Electronic Supplementary Material (ESI) for Environmental Science: Nano.

Supplemental Data

Colloidal Stability of Reduced Graphene Oxide Materials Prepared Using Different Reducing Agents

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Procedures used to determine relative hydrophobicity of GO and RGO

Relative hydrophobicity of GO and RGOs was assessed using a hydrocarbon partitioning test with laboratory-grade *n*-dodecane [S1]. Samples were prepared by adding 4 ml of a GO suspension to a test tube containing 1 ml of *n*-dodecane. The test tube was vortexed for 2 min, and then left undisturbed for 15 min to allow phase separation. The relative hydrophobicity was assessed as the fraction of GO that partitioned into *n*-dodecane from the aqueous phase [S2].

Table S1 Ion compositions of artificial surface and ground waters.

Ion type	Artificial surface water Concentration (mM)	Artificial ground water Concentration (mM)
Na^+	0.23	0.43
K^+	0.03	0.20
Ca^{2+}	0.33	0.68
Mg^{2+}	0.15	0.24
Cl^-	0.16	0.64
NO_3^-	-	0.62
HCO_3^-	0.92	0.45
SO_4^{2-}	0.07	0.38

Table S2 Electrophoretic mobility of GO/RGOs in the absence and presence of SRHA.

	EPM ($m^2V^{-1}s^{-1}$)		
	0.5 mM Ca^{2+}	0.5 mM Ca^{2+} with 1 mg/L SRHA	0.5 mM Ca^{2+} with 10 mg/L SRHA
GO	-1.24 ± 0.06	-1.27 ± 0.02	-1.34 ± 0.07
VC-RGO	-1.09 ± 0.15	-1.11 ± 0.04	-1.31 ± 0.10
$NaBH_4$-RGO	-0.99 ± 0.01	-1.00 ± 0.04	-1.11 ± 0.07
N_2H_4-RGO	-0.91 ± 0.07	-0.98 ± 0.04	-1.11 ± 0.01

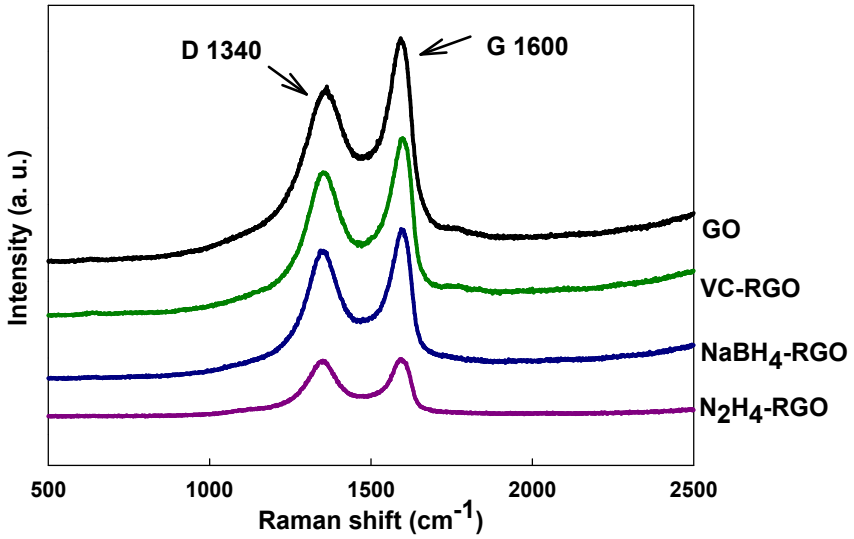

Fig. S1 Raman spectra of GO and reduced GOs. All samples displayed strong Raman peaks at approximate 1340 cm^{-1} (assigned to the D band) and 1600 cm^{-1} (G band). The G band is ascribed to the E_{2g} mode of sp^2 carbon atoms and the D band is usually related to the vibration of carbon atoms with dangling bonds and ascribed to the edge of carbon network [S3].

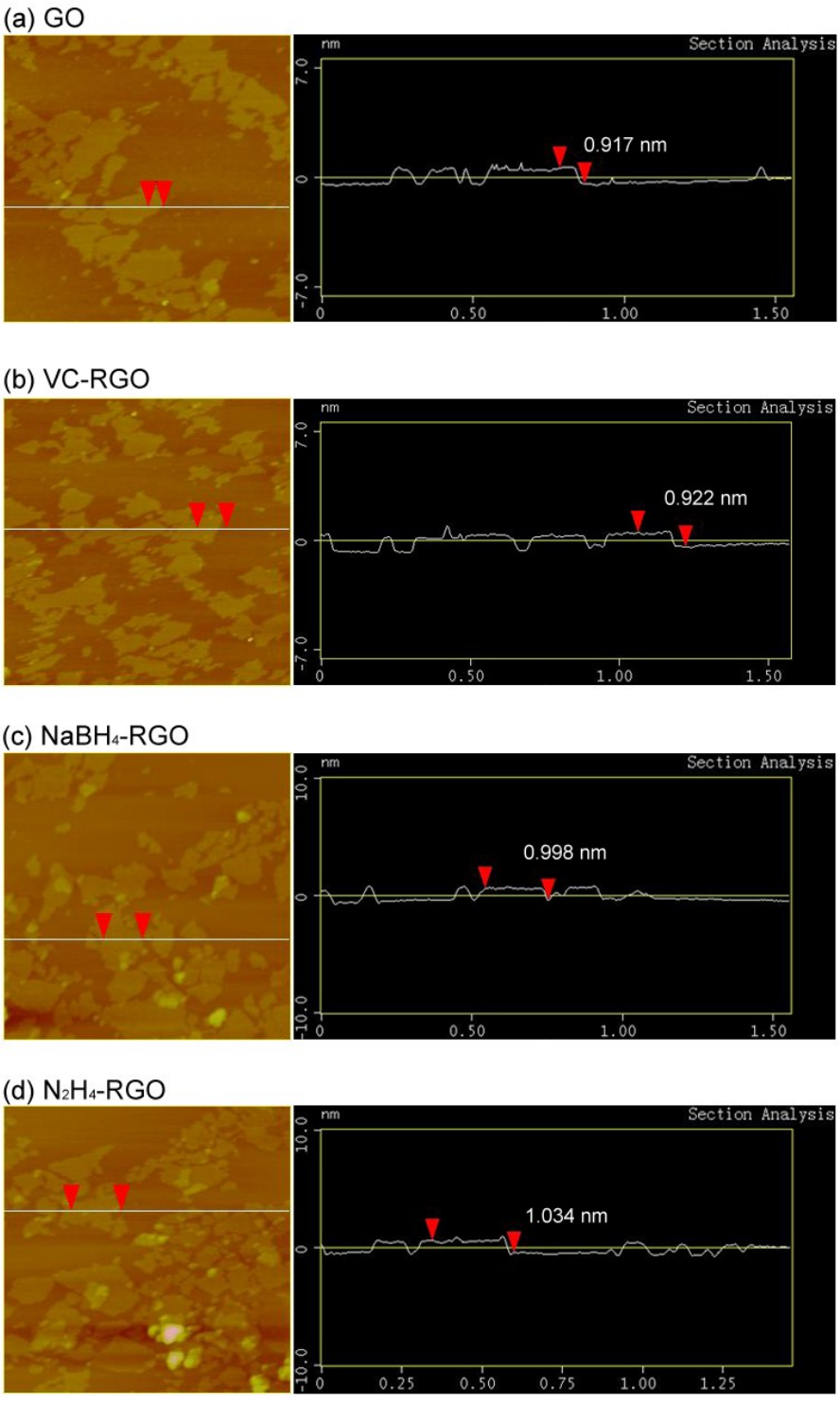

Fig. S2 AFM images and height profiles of graphene oxide (GO) and reduced graphene oxides (VC-RGO, $NaBH_4$-RGO and N_2H_4-RGO).

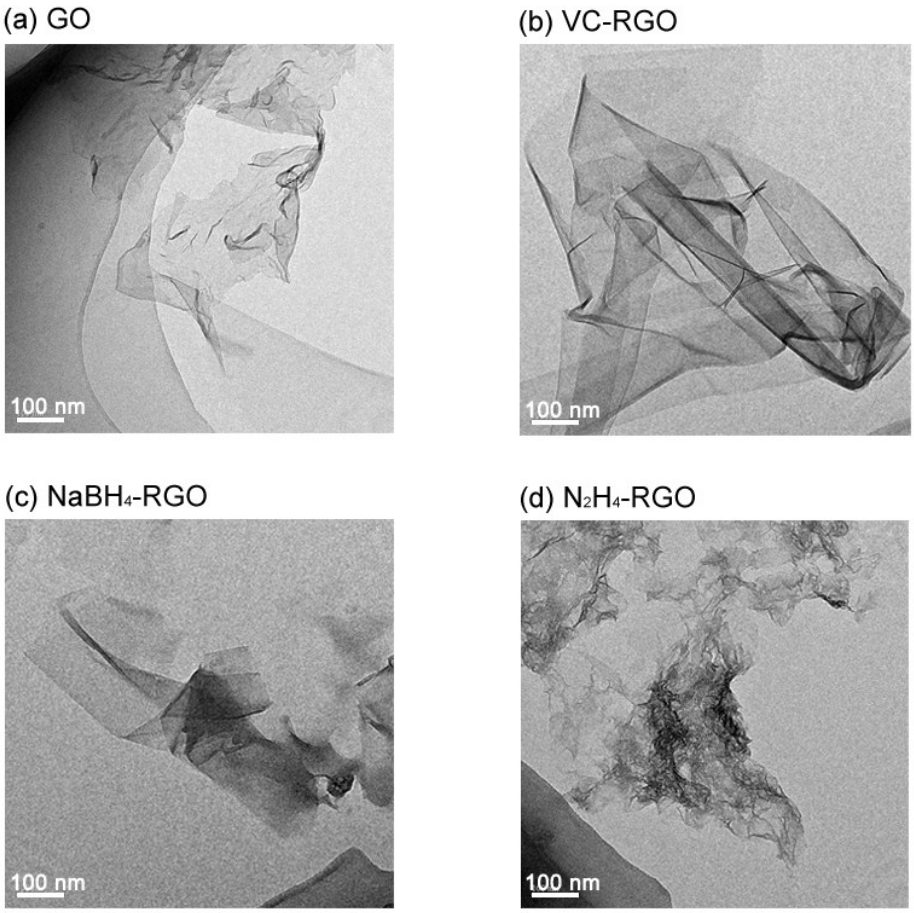

Fig. S3 TEM images of graphene oxide (GO) and reduced graphene oxides (VC-RGO, $NaBH_4$-RGO and N_2H_4-RGO).

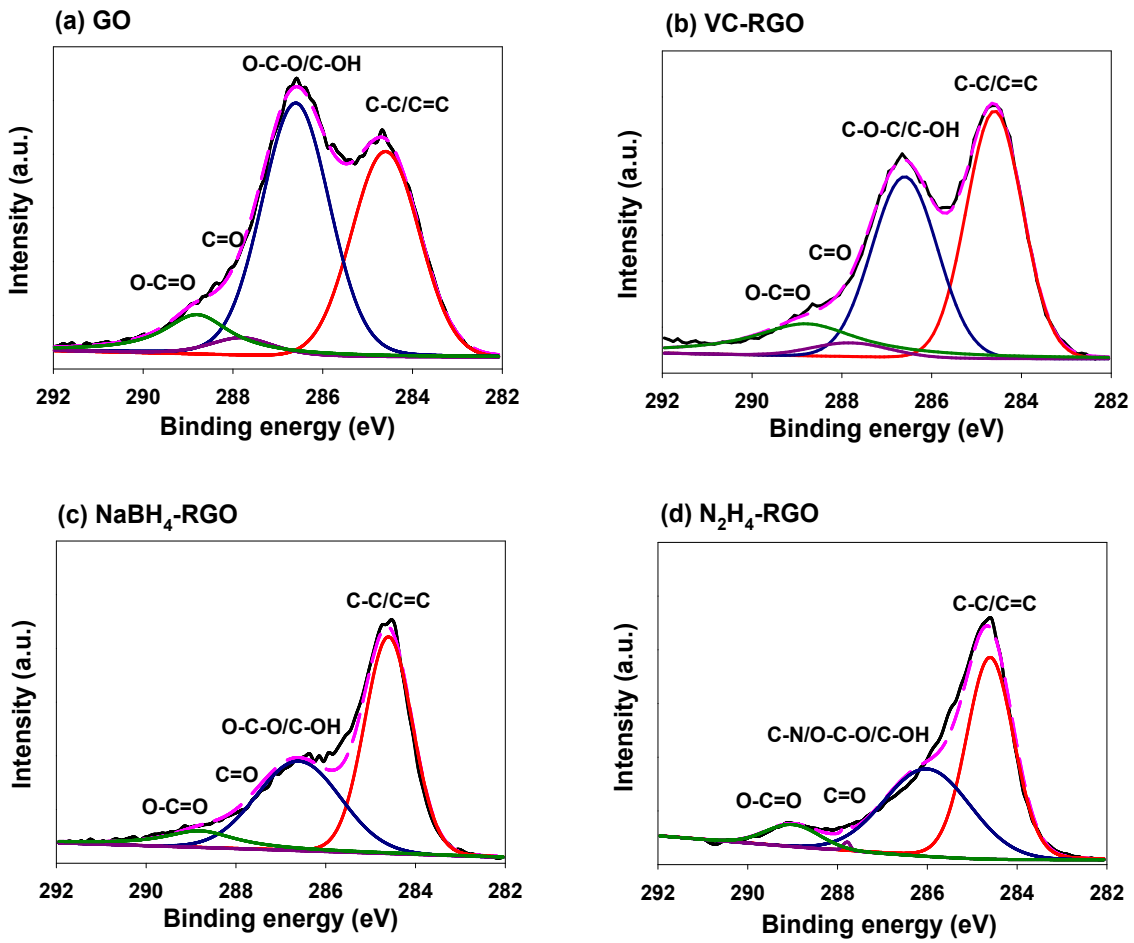

Fig. S4 XPS spectra of graphene oxide (GO) and reduced GOs (VC-RGO, $NaBH_4$-RGO and N_2H_4-RGO). The peaks with the binding energy of 284.6, 286.6, 287.8 and 288.8 eV are assigned to the carbon atoms in aromatic rings (C-C/C=C), epoxy/hydroxyl (C-O-C/C-OH), carbonyl (C=O) and carboxyl (O-C=O), respectively.

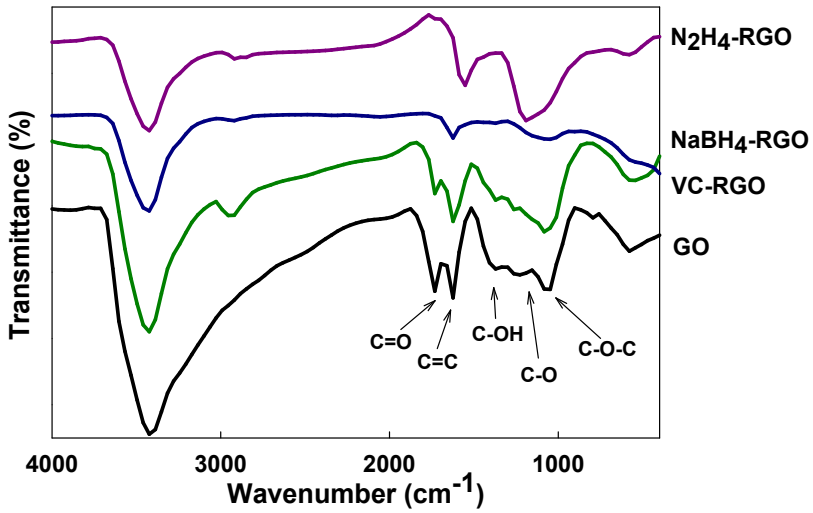

Fig. S5 FTIR spectra of GO and reduced GOs, including VC-RGO, $NaBH_4$-RGO and N_2H_4-RGO.

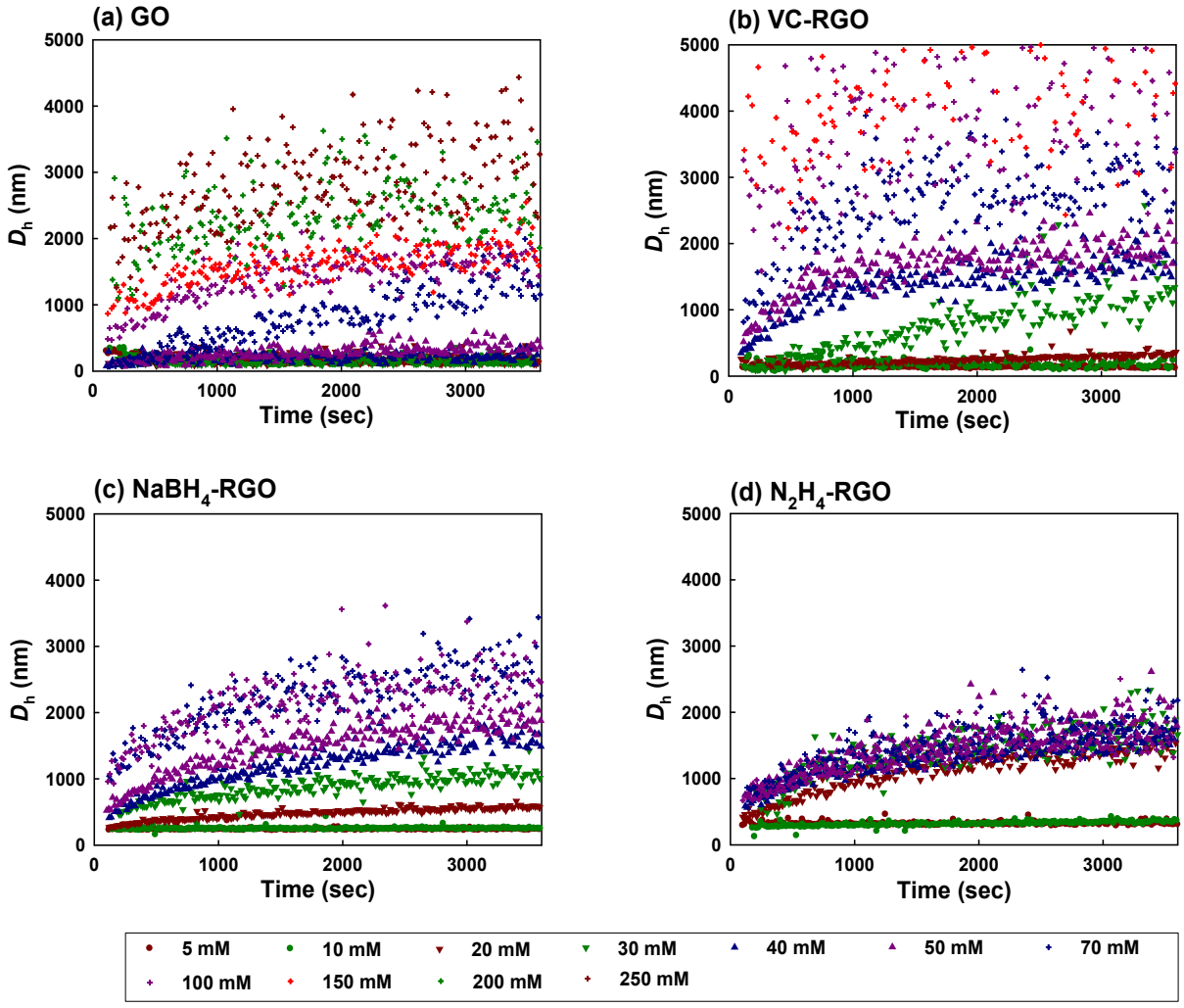

Fig. S6 Aggregation kinetics of GO and reduced GOs (VC-RGO, $NaBH_4$-RGO and N_2H_4-RGO) as a function of NaCl concentration. Aggregation of GO was studied over a NaCl concentration range of 5 to 250 mM, and that of RGOs was studied over 5 to 150 mM, due to the lower critical coagulation concentrations.

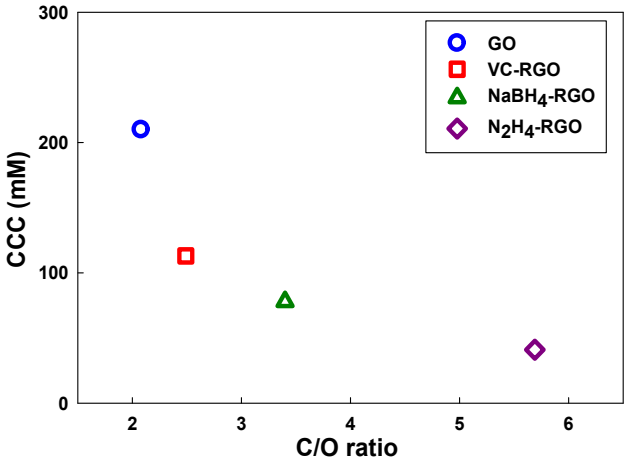

Fig. S7 Correlation of critical coagulation concentration (CCC) values of GO and reduced GOs (VC-RGO, $NaBH_4$-RGO and N_2H_4-RGO) with C/O ratios of the materials.

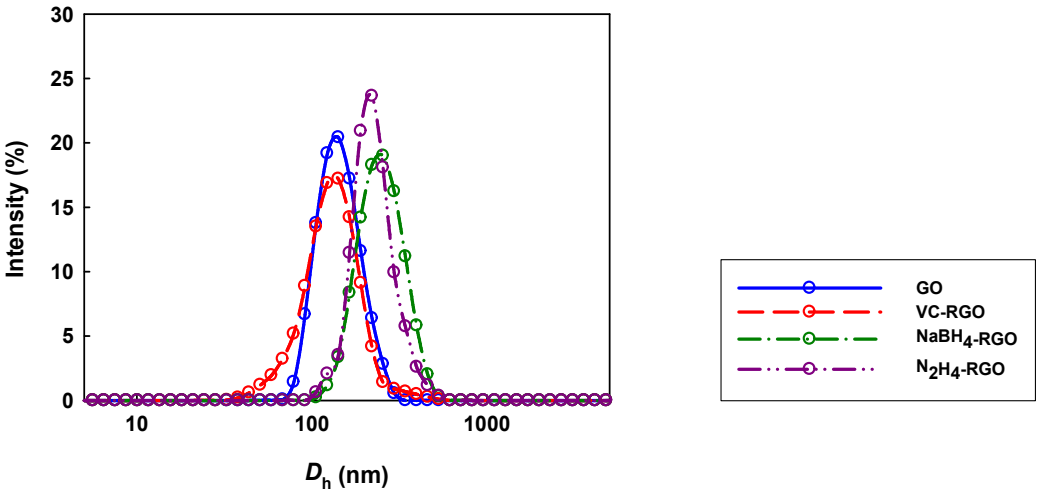

Fig. S8 Particle size distribution of GO and reduced GOs (VC-RGO, $NaBH_4$-RGO and N_2H_4-RGO) in deionized water.

References

S1 J. A. Brant, J. Labille, J. Y. Bottero, M. R. Wiesner, *Langmuir*, 2006, **22**, 3878-3885.

S2 S. L. Walker, J. E. Hill, J. A. Redman, M. Elimelech, *Appl. Environ. Microb*., 2005, **71**, 3093-3099.

S3 A.C. Ferrari, J. Robertson, *Phys. Rev. B,* 2000, **61**, 14095–14107.