APPENDIX A: METHYLENE BLUE AND FORMALDEHYDE ANALYSIS

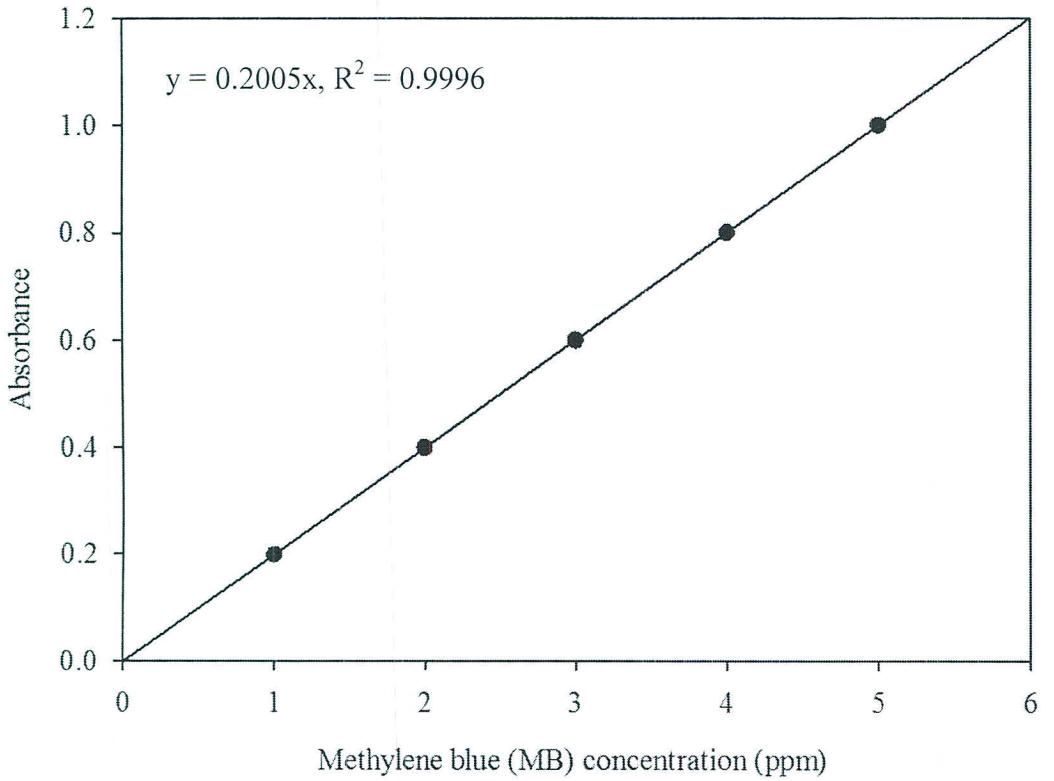

Figure A.1 Calibration curve of methylene blue (MB).

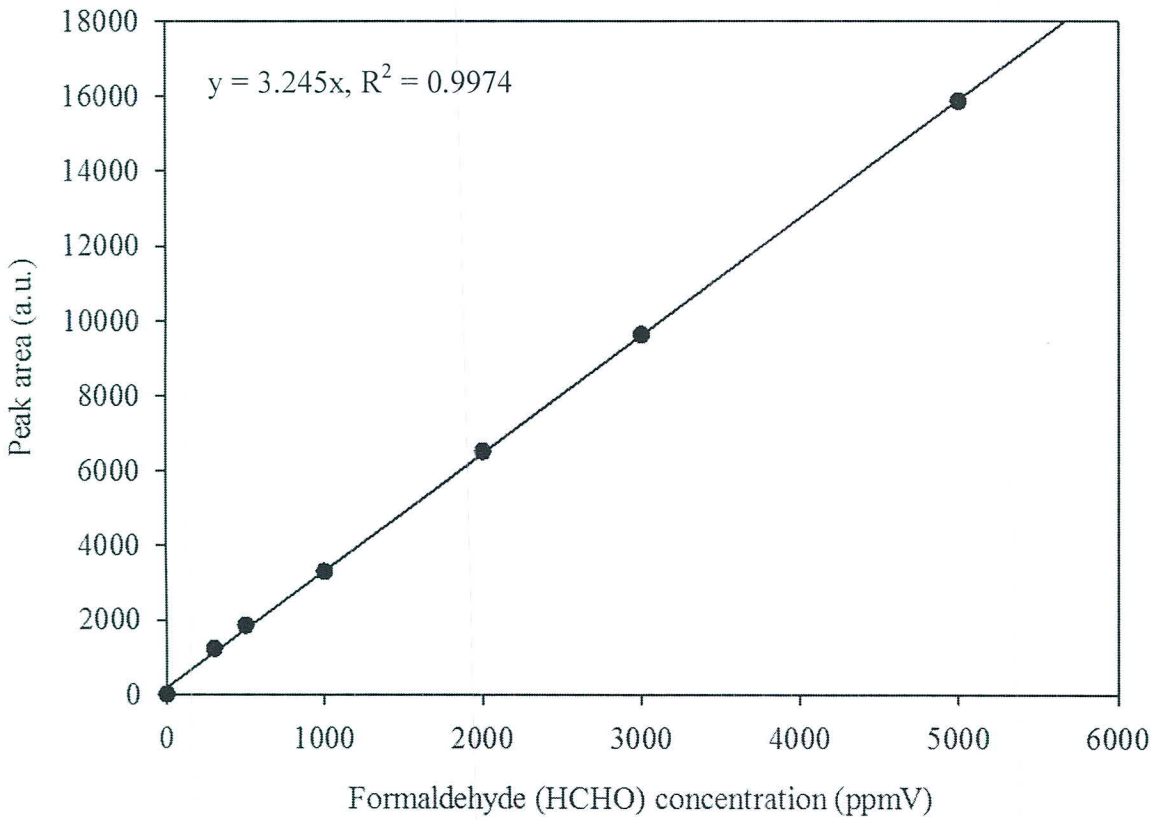

Figure A.2 Calibration curve of formaldehyde (HCHO).

Table A. 1 Analysis condition of gas chromatograph flame ionization detector (Shimadzu, GC–FID 2014).

GC–FID 2014	Analysis condition
Injection port	Temperature = 150 °C, Pressure = 30.1 kPa, Total flow = 20.0 ml min^{-1}, Column flow = 0.50 ml min^{-1}, Linear velocity = 12.8 cm sec^{-1} and Purge flow = 3.0 ml min^{-1}
Oven	DB–WAX column, maximum temperature = 250 °C, Length = 30.0 m Inner diameter = 0.32 mm, Film thickness = 0.50 μm Temperature = 150 °C and Equilibration time = 5.0 min
FID detector	Temperature = 180 °C

APPENDIX B: EXPERIMENTAL DATA OF TiO_2 AND GR–TiO_2 (PTA) PHOTOCATALYSTS (CHAPTER 4)

Table B.1 Concentration profile of MB solution in the presence of TiO_2 (PTA) and P25 under UV and visible light irradiation.

Time (min)	UV				Visible light			
	TiO_2 (PTA)		P25		TiO_2 (PTA)		P25	
	ppm	SD	ppm	SD	ppm	SD	ppm	SD
0	4.50	0.000	4.50	0.000	4.50	0.000	4.50	0.000
60	3.67	0.001	4.10	0.001	3.68	0.001	4.19	0.000
120	3.67	0.001	4.09	0.004	3.68	0.001	4.18	0.004
180	3.67	0.000	4.10	0.004	3.69	0.001	4.18	0.004
195*	3.27	0.000	3.66	0.001	3.62	0.001	4.12	0.000
210*	2.99	0.002	3.19	0.002	3.46	0.013	4.00	0.002
225*	2.74	0.001	2.90	0.001	3.37	0.008	3.99	0.001
240*	2.48	0.004	2.80	0.004	3.30	0.008	3.92	0.005
270*	2.33	0.000	2.68	0.000	3.26	0.007	3.74	0.000
330*	2.21	0.003	2.58	0.005	3.20	0.010	3.70	0.003

* Concentration of MB solution was measured under UV and visible light irradiation.

Table B.2 Degradation efficiency (%) of MB solution in the presence of TiO_2 (PTA) and P25 under UV and visible light irradiation.

Time (min)	UV				Visible light			
	TiO_2 (PTA)		P25		TiO_2 (PTA)		P25	
	%	SD	%	SD	%	SD	%	SD
0	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000
15	10.90	0.004	10.65	0.012	1.60	0.001	1.50	0.004
30	18.62	0.012	22.13	0.046	6.00	0.013	3.60	0.012
45	25.50	0.007	29.17	0.029	8.22	0.008	4.60	0.007
60	32.48	0.008	31.67	0.000	10.24	0.008	6.36	0.008
90	36.55	0.017	34.62	0.004	11.35	0.007	10.62	0.017
150	39.62	0.001	37.00	0.013	13.01	0.010	11.53	0.001

Table B.3 Concentration profile of MB solution in the presence of TiO_2 (PTA) and GR–TiO_2 (PTA) at different weight ratios of graphene under UV irradiation.

Time (min)	TiO_2 (PTA)		GR–TiO_2 (1:100)		GR–TiO_2 (1:50)		GR–TiO_2 (1:20)		GR–TiO_2 (1:10)	
	ppm	SD	ppm	SD	ppm	SD	ppm	SD	ppm	SD
0	4.50	0.000	4.50	0.000	4.50	0.000	4.50	0.000	4.50	0.000
60	3.67	0.001	3.22	0.010	3.13	0.008	2.81	0.000	2.39	0.000
120	3.67	0.001	3.22	0.010	3.13	0.008	2.81	0.000	2.39	0.000
180	3.67	0.000	3.22	0.010	3.13	0.008	2.79	0.001	2.39	0.000
195*	3.27	0.000	2.67	0.000	2.82	0.005	2.58	0.005	2.21	0.003
210*	2.99	0.002	2.35	0.001	2.44	0.005	2.37	0.005	2.05	0.001
225*	2.74	0.001	2.10	0.000	2.27	0.000	2.19	0.001	1.90	0.006
240*	2.48	0.004	1.93	0.001	2.12	0.000	2.05	0.005	1.78	0.006
270*	2.33	0.000	1.80	0.000	2.00	0.000	1.92	0.003	1.62	0.006
330*	2.21	0.003	1.76	0.000	1.79	0.003	1.71	0.010	1.48	0.005

* Concentration of MB solution was measured under UV irradiation.

Table B.4 Degradation efficiency (%) of MB solution over TiO_2 (PTA) and GR–TiO_2 (PTA) at different weight ratios of graphene under UV irradiation.

Time (min)	TiO_2 (PTA)		GR–TiO_2 (1:100)		GR–TiO_2 (1:50)		GR–TiO_2 (1:20)		GR–TiO_2 (1:10)	
	%	SD	%	SD	%	SD	%	SD	%	SD
0	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000
15	10.90	0.004	8.55	0.009	10.53	0.008	7.82	0.007	7.72	0.006
30	18.62	0.012	19.47	0.010	23.77	0.014	15.70	0.014	15.05	0.014
45	25.50	0.007	27.97	0.005	29.75	0.011	22.29	0.018	21.49	0.013
60	32.48	0.008	33.81	0.010	35.01	0.003	27.82	0.004	27.07	0.013
90	36.55	0.017	38.49	0.021	39.18	0.013	32.55	0.007	34.13	0.001
150	39.62	0.001	39.65	0.027	46.33	0.018	42.56	0.003	40.46	0.009

Table B.5 Concentration profile of MB solution in the presence of TiO_2 (PTA) and GR–TiO_2 (PTA) at different weight ratios of graphene under visible light irradiation.

Time (min)	TiO_2 (PTA)		GR–TiO_2 (1:100)		GR–TiO_2 (1:50)		GR–TiO_2 (1:20)		GR–TiO_2 (1:10)	
	ppm	SD	ppm	SD	ppm	SD	ppm	SD	ppm	SD
0	4.50	0.000	4.50	0.000	4.50	0.000	4.50	0.000	4.50	0.000
60	3.68	0.001	3.49	0.046	3.35	0.035	2.94	0.042	2.51	0.039
120	3.68	0.001	3.49	0.046	3.35	0.035	2.91	0.051	2.51	0.039
180	3.69	0.001	3.49	0.046	3.35	0.035	2.91	0.051	2.51	0.039
195*	3.62	0.001	3.39	0.005	3.26	0.001	2.82	0.009	2.39	0.022
210*	3.46	0.013	3.26	0.013	3.20	0.001	2.76	0.010	2.34	0.013
225*	3.37	0.008	3.18	0.013	3.10	0.000	2.69	0.005	2.31	0.010
240*	3.30	0.008	3.11	0.013	2.98	0.001	2.59	0.010	2.67	0.001
270*	3.26	0.007	3.07	0.002	2.82	0.001	2.49	0.021	2.19	0.006
330*	3.20	0.010	3.01	0.001	2.69	0.009	2.39	0.027	2.09	0.024

* Concentration of MB solution was measured under visible light irradiation.

Table B.6 Degradation efficiency (%) of MB solution over TiO_2 (PTA) and GR–TiO_2 (PTA) at different weight ratios of graphene under visible light irradiation.

Time (min)	TiO_2 (PTA)		GR–TiO_2 (1:100)		GR–TiO_2 (1:50)		GR–TiO_2 (1:20)		GR–TiO_2 (1:10)	
	%	SD	%	SD	%	SD	%	SD	%	SD
0	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000
15	1.60	0.001	2.83	0.006	2.84	0.000	3.14	0.009	4.82	0.022
30	6.00	0.013	6.61	0.014	4.67	0.000	5.09	0.010	6.97	0.013
45	8.22	0.008	9.05	0.013	7.63	0.000	7.62	0.005	8.21	0.010
60	10.24	0.008	10.93	0.013	11.04	0.001	10.89	0.010	9.91	0.000
90	11.35	0.007	11.98	0.001	15.75	0.001	14.52	0.021	13.09	0.006
150	13.01	0.010	13.93	0.009	19.83	0.009	17.83	0.027	16.80	0.024

Table B.7 Distribution diameter of GR–TiO_2 (PTA) nanoparticles.

Crystal size (nm)	Frequency
12.15–13.89	2
13.89–15.64	1
15.64–17.40	5
17.40–19.13	2
19.13–20.88	3
20.88–22.62	10
22.62–24.37	7
24.37–26.12	5

Table B.8 Distribution length of GR–TiO_2 (PTA) nanoparticles.

Crystal size (nm)	Frequency
47.74–59.54	1
59.54–71.34	1
71.34–83.14	3
83.14–94.95	12
94.95–106.75	6
106.75–118.55	5
118.55–130.35	4
130.35–142.15	3

APPENDIX C: EXPERIMENTAL DATA OF GR/Fe^{3+}–TiO_2 PHOTOCATALYSTS (CHAPTER 5)

Table C.1 Degradation efficiency (%) of formaldehyde over TiO_2, GR–TiO_2 and GR/Fe^{3+}–TiO_2 at different weight ratios of Fe^{3+} under UV irradiation.

Time (min)	TiO_2		GR–TiO_2		GR/Fe^{3+}–TiO_2					
					0.06 wt% Fe^{3+}		0.12 wt% Fe^{3+}		0.18 wt% Fe^{3+}	
	%	SD	%	SD	%	SD	%	SD	%	SD
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	3.00	0.62	8.36	0.43	10.28	0.46	17.22	0.20	8.81	0.96
30	6.55	1.24	16.39	0.60	17.40	0.51	27.96	0.18	18.87	0.37
45	11.41	0.35	23.24	0.74	21.86	0.74	34.61	0.10	23.38	0.17
75	21.05	0.31	25.56	0.83	28.37	0.83	44.30	0.18	30.17	0.37
90	21.50	0.53	26.76	0.78	32.01	0.78	50.31	0.18	32.76	0.28

Table C.2 Degradation efficiency (%) of formaldehyde over TiO_2, GR–TiO_2 and GR/Fe^{3+}–TiO_2 at different weight ratios of Fe^{3+} under visible light irradiation.

Time (min)	TiO_2		GR–TiO_2		GR/Fe^{3+}–TiO_2					
					0.06 wt% Fe^{3+}		0.12 wt% Fe^{3+}		0.18 wt% Fe^{3+}	
	%	SD	%	SD	%	SD	%	SD	%	SD
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	2.79	0.35	6.79	0.98	3.92	0.20	10.79	1.20	7.72	0.12
30	7.63	0.28	10.83	0.42	4.34	0.27	16.76	1.63	7.85	0.26
45	8.30	0.17	10.79	0.07	11.86	0.46	25.63	0.24	13.88	0.28
75	11.93	0.35	11.39	1.12	10.93	0.25	26.17	0.35	15.98	0.30
90	12.52	0.35	12.56	0.35	14.87	0.24	24.95	0.24	15.57	1.29

Table C.3 Degradation efficiency (%) of formaldehyde over Fe^{3+}–TiO_2 (0.12 wt% Fe^{3+}) under UV and visible light irradiation.

Time (min)	Fe^{3+}–TiO_2 (0.12 wt% Fe^{3+})			
	UV irradiation		Visible light irradiation	
	%	SD	%	SD
0	0.00	0.00	0.00	0.00
15	6.50	0.33	5.05	0.06
30	10.20	0.40	9.06	0.14
45	20.67	0.42	13.43	0.21
75	26.34	0.41	14.85	0.43
90	26.25	0.74	16.06	0.52

Table C.4 Repeatability of GR/Fe^{3+}–TiO_2 (0.12 wt% Fe^{3+}) film over five cycles under UV and visible light irradiation.

Cycle time	Repeatability	
	% (UV irradiation)	% (visible light irradiation)
1	57.42	25.50
2	54.15	24.37
3	50.31	27.55
4	52.80	26.44
Average	53.67	25.96
SD	2.57	1.17

APPENDIX D: EXPERIMENTAL DATA OF GR/Ag_2S–TiO_2 PHOTOCATALYSTS (CHAPTER 6)

Table D.1 Degradation efficiency (%) of formaldehyde over TiO_2, GR–TiO_2 and GR/Ag_2S –TiO_2 photocatalyst under UV irradiation.

Time (min)	TiO_2		GR–TiO_2		GR/Ag_2S –TiO_2					
					2.9 wt% Ag_2S		5.6 wt% Ag_2S		8.2 wt% Ag_2S	
	%	SD	%	SD	%	S D	%	SD	%	SD
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	3.13	0.18	5.96	0.34	6.48	0.00	2.95	0.00	8.60	0.00
30	6.53	0.40	11.75	0.66	18.20	0.02	19.11	0.10	14.34	0.06
60	16.40	0.35	21.32	0.13	20.50	0.10	22.11	0.10	19.28	0.06
90	19.84	0.58	23.28	0.46	24.00	0.03	27.27	0.05	26.28	0.07

Table D.2 Degradation efficiency (%) of formaldehyde over TiO_2, GR–TiO_2 and GR/Ag_2S –TiO_2 photocatalyst under visible light irradiation.

Time (min)	TiO_2		GR–TiO_2		GR/Ag_2S –TiO_2					
					2.9 wt% Ag_2S		5.6 wt% Ag_2S		8.2 wt% Ag_2S	
	%	SD	%	SD	%	SD	%	SD	%	SD
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	1.77	0.14	3.96	0.40	1.09	0.22	1.17	0.12	0.97	0.10
30	4.57	0.43	6.55	0.60	5.32	0.10	6.14	0.50	5.21	0.08
60	9.12	0.39	12.43	0.15	11.20	0.07	10.93	0.50	12.42	0.08
90	10.16	0.33	12.49	0.10	15.88	0.10	15.20	0.70	13.59	0.05

Table D.3 Degradation efficiency (%) of formaldehyde over Ag_2S sensitizer and Ag_2S –TiO_2 (5.6 wt% Ag_2S) under UV and visible light irradiation.

Time (min)	UV irradiation				Visible light irradiation			
	Ag_2S		Ag_2S –TiO_2 (5.6 wt% Ag_2S)		Ag_2S		Ag_2S –TiO_2 (5.6 wt% Ag_2S)	
	%	SD	%	SD	%	SD	%	SD
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	3.09	0.43	6.06	0.06	1.07	0.34	1.07	0.29
30	5.27	0.68	17.26	0.06	3.64	0.70	4.66	0.17
60	7.74	0.35	20.05	0.78	5.64	0.10	11.94	0.30
90	7.67	0.50	22.08	0.24	6.00	0.90	14.74	0.24

APPENDIX E: EXPERIMENTAL DATA FOR THE STUDY OF THE EFFECTS OF ENVIRONMENTAL PARAMETERS OF GR/Fe^{3+}–TiO_2 PHOTOCATALYST FOR FORMALDEHYDE REMOVAL (CHAPTER 7)

Table E.1 Effect of initial concentration of formaldehyde (HCHO) on GR/Fe^{3+}–TiO_2 photocatalytic activity (degradation efficiency (%)).

Irradiation time (min)	750 ppmV	1500 ppmV	2000 ppmV
	%	%	%
0	0.00	0.00	0.00
15	1.00	2.62	3.93
30	2.00	6.28	7.18
60	3.70	9.94	8.78
90	5.56	13.32	13.89
120	8.35	17.74	22.86

* Relative humidity (%RH) and visible light intensity was fixed at 30 %RH and 0.23–0.25 W m^{-2}, respectively.

Table E.2 Effect of relative humidity (%RH) on GR/Fe^{3+}–TiO_2 photocatalytic activity (degradation efficiency (%)).

Irradiation time (min)	30 %RH	60 %RH	80 %RH
	%	%	%
0	0.00	0.00	0.00
15	2.47	5.71	1.87
30	5.93	8.48	2.55
60	9.88	11.21	3.30
90	12.58	12.00	4.00
120	16.76	14.12	3.81

* Initial concentration of HCHO and visible light intensity was fixed at 1500 ppmV and 0.23–0.25 W m^{-2}, respectively.

Table E.3 Effect of visible light intensity on GR/Fe^{3+}–TiO_2 photocatalytic activity (degradation efficiency (%)).

Irradiation time (min)	0.23–0.25 W m^{-2}	0.60–0.62 W m^{-2}	1.24–1.27 W m^{-2}
	%	%	%
0	0.00	0.00	0.00
15	2.62	4.80	6.88
30	6.28	8.63	15.40
60	9.94	14.43	23.85
90	13.32	19.90	26.42
120	17.74	25.50	31.80

* Initial concentration of HCHO and relative humidity (%RH) was fixed at 1500 ppmV and 30 %RH, respectively.

Table E.4 Experimental data of GR/Fe^{3+}–TiO_2 for formaldehyde removal under outdoor sunshade irradiation.

Experimental Date		Monday 8 July 2013 (Experiment 1)			
Time (min)	Temperature (°C)	Relative humidity (%RH)	Visible light intensity ($W\ m^{-2}$)	UV intensity ($\mu W\ cm^{-2}$)	Formaldehyde (C_1/C_0)
0	28.00	45.00	0.00	0.00	1.00
15	28.00	45.00	0.00	0.00	0.99
30	29.00	45.00	0.00	0.00	0.93
45	28.00	45.00	0.00	0.00	0.90
60	30.00	45.00	1.12	16.00	0.91
75	29.50	42.00	1.12	18.00	0.84
90	29.50	40.00	1.11	16.00	0.83
105	29.50	41.00	1.21	20.00	0.84
120	29.50	40.00	1.49	22.00	0.78
150	30.00	40.00	1.60	29.83	0.75
180	30.50	39.00	1.70	21.00	0.72
210	30.50	39.00	1.11	21.00	0.71
240	30.00	39.00	1.88	25.00	0.65

Table E.5. Experimental data of GR/Fe^{3+}–TiO_2 for formaldehyde removal under outdoor sunshade irradiation.

Experimental Date		Tuesday 9 July 2013 (Experiment 2)			
Time (min)	Temperature (°C)	Relative humidity (%RH)	Visible light intensity ($W\ m^{-2}$)	UV intensity ($\mu W\ cm^{-2}$)	Formaldehyde (C_1/C_0)
0	30.00	43.00	0.00	0.00	1.00
15	30.50	45.00	0.00	0.00	0.85
30	30.50	46.00	0.00	0.00	0.82
45	30.50	46.00	0.00	0.00	0.82
60	31.00	46.00	2.46	31.00	0.82
75	31.00	45.00	2.46	31.00	0.81
90	30.50	45.00	2.41	45.00	0.63
105	30.50	45.00	2.57	45.00	0.60
120	30.50	45.00	2.52	30.50	0.55
150	31.00	43.00	2.56	43.00	0.46
180	31.00	43.00	2.36	31.00	0.33
210	31.00	43.00	2.08	31.00	0.29
240	31.00	43.00	1.65	23.25	0.34

Table E.6 Experimental data of GR/Fe^{3+}–TiO_2 for formaldehyde removal under outdoor sunshade irradiation.

Experimental Date		Wednesday 10 July 2013 (Experiment 3)			
Time (min)	Temperature (°C)	Relative humidity (%RH)	Visible light intensity ($W\ m^{-2}$)	UV intensity ($\mu W\ cm^{-2}$)	Formaldehyde (C_1/C_0)
0	29.50	45.00	0.00	0.00	1.00
15	29.50	46.00	0.00	0.00	0.78
30	29.50	45.00	0.00	0.00	0.90
45	29.50	45.00	0.00	0.00	0.87
60	29.50	45.00	2.32	36.67	0.87
75	30.00	45.00	2.32	36.67	0.86
90	30.00	45.00	2.13	35.00	0.53
105	30.00	45.00	2.37	40.67	0.44
120	30.00	45.00	2.79	45.00	0.44
150	30.00	45.00	2.83	42.00	0.43
180	30.33	45.00	2.97	52.00	0.42
210	30.50	45.00	2.41	36.67	0.43
240	30.50	45.00	2.21	30.00	0.31

Table E.7 Experimental data of GR/Fe^{3+}–TiO_2 for formaldehyde removal under outdoor sunshade irradiation.

Experimental Date		Thursday 11 July 2013 (Experiment 4)			
Time (min)	Temperature (°C)	Relative humidity (%RH)	Visible light intensity ($W\ m^{-2}$)	UV intensity ($\mu W\ cm^{-2}$)	Formaldehyde (C_1/C_0)
0	29.50	46.00	0.00	0.00	1.00
15	29.50	46.00	0.00	0.00	0.88
30	30.00	46.00	0.00	0.00	0.88
45	30.00	46.00	0.00	0.00	0.84
60	30.00	46.00	2.72	28.67	0.84
75	30.00	46.00	2.72	28.67	0.74
90	30.00	46.00	2.39	33.33	0.71
105	30.50	46.00	2.99	34.67	0.69
120	30.50	45.00	2.99	34.67	0.71
150	30.50	44.00	2.53	34.67	0.66
180	30.50	44.00	2.44	37.00	0.47
210	30.50	44.00	2.99	44.33	0.44
240	30.50	44.00	3.04	46.67	0.35

Table E.8 Experimental data of GR/Fe^{3+}–TiO_2 for formaldehyde removal under outdoor sunshade irradiation.

Experimental Date		Friday 12 July 2013 (Experiment 5)			
Time (min)	Temperature (°C)	Relative humidity (%RH)	Visible light intensity ($W\ m^{-2}$)	UV intensity ($\mu W\ cm^{-2}$)	Formaldehyde (C_1/C_0)
0	29.00	45.00	0.00	0.00	1.00
15	29.00	45.00	0.00	0.00	0.99
30	29.00	45.00	0.00	0.00	0.91
45	29.00	45.00	0.00	0.00	0.88
60	29.00	44.00	1.84	15.33	0.88
75	30.00	44.00	1.84	15.33	0.82
90	30.00	44.00	1.55	20.33	0.78
105	30.50	44.00	1.82	23.00	0.72
120	30.50	44.00	1.85	23.00	0.69
150	30.50	44.00	1.82	24.00	0.67
180	31.00	44.00	1.83	24.00	0.65
210	31.00	44.00	1.60	21.20	0.62
240	31.00	44.00	1.80	23.50	0.48

Table E.9 Experimental data of GR/Fe^{3+}–TiO_2 for formaldehyde removal under outdoor sunshade irradiation.

Experimental Date		Saturday 13 July 2013 (Experiment 6)			
Time (min)	Temperature (°C)	Relative humidity (%RH)	Visible light intensity ($W\ m^{-2}$)	UV intensity ($\mu W\ cm^{-2}$)	Formaldehyde (C_1/C_0)
0	33.00	36.00	0.00	0.00	1.00
15	33.00	35.00	0.00	0.00	0.88
30	33.00	35.00	0.00	0.00	0.83
45	33.00	35.00	0.00	0.00	0.83
60	33.00	35.00	3.27	40.67	0.83
75	33.00	34.00	3.27	40.67	0.66
90	33.00	34.00	3.32	43.33	0.52
105	33.00	34.00	3.28	43.67	0.50
120	33.00	34.00	3.53	44.00	0.39
150	33.00	34.00	3.27	44.33	0.33
180	33.00	33.00	3.42	44.33	0.26
210	33.00	33.00	3.90	46.33	0.28
240	33.00	33.00	3.62	48.67	0.17

Table E.10 Experimental data of GR/Fe^{3+}–TiO_2 for formaldehyde removal under outdoor sunshade irradiation.

Experimental Date		Monday 15 July 2013 (Experiment 7)			
Time (min)	Temperature (°C)	Relative humidity (%RH)	Visible light intensity (W m^{-2})	UV intensity (μW cm^{-2})	Formaldehyde (C_1/C_0)
0	30.00	38.00	0.00	0.00	1.00
15	30.00	38.00	0.00	0.00	1.00
30	30.00	38.00	0.00	0.00	0.96
45	30.00	37.00	0.00	0.00	0.87
60	30.00	37.00	2.30	31.00	0.86
75	30.00	36.00	2.30	31.00	0.79
90	30.00	36.00	2.40	38.00	0.55
105	30.00	36.00	2.61	39.00	0.49
120	30.00	36.00	2.43	32.00	0.32
150	30.00	36.00	3.88	44.00	0.32
180	30.00	36.00	2.62	43.00	0.32
210	30.00	36.00	2.64	43.00	0.23
240	30.00	36.00	2.50	39.00	0.22

Table E.11 Experimental data of GR/Fe^{3+}–TiO_2 for formaldehyde removal under outdoor sunshade irradiation.

Experimental Date		Tuesday 16 July 2013 (Experiment 8)			
Time (min)	Temperature (°C)	Relative humidity (%RH)	Visible light intensity ($W\ m^{-2}$)	UV intensity ($\mu W\ cm^{-2}$)	Formaldehyde (C_1/C_0)
0	31.00	35.00	0.00	0.00	1.00
15	31.00	35.00	0.00	0.00	0.91
30	31.00	35.00	0.00	0.00	0.82
45	31.00	35.00	0.00	0.00	0.78
60	31.00	35.00	2.66	30.00	0.79
75	31.00	35.00	2.66	30.00	0.68
90	31.00	35.00	3.03	36.00	0.64
105	31.00	35.00	2.99	38.33	0.55
120	31.50	35.00	3.04	39.00	0.54
150	31.50	35.00	3.27	39.33	0.54
180	31.50	33.00	2.03	36.33	0.36
210	32.50	32.50	3.67	44.67	0.31
240	31.00	33.00	3.01	42.00	0.18

Table E.12 Experimental data of GR/Fe^{3+}–TiO_2 for formaldehyde removal under outdoor sunshade irradiation.

Experimental Date		Wednesday 17 July 2013 (Experiment 9)			
Time (min)	Temperature (°C)	Relative humidity (%RH)	Visible light intensity ($W\ m^{-2}$)	UV intensity ($\mu W\ cm^{-2}$)	Formaldehyde (C_1/C_0)
0	30.00	41.00	0.00	0.00	1.00
15	30.00	41.00	0.00	0.00	0.87
30	30.00	41.00	0.00	0.00	0.78
45	30.50	41.00	0.00	0.00	0.81
60	30.50	41.00	2.56	27.00	0.82
75	30.50	40.00	2.56	27.00	0.73
90	30.50	39.00	2.64	29.33	0.68
105	30.67	39.00	2.98	30.33	0.49
120	31.00	39.00	2.62	27.67	0.42
150	31.00	39.00	2.66	33.33	0.46
180	31.17	39.00	2.75	33.67	0.37
210	32.83	38.67	3.16	37.33	0.36
240	33.00	37.00	2.79	32.67	0.35

Table E.13 Experimental data of GR/Fe^{3+}–TiO_2 for formaldehyde removal under outdoor sunshade irradiation.

Experimental Date		Thursday 18 July 2013 (Experiment 10)			
Time (min)	Temperature (°C)	Relative humidity (%RH)	Visible light intensity ($W\ m^{-2}$)	UV intensity ($\mu W\ cm^{-2}$)	Formaldehyde (C_1/C_0)
0	30.00	41.00	0.00	0.00	1.00
15	30.00	41.00	0.00	0.00	0.97
30	30.00	41.00	0.00	0.00	0.96
45	30.50	41.00	0.00	0.00	0.85
60	30.50	41.00	2.73	20.00	0.84
75	30.50	40.00	2.73	20.00	0.67
90	30.50	39.00	2.68	20.67	0.64
105	31.00	39.00	1.63	15.33	0.56
120	31.00	39.00	1.30	9.33	0.52
150	31.00	39.00	1.34	7.67	0.47
180	31.00	39.00	2.71	26.67	0.47
210	31.50	40.00	1.39	6.33	0.47
240	33.00	37.00	0.82	5.67	0.46

Table E.14 Degradation efficiency (%) of GR/Fe^{3+}–TiO_2 for formaldehyde removal under outdoor sunshade irradiation.

Time (min)	Experiment									
	1	2	3	4	5	6	7	8	9	10
	%	%	%	%	%	%	%	%	%	%
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	7.08	1.75	18.08	12.05	0.92	20.15	0.00	7.01	12.33	9.00
30	8.57	23.78	36.15	14.94	5.58	37.14	30.83	12.06	18.83	12.42
45	7.33	27.38	46.49	18.19	13.29	40.00	38.10	24.68	41.74	23.78
60	13.46	33.46	46.67	14.95	17.36	52.97	59.64	25.45	49.94	29.45
90	16.79	43.85	47.94	21.95	19.39	59.84	59.88	26.22	45.29	35.13
120	20.57	59.71	49.21	44.26	21.43	68.15	60.11	50.32	56.12	35.78
150	21.97	64.80	47.45	48.15	25.76	66.38	71.21	57.16	57.34	35.15
180	28.29	58.39	62.78	58.10	41.63	79.21	72.01	74.80	57.72	36.54