

SUPPORTING INFORMATION

Influence of Functional Groups on the Degradation of Graphene Oxide Nanomaterials

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Table S1. Decrease in hydrodynamic diameter (d.nm) of GO, rGO-2h, and rGO-5h with irradiation time (n = 3; uncertainties always indicate standard deviation values if not specified)

Sample	Time (hr)	Z-Average (d.nm)
GO	0	712.64 ± 109.88
	3	489.48 ± 99.57
	24	453.34 ± 82.27
	48	389.08 ± 51.97
	168	568.32 ± 44.06
rGO-2h	0	591.36 ± 26.01
	3	507.10 ± 9.42
	24	440.80 ± 4.91
	48	487.47 ± 18.72
	168	554.8 ± 74.71
rGO-5h	0	765 ± 32.86
	3	740.23 ± 135.43
	24	673.43 ± 15.13
	48	624.33 ± 62.25
	168	652.47 ± 56.00

Table S2. Negative zeta potential (mV) values of GO, rGO-2h, and rGO-5h with irradiation time. (n = 3)

Sample	Time (hr)	ZP (mV)
GO	0	-40.10 ± 0.85
	3	-42.62 ± 1.21
	24	-42.50 ± 2.91
	72	-46.42 ± 0.70
rGO-2h	0	-48.87 ± 0.38
	3	-47.23 ± 0.47
	24	-42.40 ± 1.97
	72	-45.70 ± 1.40
rGO-5h	0	-38.90 ± 0.79
	3	-41.27 ± 1.10
	24	-40.03 ± 0.86
	72	-37.93 ± 0.45

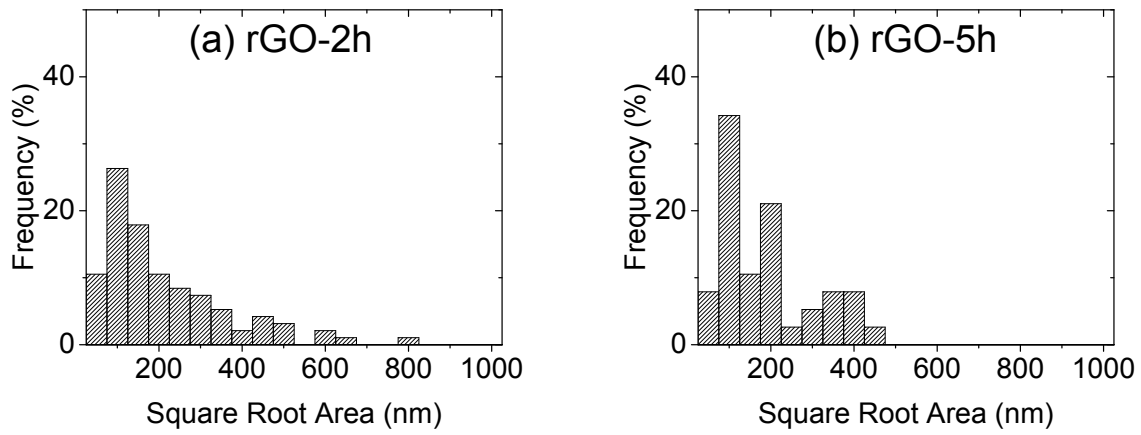


Figure S1. Histograms of lateral sizes of flakes of initial (0 h) (a) rGO-2h and (b) rGO-5h based on AFM imaging.

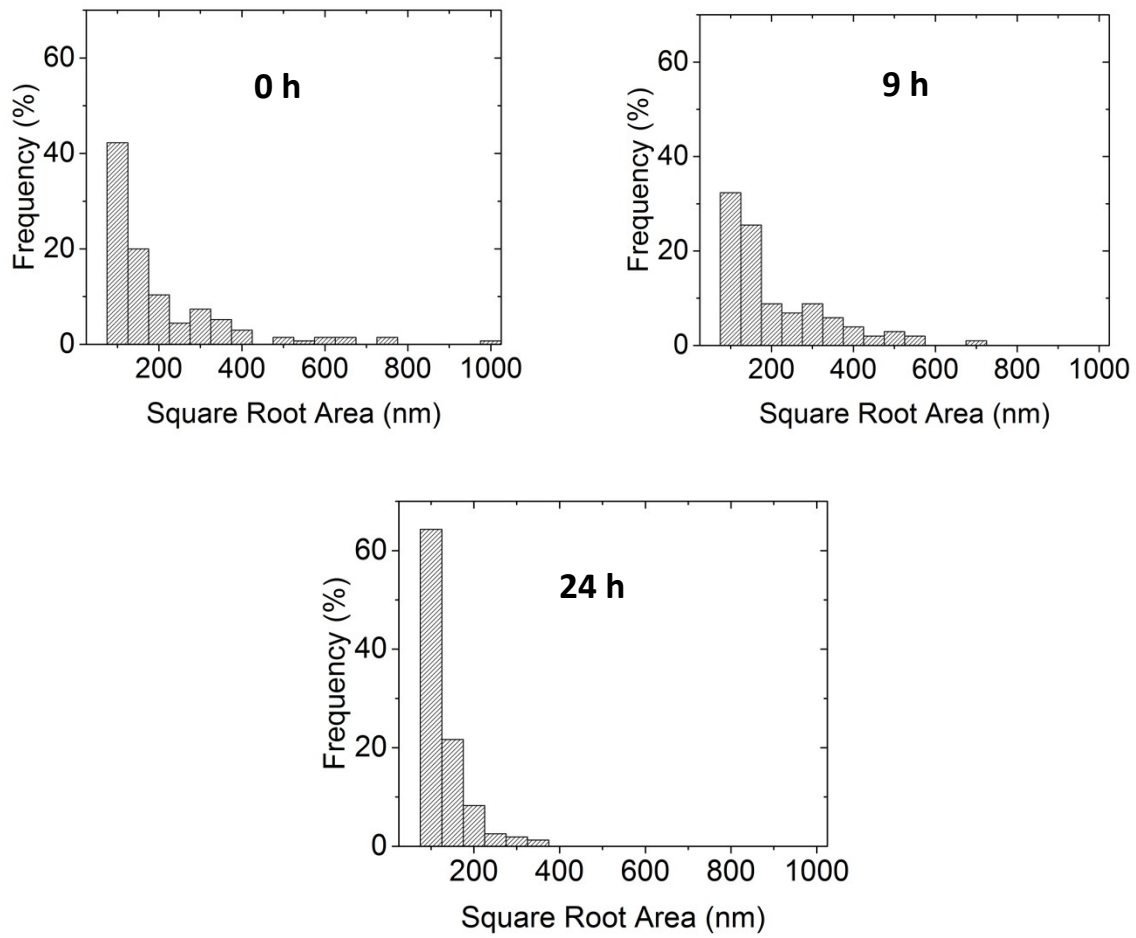


Figure S2. Lateral size histograms of GO showing the decreased average square root area from 0 h to 24 h of irradiation time.

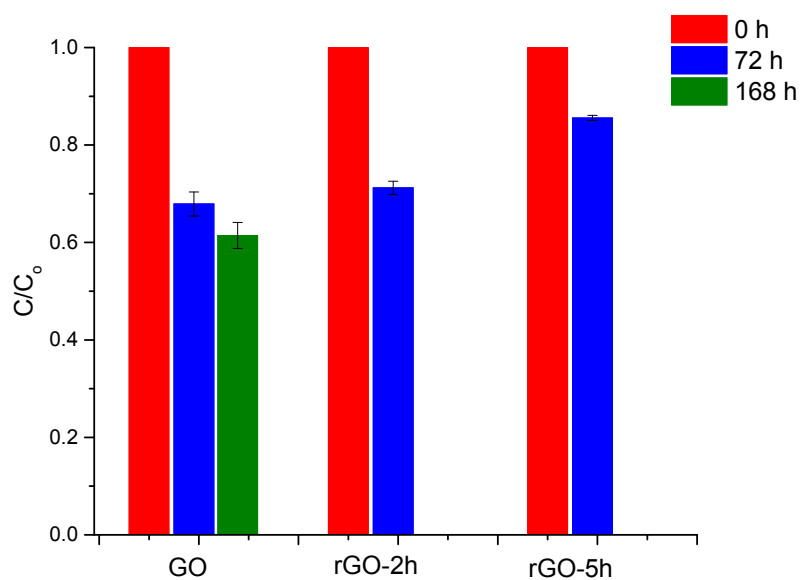


Figure S3. Total organic carbon analysis of GO, rGO-2h, and rGO-5h samples in direct photolysis over sunlight exposure time. (Error bars indicate one standard deviation of at least three samples)

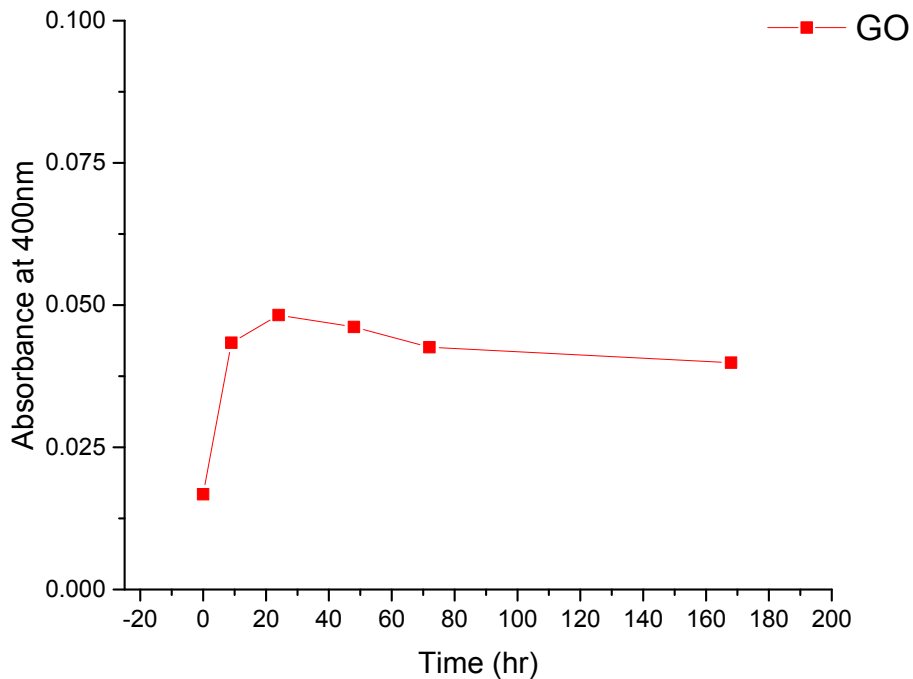


Figure S4. UV-visible absorbance value at 400 nm wavelength of irradiated GO samples. At 400 nm, the UV-Vis absorbance value is increasing significantly for GO with irradiation time, indicating photochemical change of the material likely caused by the formation of light-absorbing photoproducts.

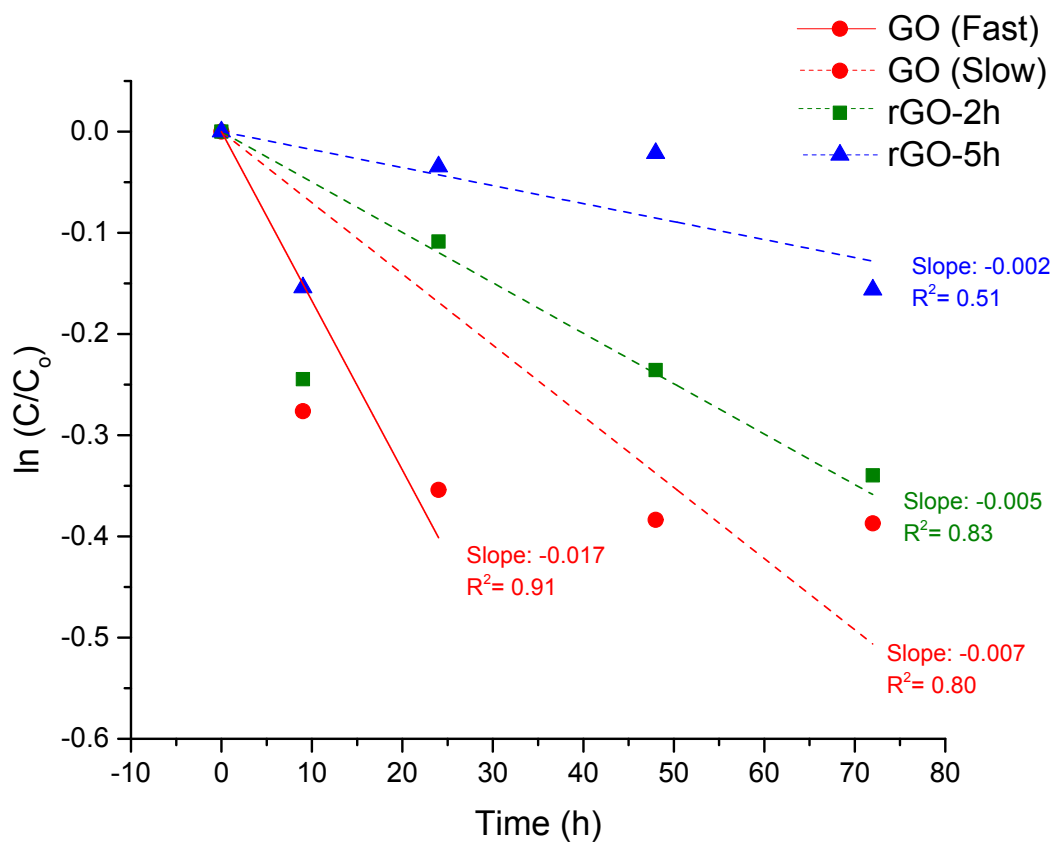


Figure S5. Pseudo-first-order of kinetics of TOC change of different GO materials. As the slope is becoming flat, the reaction rate is decreasing from GO to rGO-5h.

1.1 Control study

Separate irradiation studies were conducted on GO, rGO-2h, and rGO-5h solutions where the samples were wrapped with aluminum foil. These studies were performed to determine whether any of the observed changes occurred in the absence of sunlight. These control samples did not show prominent changes in color (Figure S6) or in absorbance values for GO (Figure S7a). However, the decrease in absorbance values for rGO (Figure S7b, S7c) is suggesting that agglomeration and settling likely occurred after 168 h.

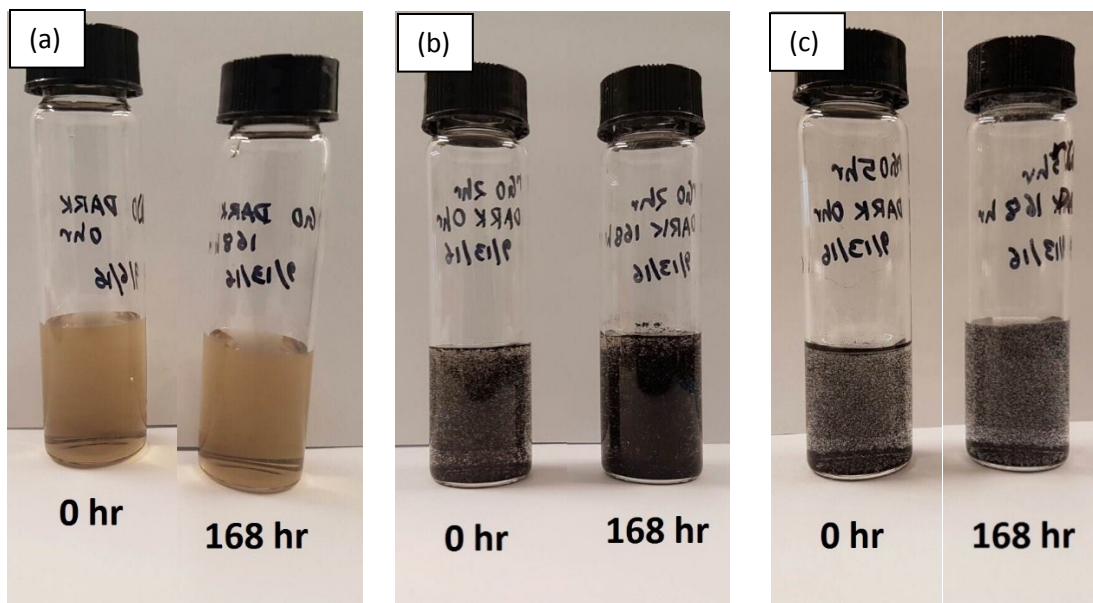


Figure S6. Photographs of the (a) GO, (b) rGO-2h, and (c) rGO-5h samples in the absence of sunlight exposure. In all the cases, the samples after 168 h show no prominent color change compared to the 0 h sample.

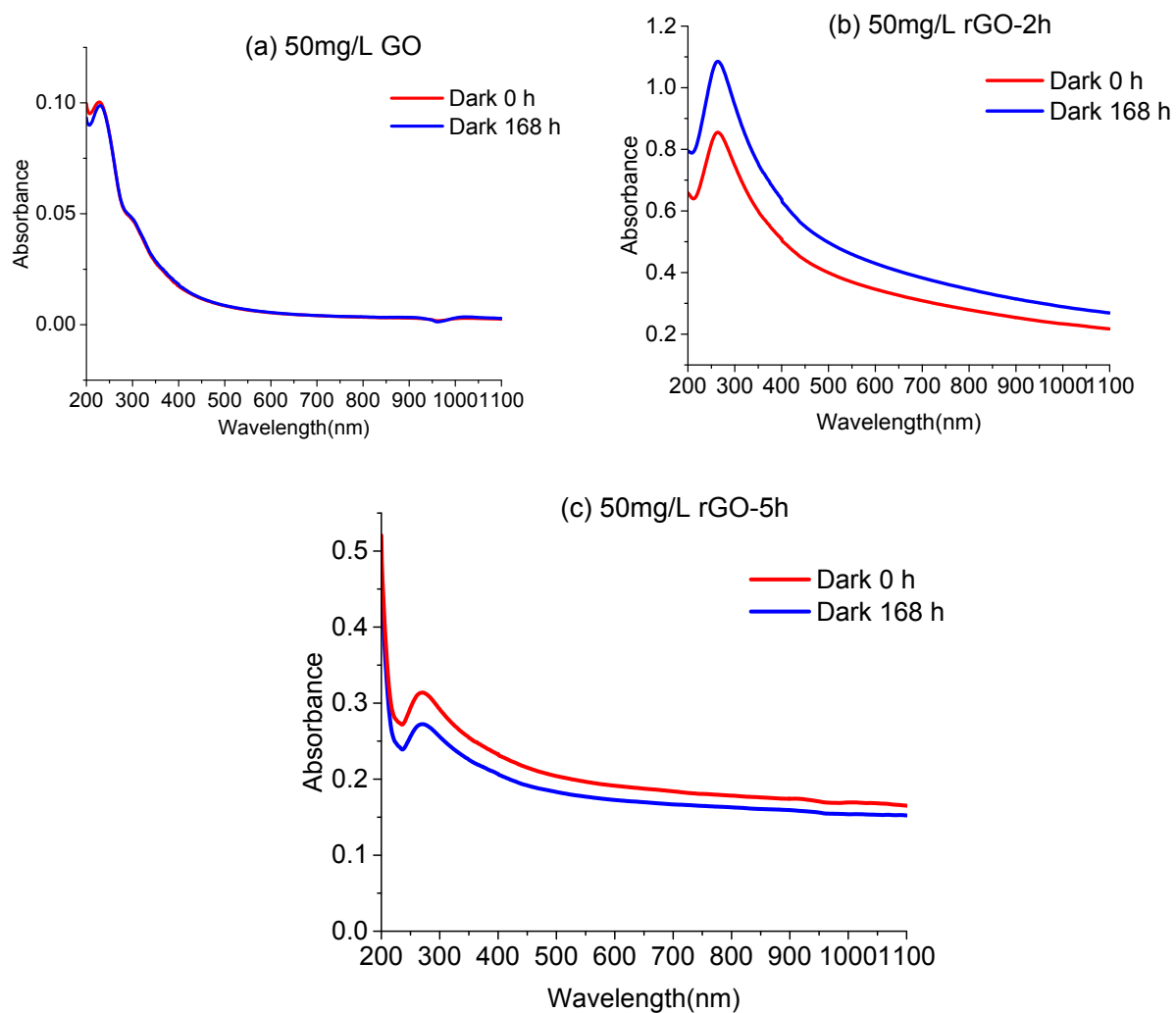


Figure S7. UV-visible absorbance spectra of (a) GO, (b) rGO-2h, and (c) rGO-5h samples in the absence of sunlight. The GO samples after 168 h show no significant change compared to the 0 h sample. Changes in absorbance values for rGO implies agglomeration and settling after 168 h.