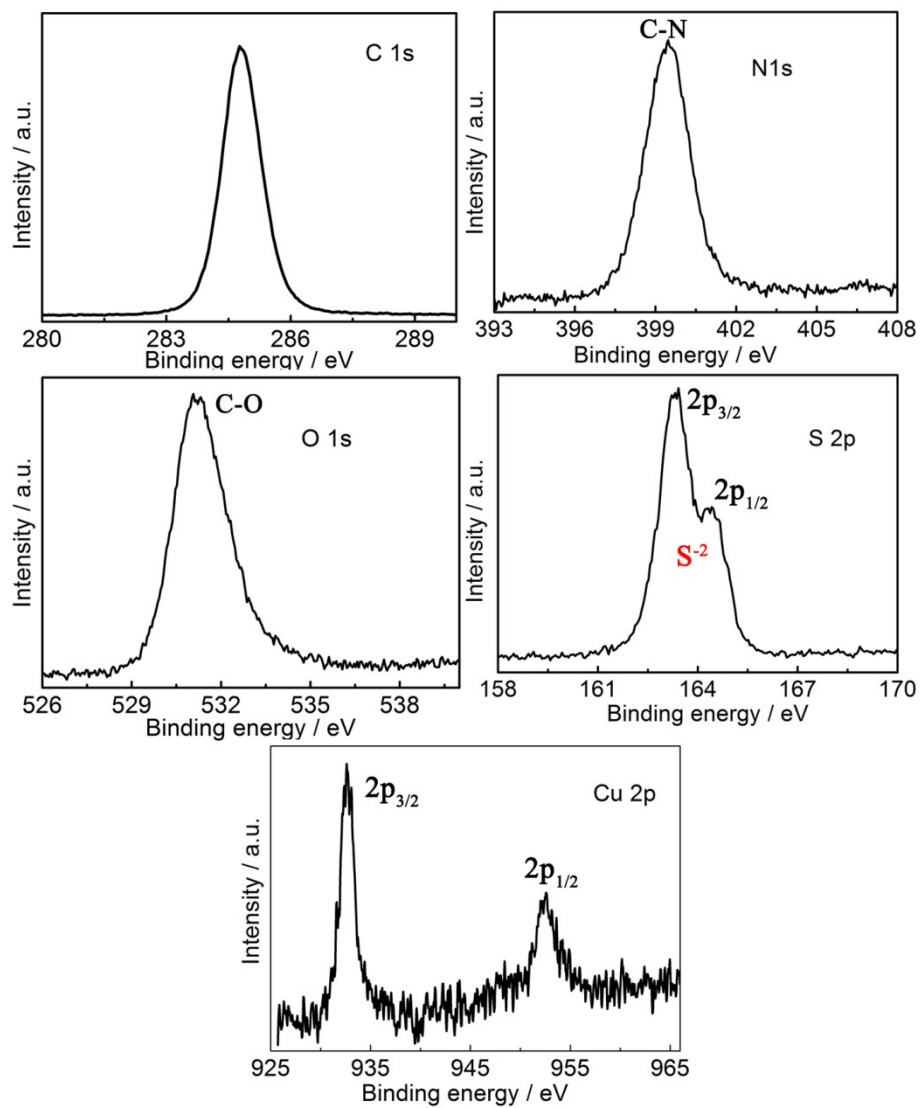


Figure S3 High resolution XPS spectra of Cu_{1.8}S-passivated CDs: C1s, N1s, O1s, S2p

Cu2p

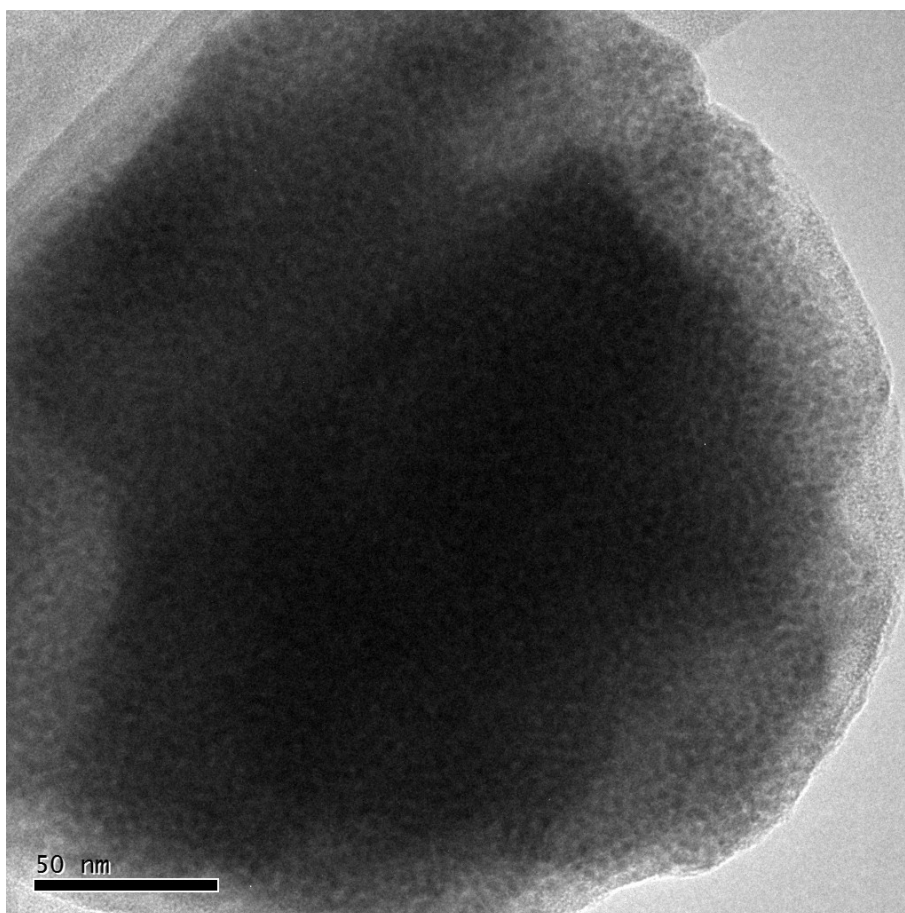


Figure S4 TEM image of $\text{Cu}_{1.8}\text{S}$ -passivated CDs

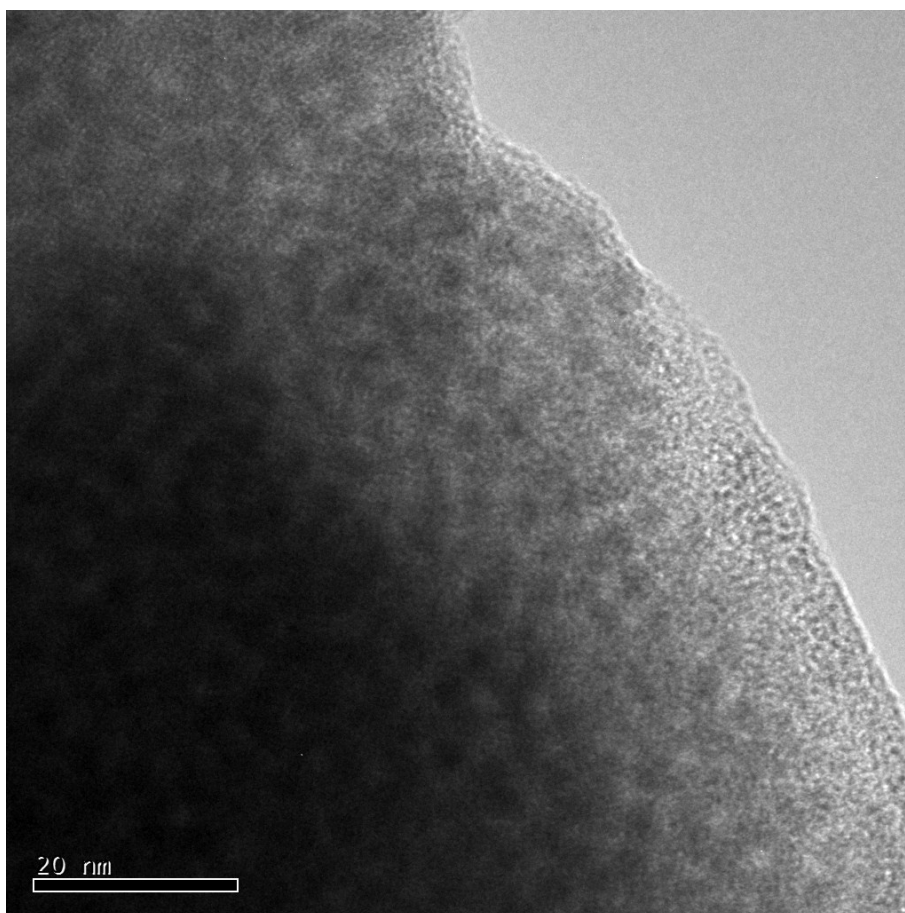


Figure S5 TEM image of Cu_{1.8}S-passivated CDs

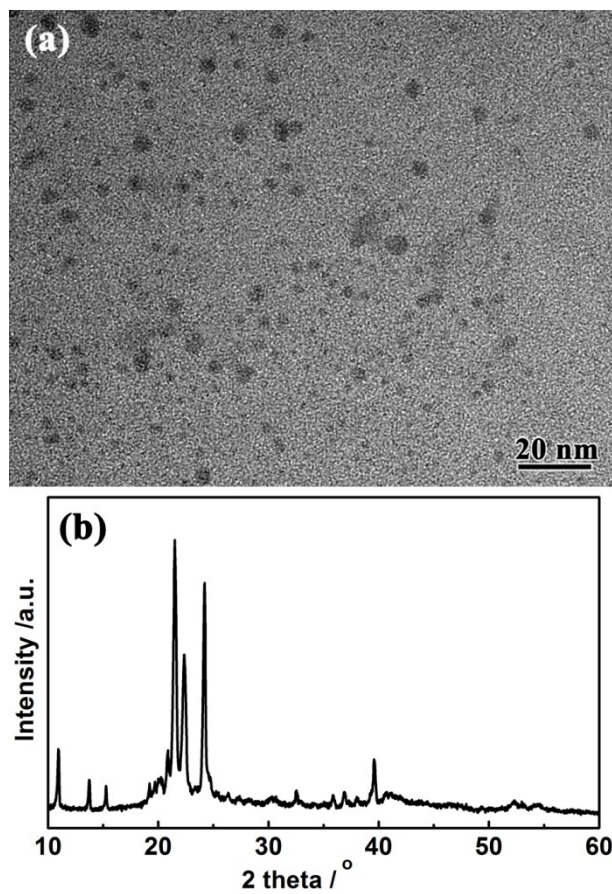


Figure S6 TEM image (a) and XRD pattern (b) of one-pot sample

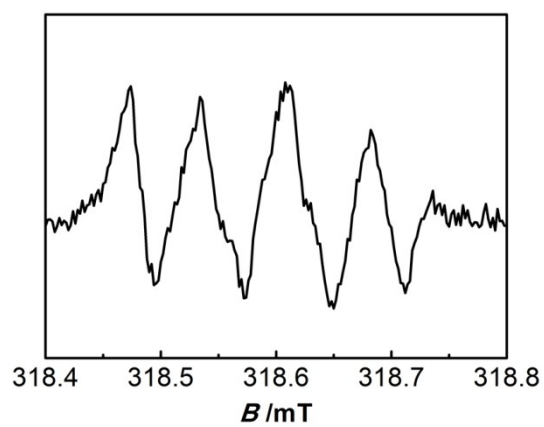


Figure S7 ESR spectrum from the mixture of $Cu_{1.8}S$ -passivated CDs with DMPO under light

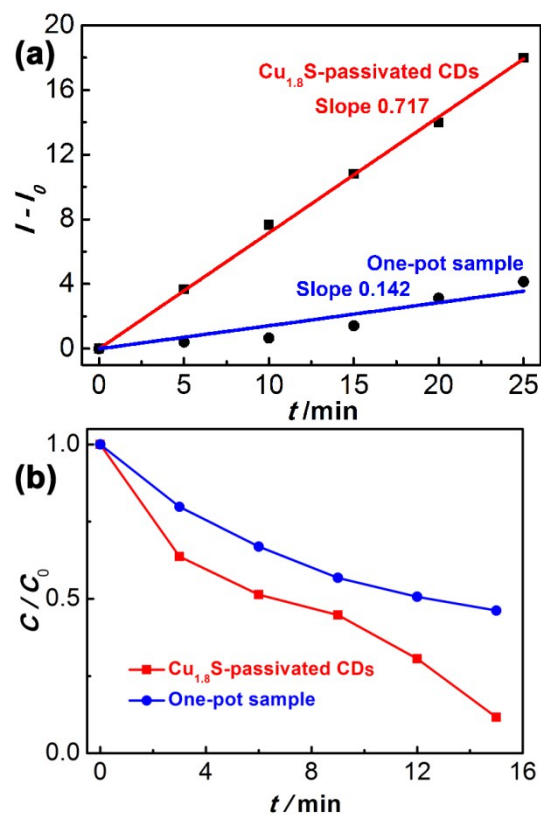


Figure S8 Photocatalytic activity comparisons of Cu_{1.8}S-passivated CDs and one-pot sample. (a) The dependence of the changes of fluorescence intensities at 426 nm from the formed TAOH on the irradiation time; (b) The dependence of TBBQ content changes on the irradiation time.