Design and properties of Titanium Dioxide/Graphene Oxide composites exploitable in wastewater treatments

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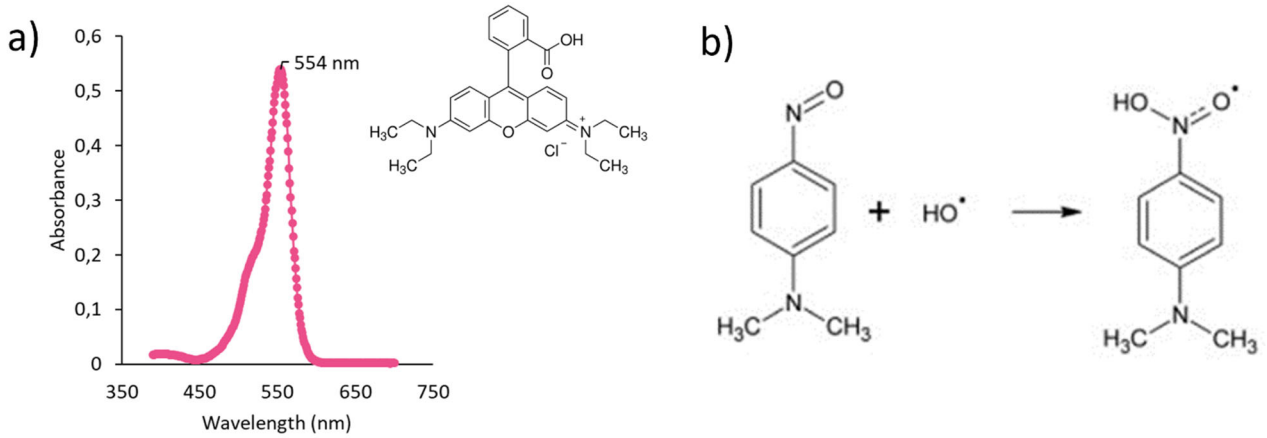


Figure S1. a) Rhodamine B absorbance spectra and molecular strcucture; b) oxidation reaction scheme of RNO.

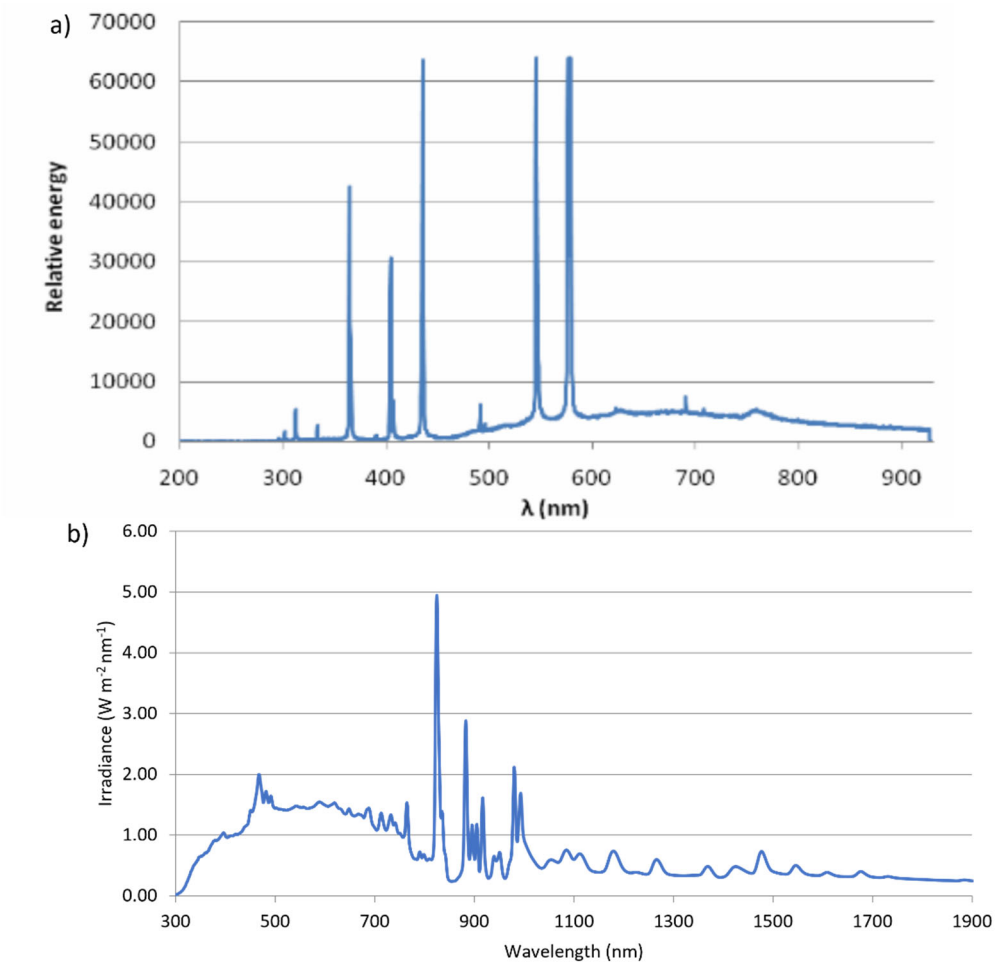
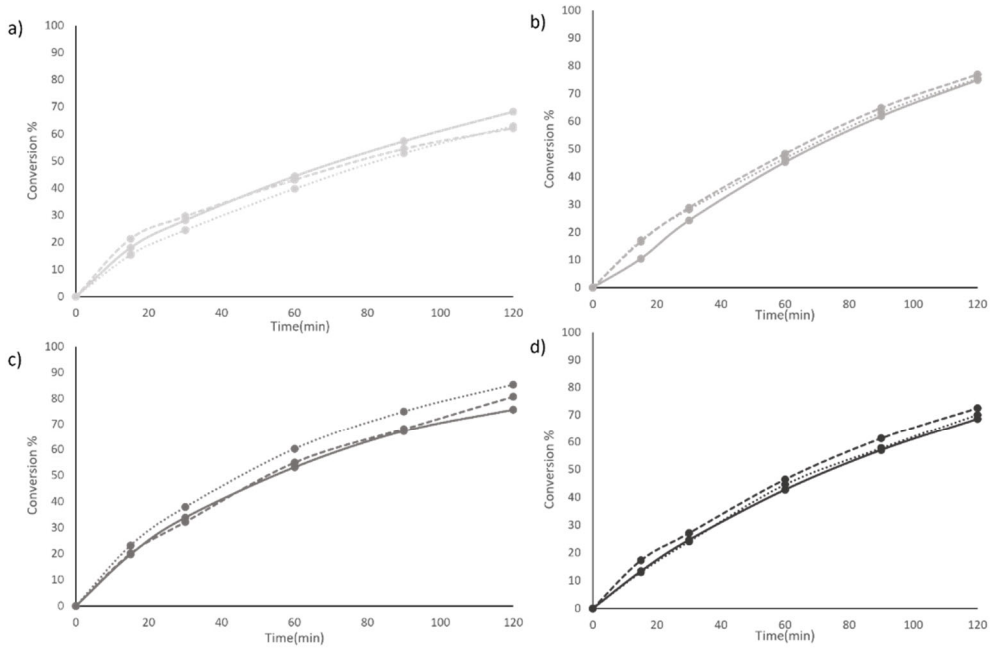
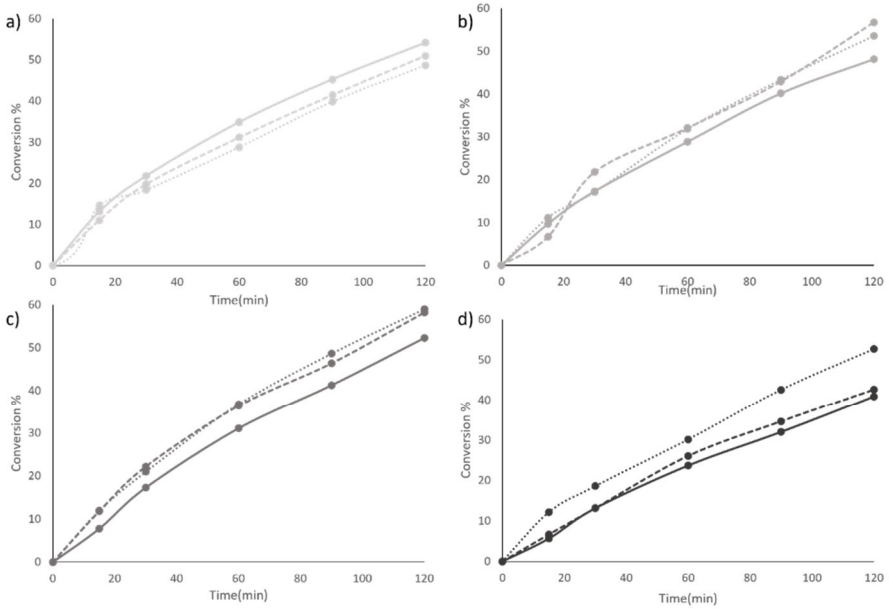


Figure S2. Emission spectrum of a) UV lamp and b) solar simulator.



time (min)	Standard deviation			
	TiO_2 DT-51	TGO_9	TGO_16	TGO_25
0	0.0	0.0	0.0	0.0
15	3.0	3.7	1.9	2.4
30	2.6	2.5	2.9	1.6
60	2.4	1.5	3.7	1.9
90	2.2	1.5	4.2	2.3
120	3.3	1.0	4.9	2.0

Figure S3. Photocatalytic degradation of RhB, under UV light, using as catalyst a) TiO_2 DT-51; b) TGO_9%; c) TGO_16% and d) TGO_25% and corresponding standard deviation.



time (min)	Standard deviation			
	TiO_2 DT-51	TGO_9	TGO_16	TGO_25
0	0.0	0.0	0.0	0.0
15	1.8	2.3	2.4	3.5
30	1.7	2.6	2.6	3.2
60	3.1	1.8	3.2	3.3
90	2.8	1.7	3.8	5.5
120	2.8	4.3	3.7	6.4

Figure S4. Photocatalytic degradation of RhB, under solar light, using as catalyst a) TiO_2 DT-51; b) TGO_9%; c) TGO_16% and d) TGO_25% and corresponding standard deviation.

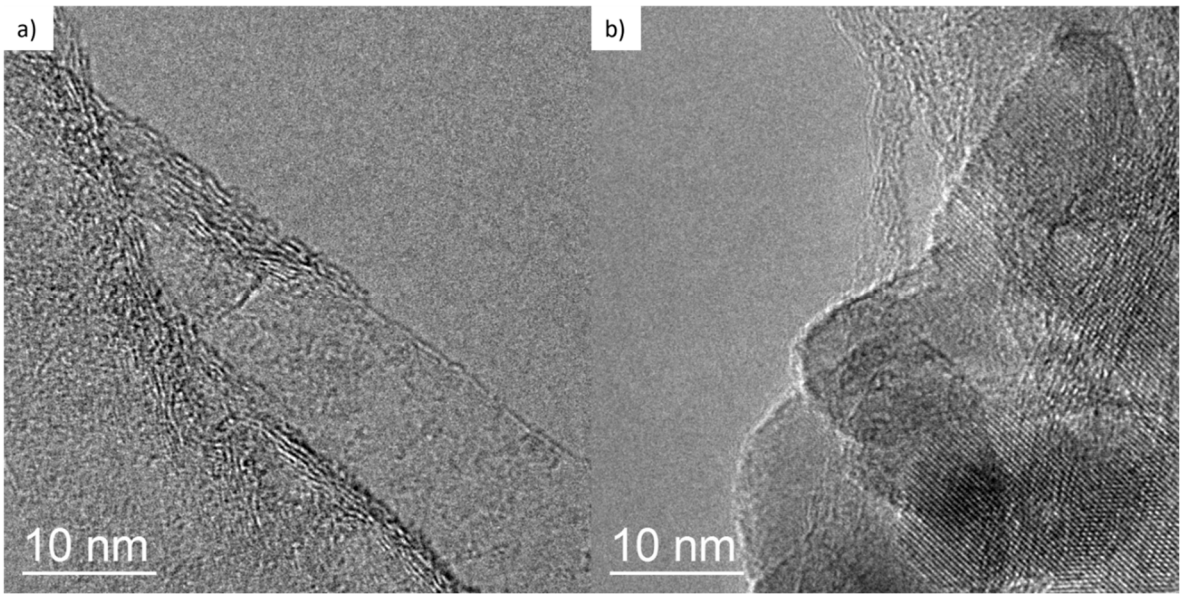


Figure S5. HRTEM images of a) GO and b) TGO_16% sample.

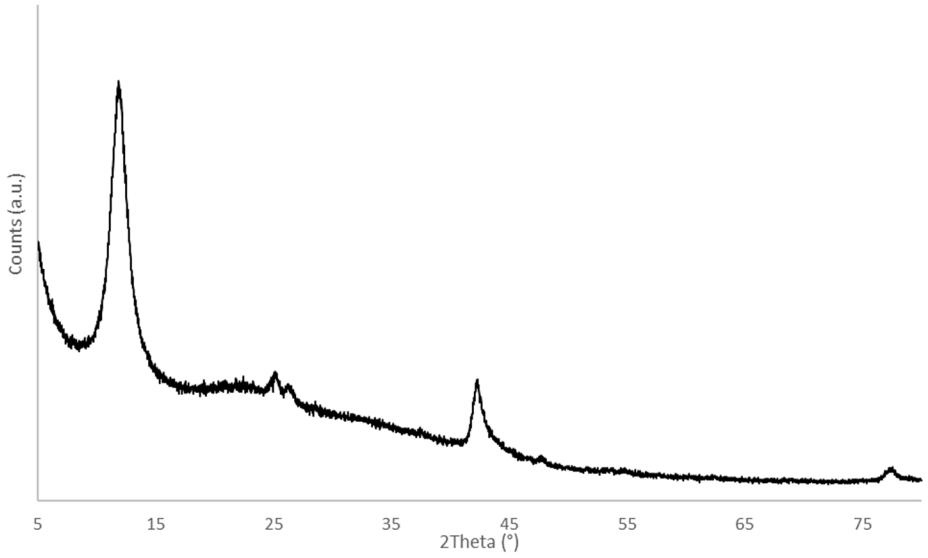


Figure S6. XRD patterns for GO.

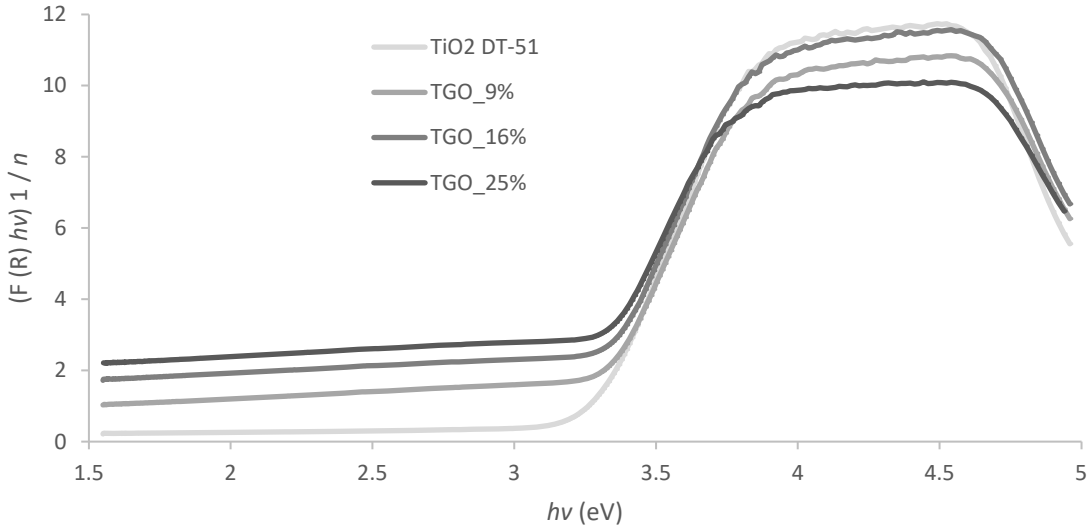


Figure S7. Tauc's curve for TiO_2 DT-51 and TGO composites.

Table S1. Specific surface area of TiO_2, GO and TGO composites.

Sample	s.s.a. (m^2/g)
TiO_2 DT51	91
GO	23
TGO_9%	121
TGO_16%	76
TGO_25%	69

Table S2. Results of Cu^{2+} adsorption (% Cu^{2+} adsorbed with relative standard deviation) tests

Sample	Time (min)					
	1	5	15	45	60	1440 (24h)
TiO_2 DT-51	5 ± 2.6	32 ± 1.1	18 ± 0.8	34 ± 0.8	36 ± 2.1	22 ± 0.4
GO	69 ± 0.3	81 ± 1.4	85 ± 0.6	79 ± 0.2	97 ± 0.9	85 ± 1.3
TGO_9%	25 ± 1.0	12 ± 3.0	17 ± 0.8	22 ± 4.8	28 ± 1.1	25 ± 2.3
TGO_16%	26 ± 4.1	37 ± 7.3	43 ± 4.5	52 ± 5.5	51 ± 1.0	42 ±8.3
TGO_25%	19 ± 3.3	32 ± 2.9	39 ± 1.7	37 ± 7.3	36 ± 1.8	33 ± 2.3

Table S3. Summary of photocatalytic (RhB conversion %, after 120 min and moles RNO consumed/mg of phase dispersed, after 1 h) and adsorption (% Cu^{2+} adsorbed, after 60 min) results.

Sample	RhB conversion %		moles RNO consumed/mg of phase dispersed	Adsorption % Cu^{2+} adsorbed
	Under UV light	Under solar light		
TiO_2 DT-51	64 ± 3.3	51 ± 2.8	4.3E-07 ± 4.09E-10	36 ± 2.1
GO	nd*	nd*	1.22E-07 ± 7.90E-09	97 ± 0.9
TGO_9%	76 ± 1.0	53 ± 4.3	3.67E-07 ± 1.08E-9	28 ± 1.1
TGO_16%	80 ± 4.9	56 ± 3.7	6.20E-07 ± 1.78E-09	51 ± 1.0
TGO_25%	70 ± 2.0	45 ± 6.4	4.19E-07 ± 2.49E-09	36 ± 1.8

* *not determined*

Table S4. The adsorption capacity in this study compared with previous studies.

Sample	Dye or metal	Adsorption capacity	Reference
TGO - 25%	MB	20.25mg/g	[50]
TiO_2/GO nanocomposite	Cd^{2+} Pb^{2+}	69,36% 89%	[51]
GO, TiO_2 and $MgFe_2O_4$ nanocomposite	MB	99%	[52]
GO/TiO_2 nanocomposite	RhB Cd^{2+} Zn^{2+}	11.299 mg/g 14.326 mg/g 11.326 mg/g	[53]
GO/$ZnTiO_3$/TiO_2	MB	78 mg/g	[54]
TiO_2-GO aerogel	Cu^{2+}	39.8 mg/g	[55]
TGO_16%	Cu^{2+}	52%	Present study

The hypothetical RhB photodegradation mechanism is shown below

$TiO_2 + hv \rightarrow TiO_2 (e^-) + TiO_2 (h^+)$

$GO + e^- \rightarrow GO(e^-)$

$h^+ + OH^- \rightarrow {}^\bullet OH$

$h^+ + H_2O \rightarrow {}^\bullet OH + H^+$

$e^- + O_2 \rightarrow {}^\bullet O_2^-$

TGO ($^\bullet OH$ or $^\bullet O_2^-$) + RhB $\rightarrow CO_2 + H_2O$