

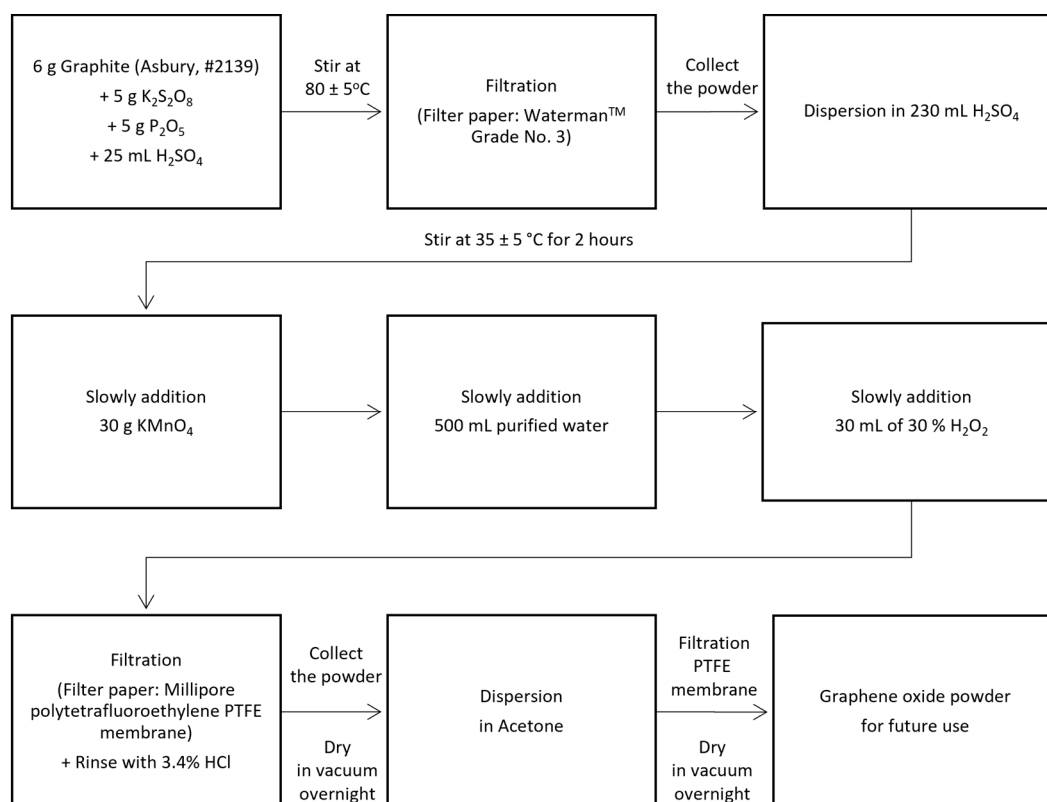


# TiO<sub>2</sub> (Core)/Crumpled Graphene Oxide (Shell) Nanocomposites Show Enhanced Photodegradation of Carbamazepine

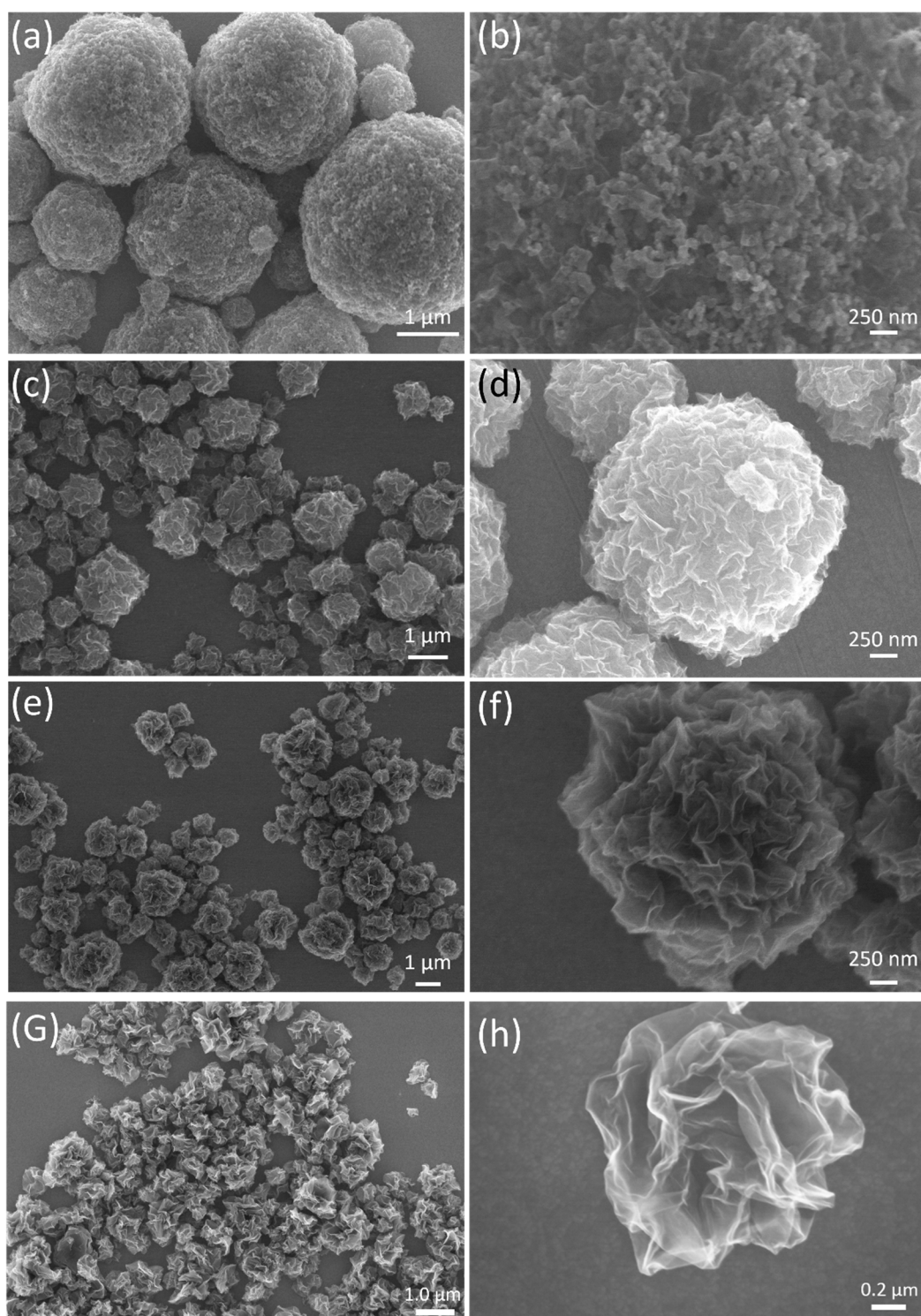
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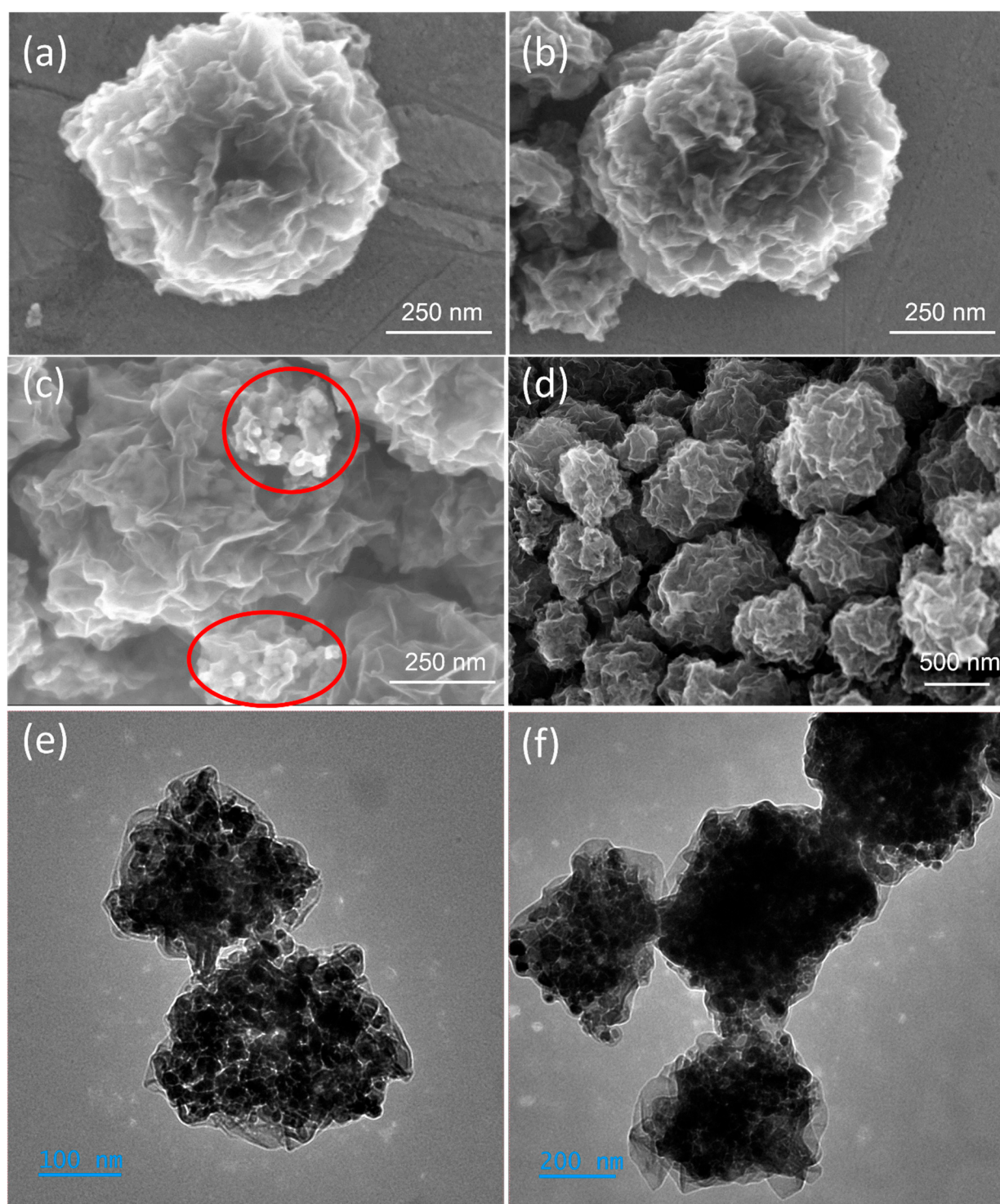
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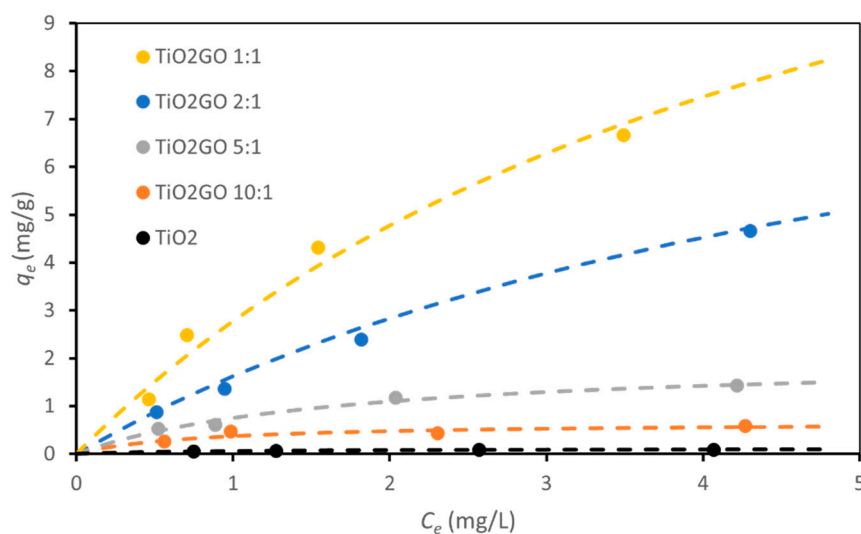
**Figure S1.** Schematic flow chart of graphene oxide synthesis method. All the chemicals were purchased from Sigma-Aldrich, or Fisher Chemical.



**Figure S2.** SEM images of TiGC with different  $\text{TiO}_2$  and GO weight ratio (a,b)  $\text{TiO}_2$ :GO ratio 10:1 (c,d)  $\text{TiO}_2$ :GO ratio 5:1 (e,f)  $\text{TiO}_2$ :GO ratio 1:1 (g,h) Crumpled graphene ball (CGB, no presence of  $\text{TiO}_2$  during synthesis).



**Figure S3.** (a–d) SEM images and (e,f) TEM images of TiGC (TiO<sub>2</sub>:GO weight ratio 2:1) after photodegradation experiment.

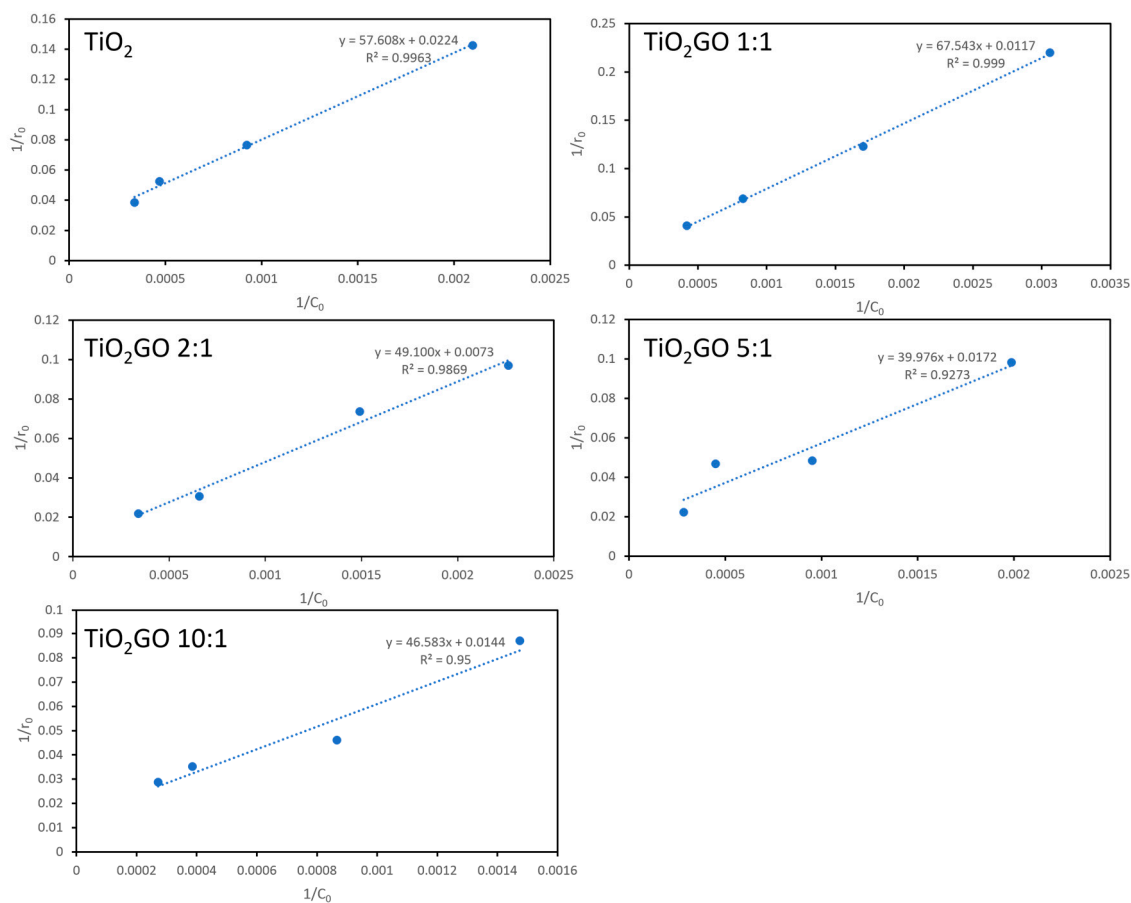


Name	$q_m(\text{mg/g})$	$K_L(\text{L/mg})$	$R^2$
TiGC (TiO <sub>2</sub> :GO Ratio 10:1)	1.25	0.67	0.9765
TiGC (TiO <sub>2</sub> :GO Ratio 5:1)	2.02	0.59	0.9816
TiGC (TiO <sub>2</sub> :GO Ratio 2:1)	11.19	0.17	0.9965
TiGC (TiO <sub>2</sub> :GO Ratio 1:1)	17.12	0.19	0.9913
TiO <sub>2</sub>	0.12	1.04	0.9936

**Figure S4.** Langmuir adsorption model for carbamazepine adsorption with different TiO<sub>2</sub> and graphene oxide ratios in TiGC.

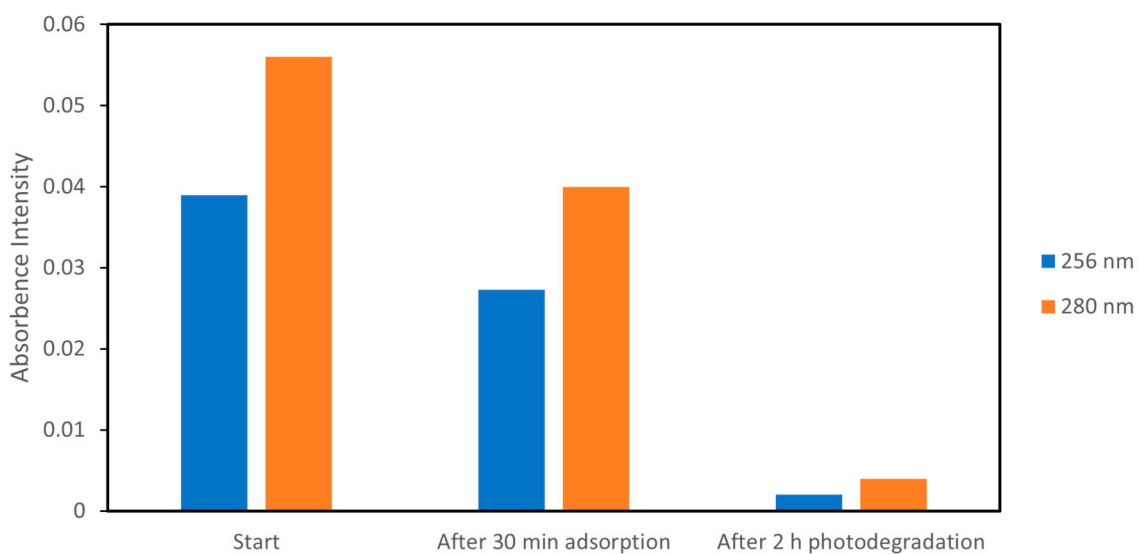
#### Pseudo first-reaction model

Name	$k_1(\text{min}^{-1})$	$R^2$
TiGC (TiO <sub>2</sub> :GO Ratio 10:1)	0.0269	0.9554
TiGC (TiO <sub>2</sub> :GO Ratio 5:1)	0.0326	0.9924
TiGC (TiO <sub>2</sub> :GO Ratio 2:1)	0.0286	0.9953
TiGC (TiO <sub>2</sub> :GO Ratio 1:1)	0.0177	0.9934
TiO <sub>2</sub>	0.0226	0.9914

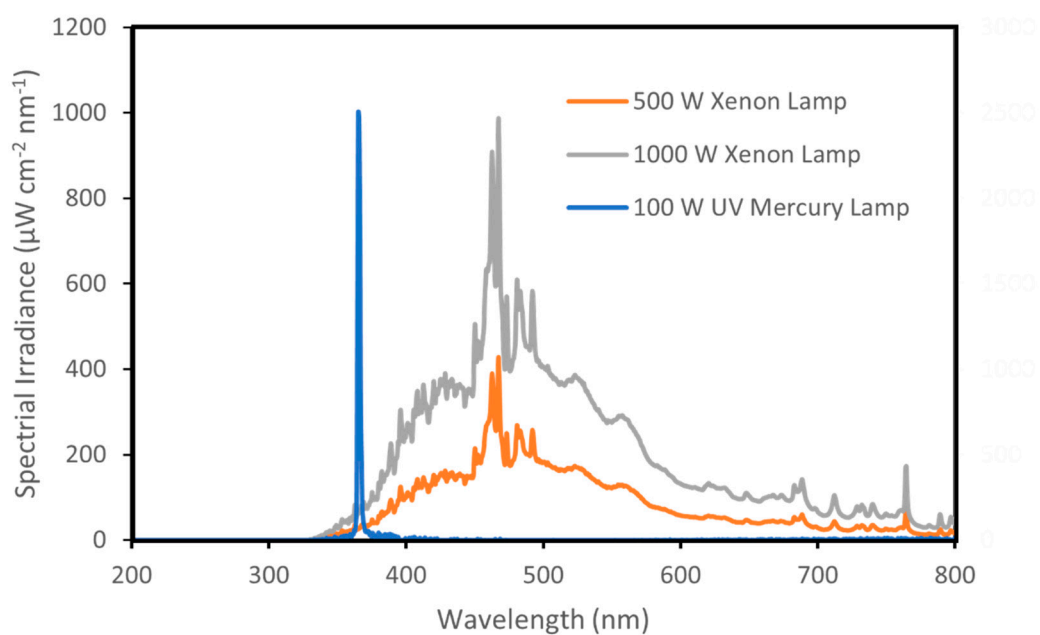
**Langmuir Hinshelwood model**

Name	$k_{L-H}$ ( $\mu\text{g L}^{-1}\text{min}^{-1}$ )	$K_{L-H}$ ( $\text{L } \mu\text{g}^{-1}$ )	$R^2$
TiGC (TiO <sub>2</sub> :GO Ratio 10:1)	69.45	0.00028	0.9500
TiGC (TiO <sub>2</sub> :GO Ratio 5:1)	58.14	0.00043	0.9273
TiGC (TiO <sub>2</sub> :GO Ratio 2:1)	142.86	0.00014	0.9869
TiGC (TiO <sub>2</sub> :GO Ratio 1:1)	93.46	0.00016	0.9990
TiO <sub>2</sub>	51.67	0.00046	0.9963

**Figure S5.** Pseudo first-reaction model and Langmuir Hinshelwood model calculation for carbamazepine photodegradation with different TiO<sub>2</sub> and graphene oxide ratios in TiGC.

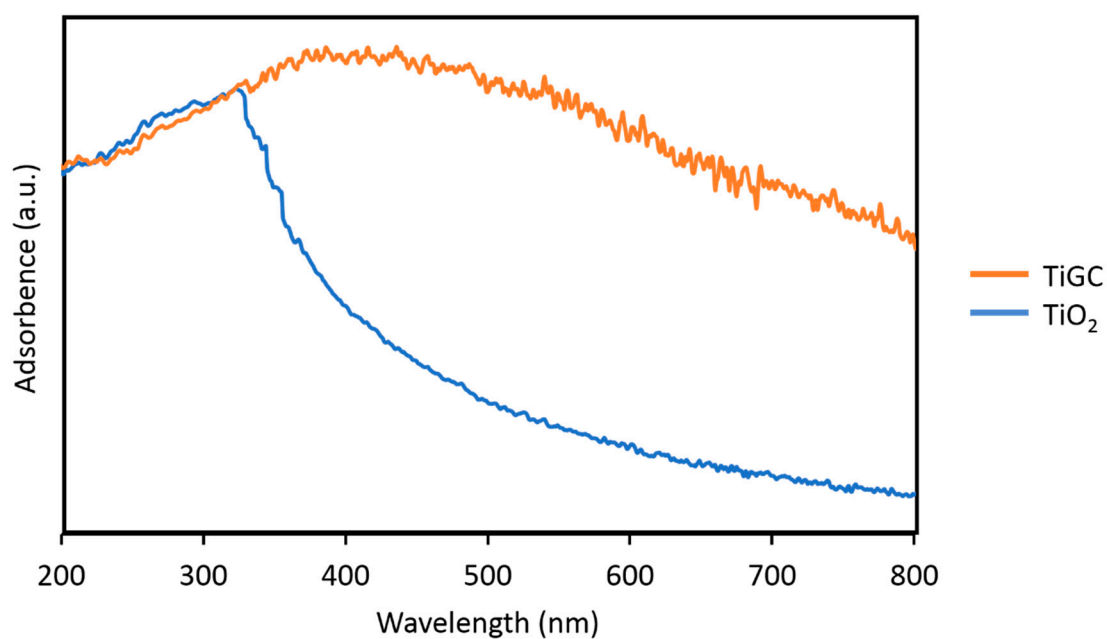


**Figure S6.** UV-vis spectra of two wavelength 256 nm and 280 nm during the photodegradation experiment.

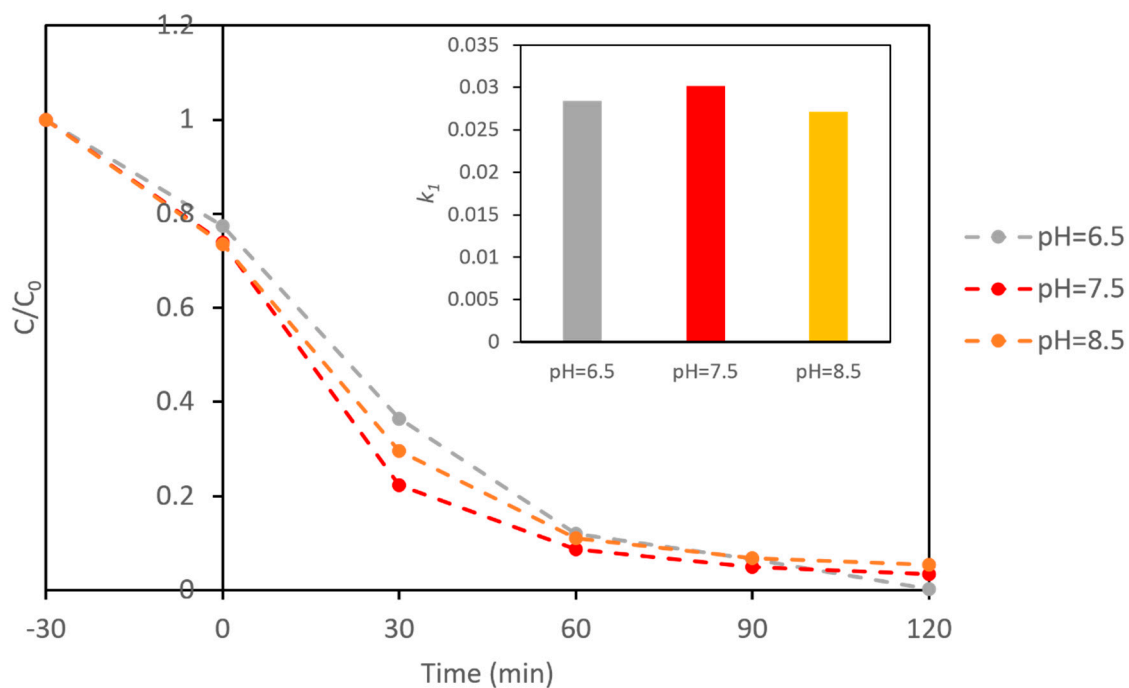


**Figure S7.** Light spectra of simulated solar irradiation from Mercury Lamp (100 W) Xe arc lamp (500 W and 1000 W) under carbamazepine photodegradation tests.





**Figure S8.** UV-vis spectra of TiO<sub>2</sub> P25 and TiGC (TiO<sub>2</sub>:GO ratio 2:1).



**Figure S9.**  $C/C_0$  Plot for CBZ photodegradation of TiGC (TiO<sub>2</sub>:GO ratio 2:1) and related pseudo first-order reaction constant,  $k_1$  ( $\text{min}^{-1}$ ) at different pH 6.5, 7.5 and 8.5. CBZ initial concentration = 1 mg/L, catalyst dose = 0.2 mg/mL.

Name	$q_m(\text{mg/g})$	$K_L(\text{L/mg})$	$R^2$
Control (purified water)	11.19	0.17	0.9913
NOM 10 mg/L	11.23	0.16	0.9969
NOM 20 mg/L	12.41	0.13	0.9915

**Figure S10.** Langmuir adsorption model for carbamazepine adsorption with TiGC (TiO<sub>2</sub>:GO ratio 2:1) under different NOM concentrations.