Electronic Supplementary Information (ESI) for

$Mg(OH)_2$@Reduced Graphene Oxide Composite for Removal of Dyes from Water

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Experimental Section

Materials Synthesis. Graphite oxide was prepared from purified natural graphite according to a modified Hummers method.[S1,S2] A suspension of graphite oxide (200 mg, equal to 100 mg of reduced graphene oxide) in water (200 ml) was ultrasonicated for 2 h to produce suspension of graphene oxide (GO). An aqueous solution (50 ml) of $MgCl_2$ (3.145 g of $MgCl_2 \cdot 6H_2O$) added into the suspension. The mixture was stirred for 4 h to complete ion exchange. Aqueous solution (50 mL) of NaOH (1.0 equ.) was added dropwise. The mixture was kept stirring for a further 1 h. The solid was obtained by centrifuge and washed with water, dried in vacuum at room temperature and then heated in air at 140 °C for 2 h. The powder was suspended into water (40 ml). After stirring and ultrasonication for 30 min, N_2H_4 (80%, 2.0 ml) was added and the mixture was transferred into a Teflon lined autoclave and heated to 160 °C for 8 h. The resulted solid products were washed with water (3×50 ml) and $Mg(OH)_2$@reduced graphene oxide (rGO) composites (termed as MGC) were obtained. The rGO was obtained from GO by reduction with N_2H_4 via similar process. The designated amount of $Mg(OH)_2$ on rGO is 900 mg. In the absence of GO, pure $Mg(OH)_2$ was obtained via similar process.

Materials Characterization. The morphology of as–prepared products was studied by using transmission electron microscope (TEM, Hitachi H–7650B operating at 80.0 kV, and JEOL JEM–2100 operating at 100 kV). For atom force microscopy (AFM) measurement, the samples were coated on Si surface and AFM studies were performed using a Digital Instruments Dimension 3100 microscope in the tapping mode. Fourier transform infrared (FT-IR) spectra measurements were carried out on a NICOLET 560 Fourier transform infrared spectrophotometer. Raman spectrum was recorded on a Renishaw RM–1000 with excitation from the 514 nm line of an Ar–ion laser with a power of about 5 mW. The phase structures of as–prepared products were characterized with X–ray diffraction (XRD, Bruker D8 advance) with Cu Kα λ=1.5418 Å). X–ray photoelectron spectrum (XPS) were recorded on a PHI quantera SXM spectrometer with an Al Kα=280.00 eV excitation source, where binding energies were calibrated by referencing the C1s peak (284.8 eV) to reduce the sample charge effect. N_2 adsorption–desorption was tested on TriStar II 3020 (Micromeritics Instrument Corporation, USA).

Adsorption of dye from water. MGC (100 mg) was immersed into solution of methylene blue (MB, 2.0×10^{-5} M, 50 ml) with stirring for designed time. The concentration of MB in the filtrate was measured with a UV–VIS recording spectrophotometer (UNIC Corp. UV–2102PC). With GO and rGO as adsorbents, the similar process was conducted. For recycling MGC, MGC after adsorption were washed with ethanol (10 ml) under magnetic stirring for 120 min.

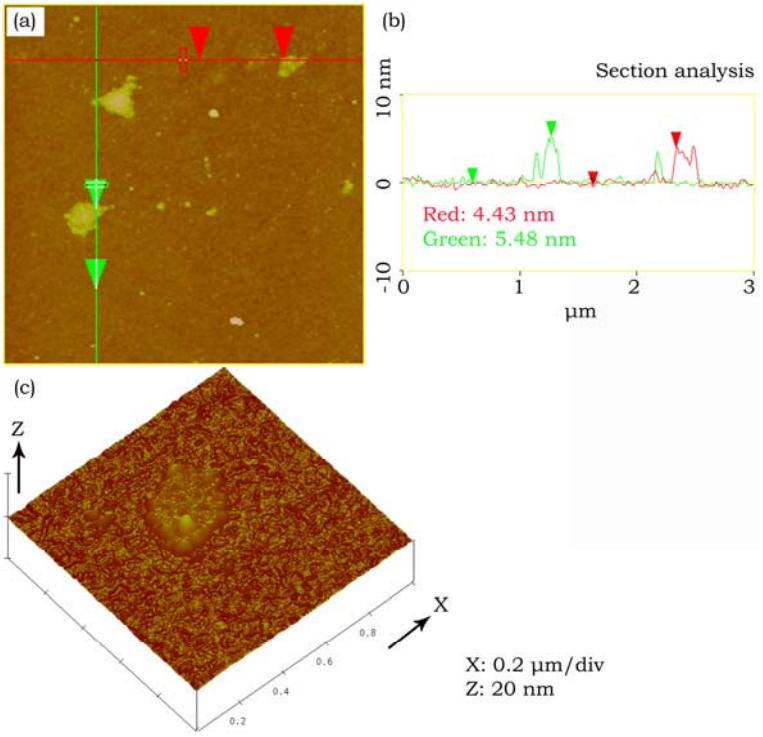

Fig. S1 (a) Typical AFM images, and (b) its cross section analysis (c) three dimensional AFM images of MGC.

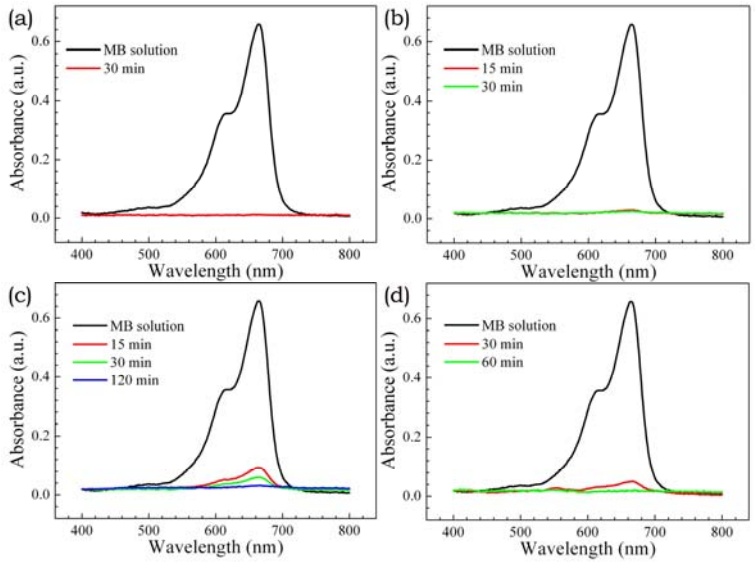

Fig. S2 UV–Vis spectra of the original and treated with MGC (100 mg) organic dyes solutions (MB, 2.0×10^{-5} M, 50 ml) for various times, and in various cycles. (a) 1st, (b) 2nd, (c) 3rd, and (d) 4th cycle.

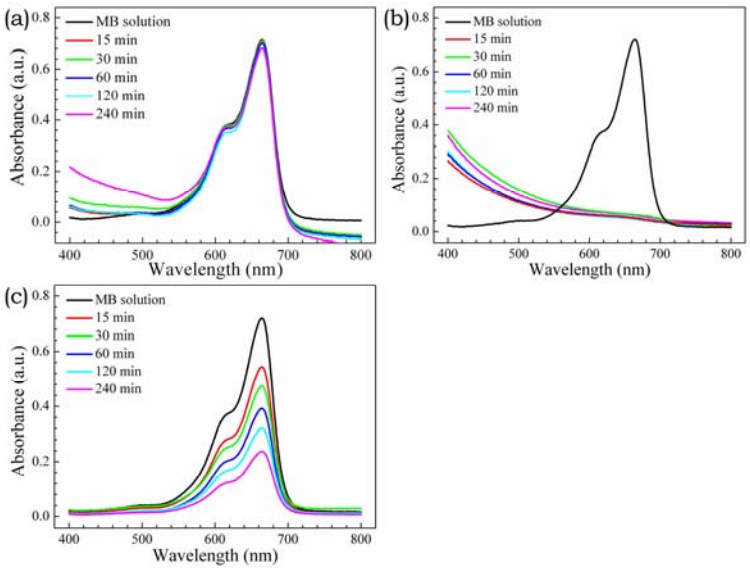

Fig. S3 UV–Vis spectra of the original and treated with (a) $Mg(OH)_2$, (b) GO, (c) rGO (100 mg) organic dyes solutions (MB, 2.0×10^{-5} M, 50 ml) for various times.

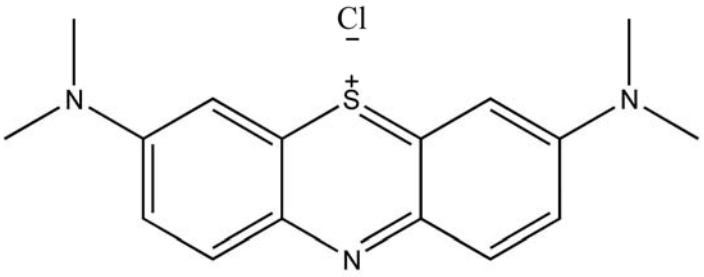

Fig. S4 The molecule structure of MB.

References

[S1] W. S. Hummers and R. E. Offeman, *J. Am. Chem. Soc.*, 1958, **80**, 1339-1339.

[S2] B. J. Li and H. Q. Cao, *J. Mater. Chem.*, 2011, **21**, 3346-3349.