Supporting Information

Cu2(OH)PO4/reduced graphene oxide nanocomposites for enhanced photocatalytic degradation of 2,4-dichlorophenol under infrared light irradiation

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Synthesis of Graphene oxide

Graphene oxide were synthesized from powdered graphite via a modified Hummers method.¹⁻² Typically, powdered graphite (2.0000 g) was added to 38 mL of H₂SO₄ (98 wt%) with stirring for 20 min in an ice-bath. Then KMnO₄ (4.0000 g) was slowly added to the above suspension under vigorous stirring. After another vigorously stirring at 37 °C for 2 h, 12.5 mL of H₂O₂ solution (30 wt%) was added to the above solution, and then the obtained suspension was diluted by adding 195 mL of deionized water under stirring. The resulting dispersion was then transferred into a dialysis membrane to remove the remaining metal species. Finally, the obtained product was diluted into 2.0 mg mL⁻¹ and then sonicated for 1 h to obtain graphene oxide dispersion.



Fig. S1 Transmission spectrum of the 300-W xenon lamp installed an 800-nm cut-off filter.



Fig. S2 AFM image of the as-prepared GO, where the AFM analysis showed that the thickness of the GO

nanosheets was ca. 1.2 nm.



Fig. S3 TEM images of a) GO, b) pure $Cu_2(OH)PO_4$ and c) $Cu_2(OH)PO_4/rGO$ nanocomposites with 1:0.005

rations.



Fig. S4 (a) Raman spectra of GO, rGO, pure $Cu_2(OH)PO_4$ and $Cu_2(OH)PO_4/rGO$ nanocomposites. (b) Enlarged

Raman spectra of $Cu_2(OH)PO_4/rGO$ nanocomposites ranges from 1200 to 1800 cm⁻¹.



Fig. S5 Full-scale XPS spectra of rGO (a), pure $Cu_2(OH)PO_4$ (b), sample 1:0.001 (c), sample 1:0.002 (d), sample

 $1{:}0.01$ (e), sample $1{:}0.02$ (f), sample $1{:}0.05$ (g) and sample $1{:}0.1$ (h).



Fig. S6 EDS spectra of the as-prepared samples of that pure $Cu_2(OH)PO_4$ (a), sample 1:0.001 (b), sample 1:0.002 (c), sample 1:0.005 (d), sample 1:0.01(e), sample 1:0.02 (f), sample 1:0.05 (g) and sample 1:0.1 (h).



Fig. S7 C 1s XPS spectra of rGO (a), pure Cu₂(OH)PO₄ (b), sample 1:0.001 (c), sample 1:0.002 (d), sample 1:0.01 (e), sample 1:0.02 (f), sample 1:0.05 (g) and sample 1:0.1 (h).



Fig. S8 (a) UV-vis-NIR absorption spectra of pure $Cu_2(OH)PO_4$ and $Cu_2(OH)PO_4/rGO$ nanocomposites. Inset: Photographs of pure $Cu_2(OH)PO_4$ and $Cu_2(OH)PO_4/rGO$ nanocomposites. (b) Enlarged UV-Vis-NIR absorption spectrum of pure $Cu_2(OH)PO_4$ ranges from 600 to 1800 nm, where infrared region is fitted with four Gaussian peaks: 1278 (Green), 978 (Blue), 775 (Oyan), and 667 nm (Magenta). c) Enlarged UV-Vis-NIR absorption spectrum of sample 1:0.005 ranges from 600 nm to 1800 nm, where infrared region is fitted with four Gaussian peaks: 1354 (Green), 1058 (Blue), 785 (Oyan), and 672 nm (Magenta). (d) Enlarged UV-Vis-NIR absorption spectrum of sample 1:0.1 ranges from 600 to 1800 nm, where the NIR region was fitted with two Gaussian peaks: 1167 (Blue) and 692 nm (Magenta).



Fig. S9 (a) Enlarged UV-Vis-NIR absorption spectra of sample 1:0.001, where infrared region is fitted with four Gaussian peaks: 1371 (Green), 1031 (Blue), 762 (Oyan), 657 nm (Magenta). (b) Enlarged UV-vis-NIR absorption spectra of sample 1:0.002, where infrared region is fitted with four Gaussian peaks: 1280 (Green), 1004 (Blue), 788 (Oyan), 672 nm (Magenta). (c) Enlarged UV-vis-NIR absorption spectra of sample 1:0.01, where infrared region is fitted with four Gaussian peaks: 1120 (Blue), 778 (Oyan), and 679 nm (Magenta). (d) Enlarged UV-vis-NIR absorption spectra of sample 1:0.02, where infrared region is fitted with four Gaussian peaks: 1115 (Blue) and 740 nm (Magenta). (e) Enlarged UV-vis-NIR absorption spectra of sample 1:0.05, where infrared region is fitted with four Gaussian peaks: 1133 (Blue) and 717 nm (Magenta).



Fig. S10 (a) Photodegradation of 2,4-DCP over pure Cu2(OH)PO4 and Cu₂(OH)PO₄/rGO nanocomposites with 1:0.002, 1:0.02, 1:0.05 and 0.1 ratios with infrared light irradiation at 20-25 °C. (b) Plots of $Ln(C_0/C_t)$ versus time for Cu₂(OH)PO₄/rGO nanocomposites with 1:0.002, 1:0.02, 1:0.05 and 1:0.1 ratios.



Fig. S11 Fluorescence spectra of Cu₂(OH)PO₄, 1:0.001, 1:0.005 and 1:0.1.



Fig. S12 Photodegradation efficiency of 2,4-DCP for sample 1:0.005 with the increase of the amount of H_2O_2 under infrared light irradiation.



Fig. S13 Plots of $Ln(C_0/C_t)$ versus time for sample 1:0.005 in the presence of different concentrations of H_2O_2 .



Fig. S14 Photodegradation of 2,4-DCP over pure $Cu_2(OH)PO_4$ and sample 1:0.005 with visible light irradiation at 20-25 °C.



Fig. S15 (a) The HO[·] generation by sample 1:0.005 after 15min of infrared light irradiation. (b) The HO[·] generation over different treatments with infrared light irradiation as a function of irradiation time.



Fig. S16 SEM images of pure Cu₂(OH)PO₄ (a) and Cu₂(OH)PO₄/rGO nanocomposites with 1:0.001 (b), 1:0.002 (c), 1:0.01 (d), 1:0.02 (e), 1:0.05 (f) and 1:0.1 (g) ratios after repeated photocatalytic cycling. Inset: Enlarged SEM images of pure Cu₂(OH)PO₄ (a) and Cu₂(OH)PO₄/rGO nanocomposites.



Fig. S17 Cu2p XPS spectra of pure $Cu_2(OH)PO_4$ and $Cu_2(OH)PO_4/rGO$ nanocomposites after repeated photocatalytic cycling.



Fig. S18 XRD patterns of pure $Cu_2(OH)PO_4$ and $Cu_2(OH)PO_4/rGO$ nanocomposites after repeated photocatalytic

cycling.



Fig. S19 Cytotoxicity of different concentrations of sample 1:0.005 to HUVECs (human umbilical vein endothelial

cells).

Sample	<i>k</i> (h ⁻¹)
Cu ₂ (OH)PO ₄	0.190
1:0.001	0.264
1:0.002	0.311
1:0.005	0.326
1:0.01	0.246
1:0.02	0.251
1:0.05	0.298
1:0.1	0.260

Table S1. The reaction rate constant K of $Cu_2(OH)PO_4/rGO$ nanocomposites.

References

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