Supporting Information

Fabrication of Magnetic Cryptomelane-Type Manganese Oxide Nanowires for Water Treatment

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Experimental Section

Synthesis of OMS-2 Nanowires: To synthesize OMS-2 nanowires, a hydrothermal method was carried out.[1] In a typical procedure, 19.1 mmol of K_2SO_4, 38.2 mmol of $K_2S_2O_8$, and 19.1 mmol of $MnSO_4 \cdot H_2O$ were dissolved in 70 ml of deionized water. The solution was then transferred to a 125 ml Teflon-lined stainless-steel autoclave. The autoclave was sealed and heated in an oven at 250 ^oC for 4 days. The resulting black precipitate was suspended in 1000 ml deionized water, and stirred vigorously for 12 hours. After thorough washing with deionized water to remove remaining ions present in the product, the samples were dried at 105 ^oC for 24 hours.

Synthesis of OMS-2/Fe_3O_4 nanowires: To fabricate the magnetic manganese oxide nanowires, nanoparticles of Fe_3O_4 were deposited onto OMS-2 nanowires using a chemical

co-precipitation method. 10 ml of 0.02mol/L ferric sulfate and 10 ml of 0.02mol/L ferrous sulfate were vigorously stirred in a beaker at room temperature. 5 mol/L KOH was then added dropwise into the solution. When pH of the solution was raised to 10, 0.5 g OMS-2 nanowires were added into the system and continuously stirred for 5 mins. After that, pH value of the solution was adjusted to 12 and stirred for another 20 mins. In order to remove all soluble ions in the solution, the product was washed several times before being separated using a magnet.

Material Characterization: The XRD data was collected on a Bruker D8 Advance X-ray diffractometer (Cu Ka X-radiation at 40 kV and 30 mA). The morphology of the OMS-2/Fe_3O_4 nanowires was studied using a field-eimission scanning election microscope (FESEM) Jeol JSM-6340F (Japan) operated at 5 kV, and transmission electron microscopy (TEM) was carried out on a Jeol JEM-2100F (Japan) operated at 200 kV. X-ray photoelectron spectroscopy (XPS) analyses were carried out in an ultrahigh vacuum (UHV) chamber with a base pressure below 2.66×10^{-7} Pa at room temperature.

Batch Adsorption Experiments: Batch equilibrium adsorption isotherm study was carried out in 50 ml centrifuge tubes at 25 ^{o}C. For the determination of adsorption isotherm, concentrations of $Cd(NO_3)_2$ were varied at 0.1, 0.2, 0.4, 0.8, 1, 2, 5, 10 mmol/L, with a fixed OMS-2/Fe_3O_4 dosage of 0.25 g/L. The equilibration time was kept at 48 h and under an agitation speed of 200 rpm. After the isothermal equilibrium runs, the samples were filtered through 0.45 μm membrane filters prior to analysis. The concentration of Cd^{2+} was determined by inductively coupled plasma emission spectroscopy (ICP, Perkin Elmer Optima 2000DV).

Table S1. Freundlich Parameters for Measured Cd^{2+} Sorption Isotherms on OMS-2/Fe_3O_4 and OMS-2.

	lnk	**1/n**	**R^2**
OMS-2/Fe_3O_4	0.438	0.949	0.982
OMS-2	0.450	0.945	0.985

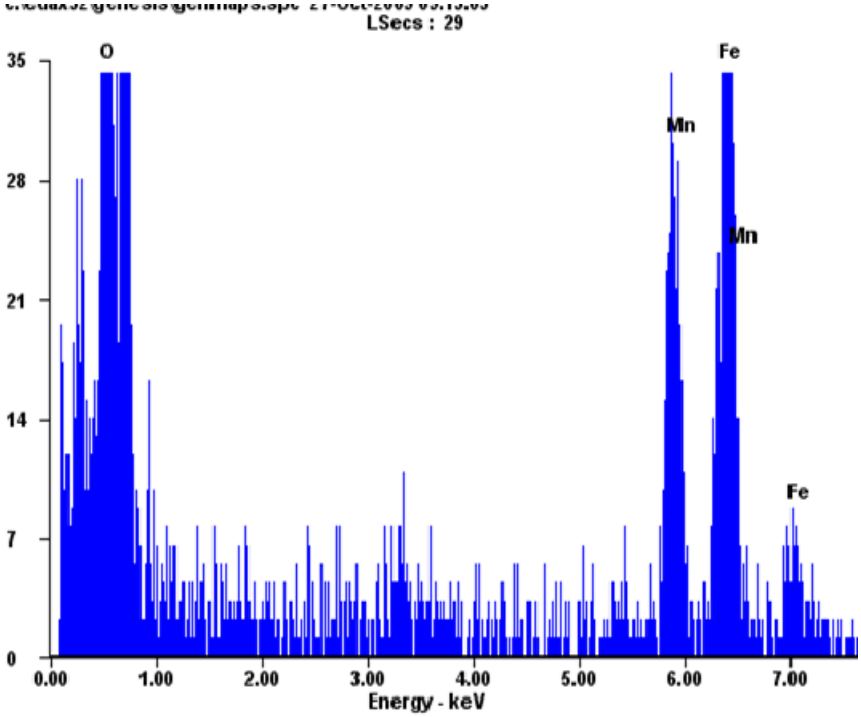

Figure S1. Energy-dispersive X-ray spectroscopy graphs of the OMS-2/Fe_3O_4.

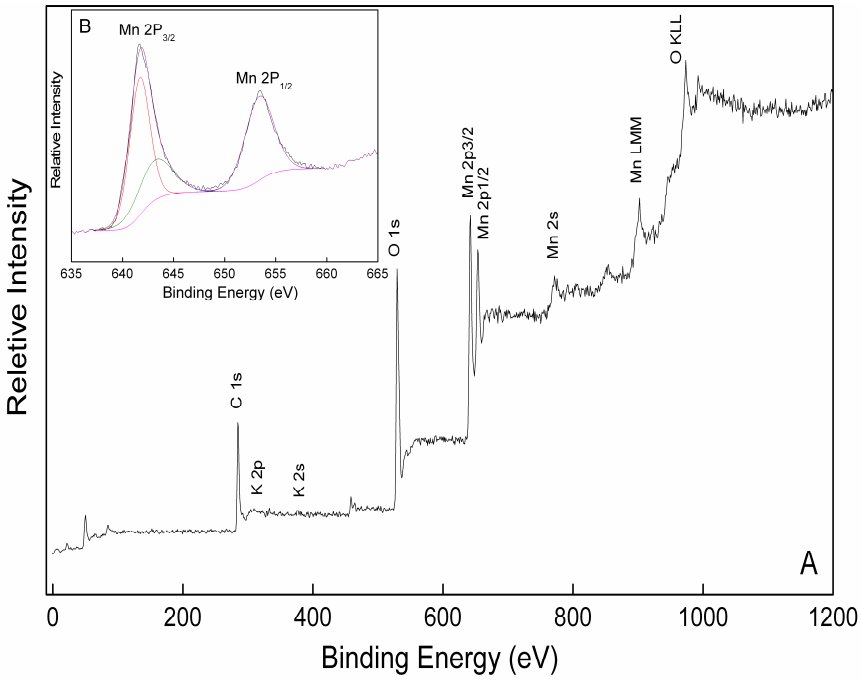

Figure S2. (A) XPS survey spectrum of OMS-2 nanowires; (B) high-resolution XPS spectrum of the Mn 2p taken on the OMS-2 nanowires.

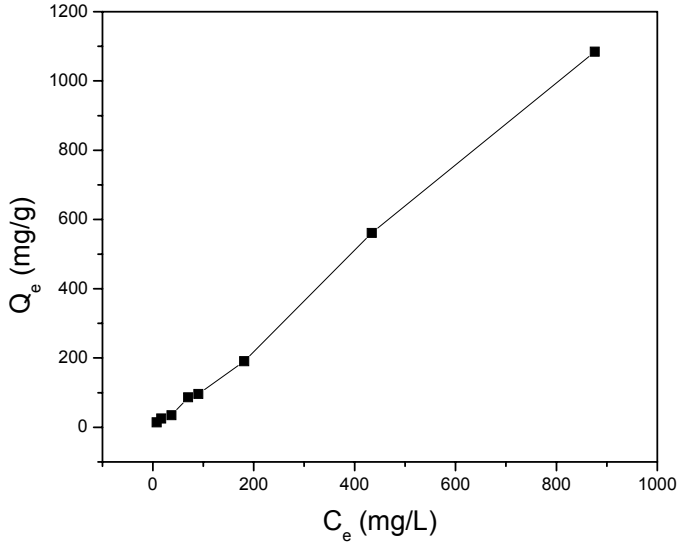

Figure S3. Adsorption isotherm of Cd^{2+} on OMS-2 at pH 5 and 25 ^{o}C.

Reference

1 J. Yuan, X. Liu, O. Akbulut, J. Hu, S. L. Suib, J. Kong and F. Stellacci, *Nat. Nanotechnol.*, 2008, **3**, 332-336.