

## Supplementary Material

### Characterization

The phase composition of the samples was investigated by X-ray diffraction (XRD) on a Shimadzu XRD-6000 X-ray powder diffractometer. A scanning electron microscopy (SEM, JSM-6390A), energy dispersive spectroscopy (EDS, JSM-6390A) and high resolution transmission electron microscopy (HRTEM, Tecnai G2F20S-TWIN) were employed to observe the morphology and elemental compositions of CdSe/C/TiO<sub>2</sub>. The chemical status of the elements was identified with XPS (Kratos AXIS NOVA ). The absorption spectra of the samples were obtained by a UV-vis spectrophotometer (UV-3600) with a wavelength range of 200-800 nm. The photoluminescence spectrum (PL) was measured by a fluorescence intensimeter (Hitachi-F7000) using an excitation wavelength of 220 nm.

### Photoelectrochemical measurements

Photoelectrochemical performance of the prepared films was studied using the electrochemical workstation (CHI 660 E) under in a three electrode cell at room temperature. The measured samples, Pt foil and HgCl<sub>2</sub>/Hg were used as the working, counter and reference electrodes, respectively. 0.5 M Na<sub>2</sub>SO<sub>4</sub> aqueous solution was employed as the electrolyte for the MB degradation. The samples with 0.785 cm<sup>2</sup> surface area was irradiated using a 300 W Xe lamp. Before the reaction, the system kept in the dark for 30 minutes to reach the adsorption-desorption equilibrium. During the reaction, 3 mL of the solution was taken per 15 min to detect the degradation of MB through UV-Vis spectrophotometer at 664 nm.

Table S1 Related reports about TiO<sub>2</sub>-based pollutant degradation in the literatures.

Catalyst	Photoelectrocatalyst(PEC) or photocatalyst(PC)	Pollutant	Degradation performance	Ref.
CdSe/C/TiO <sub>2</sub>	PEC	MB	92.43% / 120min	This work
CdSe/TiO <sub>2</sub> NTs	PEC	MB	About 60% / 240 min	1
TiO <sub>2</sub> nanosheets@CdSe	PC	MB	90.5% / 5 h	2
TiO <sub>2</sub> /CdSe/RGO film	PC	MB	About 95% / 180 min	3
CdSe/SiO <sub>2</sub>	PC	MB	90% / 180 min	4
Bi <sub>2</sub> S <sub>3</sub> -BiOBr / TiO <sub>2</sub>	PEC	RhB	93.68% / 120min	5
		MO	56.75% / 120min	
		MB	90.53% / 120min	
		Cr(VI)	67.12% / 120min	
GQDs/TiO <sub>2</sub>	PC	MO	About 95% / 120 min	6

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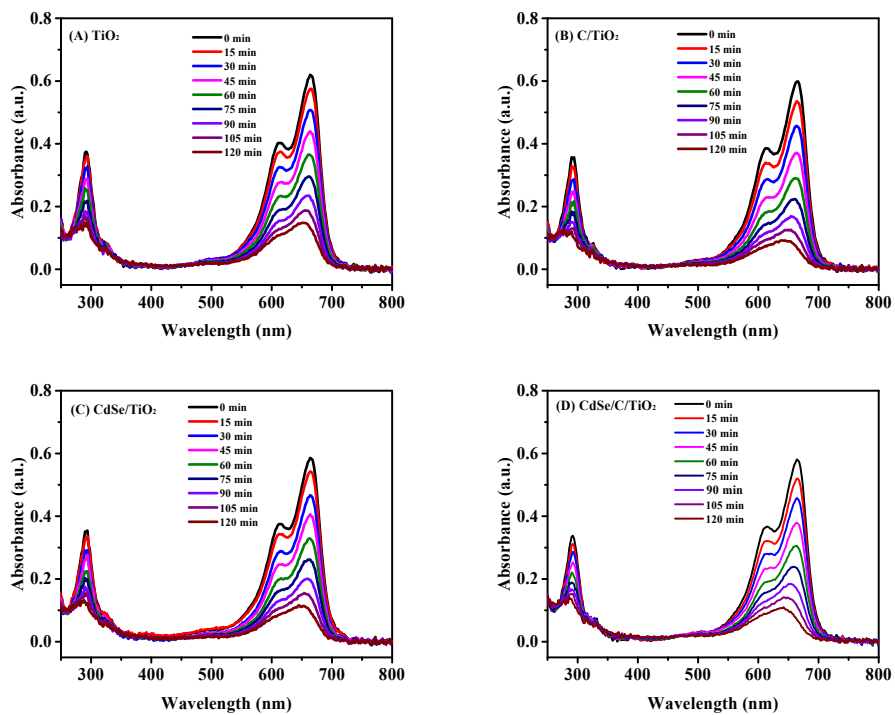


Fig. S1 Raw data for MB degradation.