Electronic Supplementary Information

A metal-free photocatalytic active hybrid fiber as a novel self-cleaning adsorbent for enhanced tetracycline removal

Text S1. Preparation of graphene oxide (GO)

To a reaction flask (250 mL) placed in an ice-water bath was added an appropriate amount of concentrated sulfuric acid. Graphite powder (2.00 g) and sodium nitrate (1.00 g) were added under stirring. Potassium permanganate (6.00 g) was slowly added in portions. The reaction mixture was stirred for a 20 min at a temperature below 20 °C. After that, the reaction temperature was increased to 35 °C and the mixture was kept stirring at this temperature for another 30 min. Next, deionized water (100 mL) was added slowly, and the diluted reaction mixture was stirred for another 20 min at 35 °C. This procedure generated graphene oxide (GO) through oxidation of graphite. Once the oxidation reactions were complete, an appropriate amount of H2O2 aqueous solution (50 mL, 30%) was added to quench excess potassium permanganate. The reaction solution then turned into a bright yellow colour. The reaction mixture was kept still for sedimentation and the supernatant was decanted. The collected GO solid was washed with 5% hydrochloric acid solution and deionized water until no sulfate ion was detected in the filtrate. Finally, the GO product was subjected to freeze drying.

Table S1. Kinetic parameters for the adsorption of TC in the dark.

	Pseudo-first-order			Pseudo-second-order		
$q_{e,exp}$	$q_{e,c}$	K_1	R^2	$q_{e,c}$	K_2	R^2
265	249.64	0.023	0.9438	293.04	9.8698×10^{-5}	0.9716

	Initial phase		Secondary phase	
Weber-Morris model	C	R^2	C	R^2
	31	0.99	85	0.99

Table S2. Constants of Langmuir and Freundlich isotherms

Isotherm	Constants	a-SA/GO/CNT hybrid fiber
Langmuir	K_L	0.006 ± 0.001
	q_m	289.65 ± 30.29
	R^2	0.98
Freundlich	K_F	7.22 ± 2.34
	n	1.73 ± 0.19
	R^2	0.96

Table S3. Second-order kinetic parameters for TC removal by GO, CNT and a-SA/GO/CNT hybrid fiber under solar irradiation.

	Slope ($\times 10^{-4}$)	R^2
GO	1.9	0.99
CNT	3.4	0.98
a-SA/GO/CNT hybrid fiber	4.8	0.98

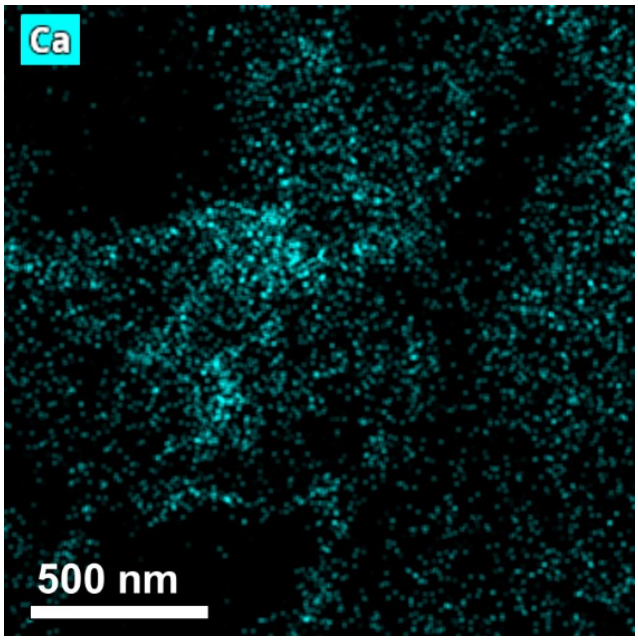

Figure S1. EDS mapping of the Ca atom in a-SA/GO/CNT hybrid fiber.

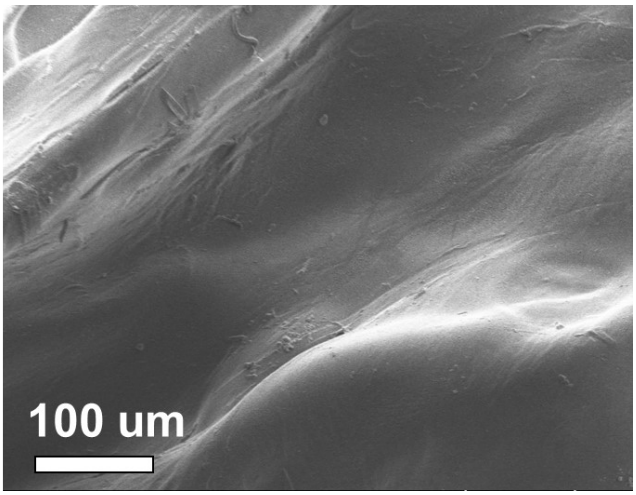

Figure S2. SEM image of a-SA.

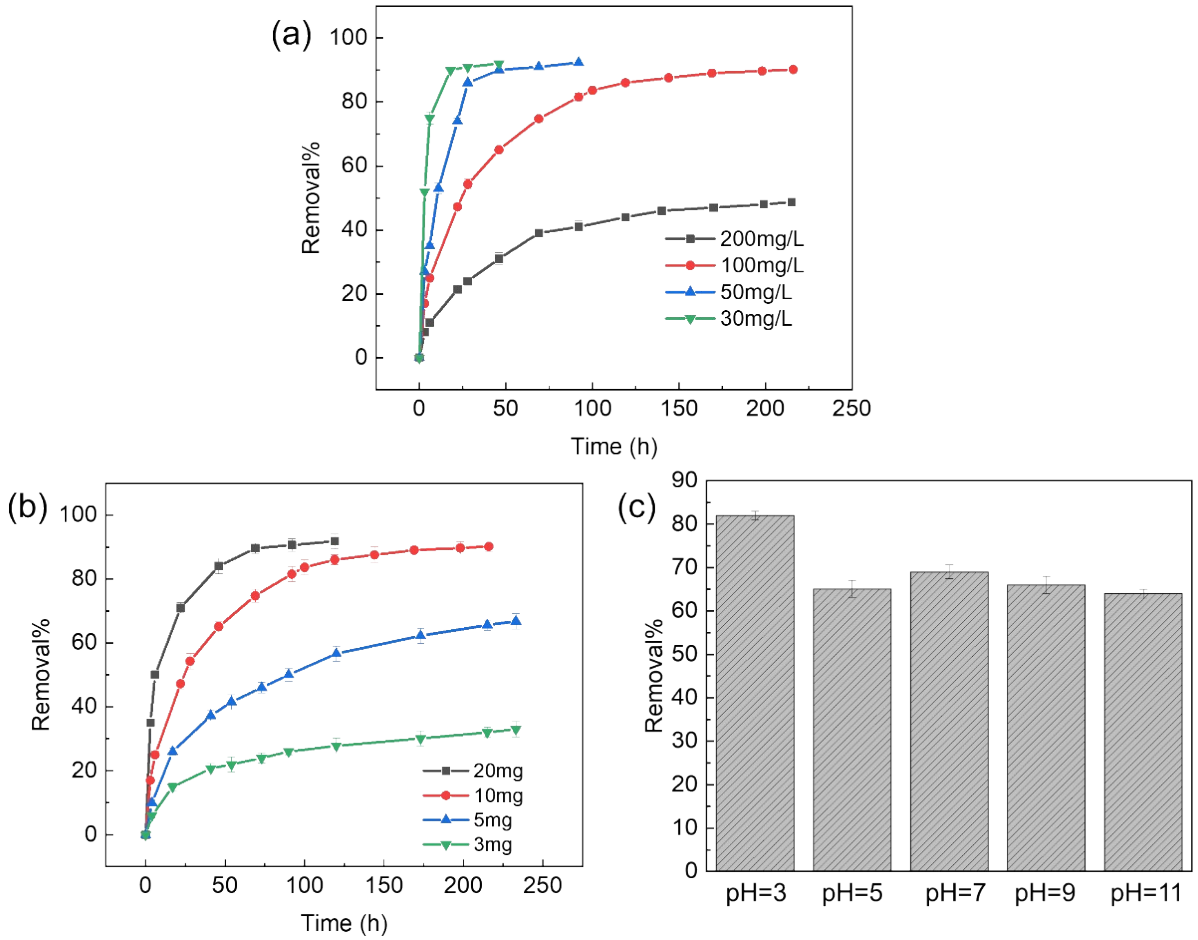

Figure S3. Influence factors in photocatalytic process of a-SA/GO/CNT fiber: (a) Effect of different initial TC concentration; (b) Effect of a-SA/GO/CNT fiber dose; (c) Effect of different pH values.

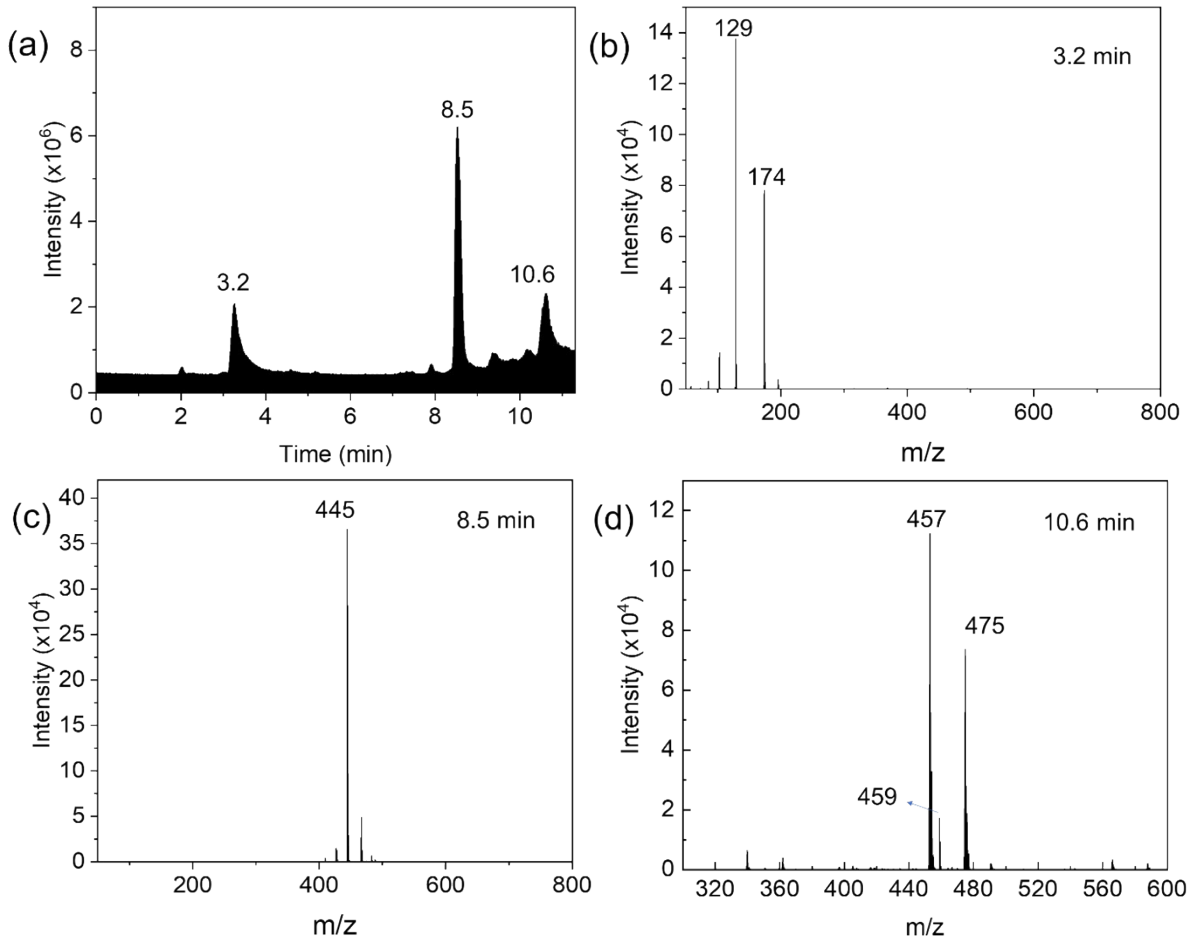

Figure S4. Total ion current LC-MS/MS chromatogram of TC solution treated by a-SA/GO/CNT fiber irradiation for 6h. Mass spectra of the corresponding.

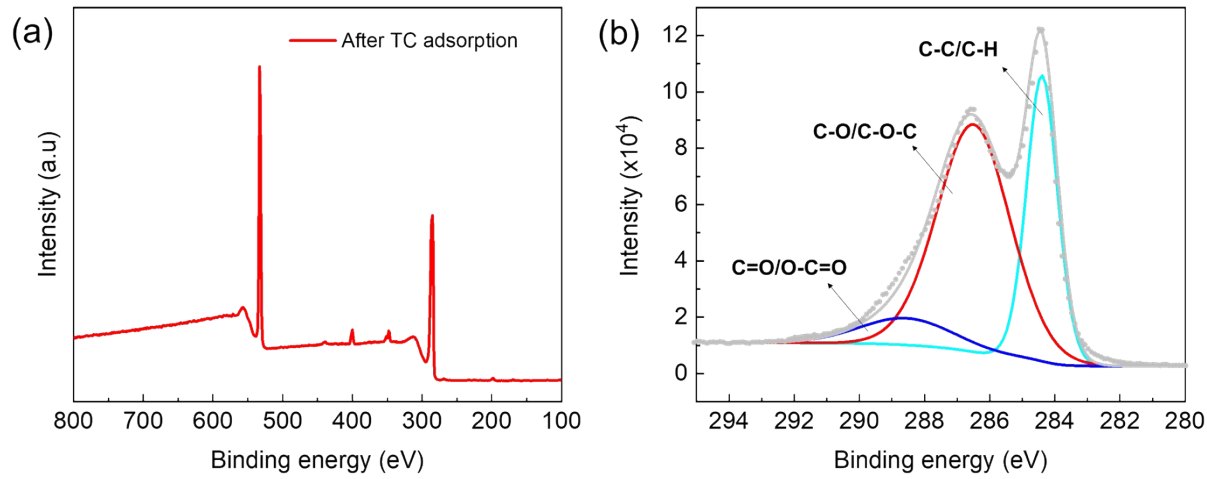

Figure S5. (a) XPS full scan of a-SA/GO/CNT hybrid fiber after TC adsorption under light irradiation. (b) High-resolution XPS spectrum of the C 1s for the a-SA/GO/CNT after TC adsorption.

Table S4. Simulation result of XPS C1s Spectra of SA/GO/CNT hydrogel before and after tetracycline adsorption and after regeneration.

		Before adsorption		After adsorption		After regeneration	
	peaks	BE (eV)	Cont. (%)	BE (eV)	Cont. (%)	BE (eV)	Cont. (%)
C1s	C-C/C=C	284.4	39.6	284.4	31.9	284.4	35.2
	C-O	286.2	49.5	286.5	59.2	286.3	54.9
	C=O	288.6	10.9	288.6	8.9	288.7	9.9