

Supporting Information

3D porous carbon foam loaded with Fe₃O₄/graphene oxide for highly effective As(III) removal

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S1 Characterization

X-ray diffraction (XRD, X'Pert-Pro MPD) with Cu K radiation ($\lambda = 1.5478 \text{ \AA}$) was used to characterize the crystalline structure of the resulting samples. The observations were carried out on Field emission scanning electron microscope (FSEM, SU8020, Hitachi) and transmission electron microscope (TEM, Philips TecnaiG2 F20) were used to analyze morphologies and microstructural of the resulting samples. The element compositions of obtained samples were analyzed by energy-dispersive X-ray spectroscopy (EDS) attached to SEM. Renishaw Micro-Raman Spectroscopy (Renishaw inVia Reflex) was used to characterize the Raman spectra at 532 nm laser excitation. Zeta potential analyzer (Nano ZS ZEN3600, Malvern Instruments Ltd., UK) was used to measure the Zeta potential of the resulting samples. XPS analyses were conducted on an ESCALAB 250 (Thermo, USA). Mettler Toledo pH meter (FG2/EL2) was used to decide the pH values of the solution. The arsenic content was determined by Inductively Coupled Plasma Optical Emission Spectrometer (ICP-AES,

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ICP-6300 Thermo Fisher Scientific, USA).

S2 Fabrication of GO

GO was prepared from natural graphite powder via a modified Hummers method. Sulphuric acid (450 mL) was added to graphite powder (10 g) and the temperature of the solution was maintained below 10 °C and stirred for 90 min. A small amount (1.5 g) of potassium permanganate was added to the mixture and stirred for 90 min. Then, a large amount of potassium permanganate (30 g) was added to the mixture and stirred for 1 hour. The solution changed in color from black to dark green. In this step, the reaction temperature was kept below 10 °C. The solution was heated to 40 °C and stirred for 1 hour. Deionized water (450 mL) was poured into the solution in a dropwise fashion and the temperature was maintained below 50 °C to prevent a rapid increase in temperature that could result in a thermal explosion. The solution turned brown. The solution was then heated to 95 °C for 30 min, and hydrogen peroxide solution (10 wt.%, 300 mL) was poured into solution and stirred for 30 min. The solution changed to light yellow. The product was centrifuged and washed with 1:10 HCl aqueous solution and DI water sequentially to remove ion species. Finally, few-layer graphene oxide was separated by centrifugation at 10000 rpm. The concentration of the as-prepared GO suspension was approximately 1 mg·mL⁻¹.

S3 Batch sorption experiments

All of the adsorption experiments were carried to study the arsenic sorption performances of the as-obtained block (experimental conditions: Varying contact time, pH and initial arsenic concentration).

S3.1 Adsorption kinetics

First, 10 mg of the as-obtained sample was added into As(III) solution (20 mL, 10 mg·L⁻¹). Afterwards, the initial solution pH was adjusted by adding HCl (0.1 M) and NaOH (0.1 M). Finally, the supernatant was taken out at different time intervals, and then filtered through a 0.45 μm filter for ICP-AES measurements in order to determine arsenic concentration.

S3.2 Adsorption isotherm

In the equilibrium studies of As(III), 10 mg of the as-obtained samples were added to As(III) solution (20 mL) with different initial concentrations (the initial As(III) concentrations from 1 to 1000 mg·L⁻¹, pH 6.0) in triangular flasks and fully mixed for 24 h. The residual arsenic concentration was analyzed by the ICP-AES measurements.

S3.3 Effect of initial pH

The effect of pH on the adsorption of arsenic was evaluated by adding 10 mg of the as-obtained samples into As(III) solution (10 mg·L⁻¹, 20 mL). The experiments were carried out by adjusting solution pH from 2 to 10 and using NaOH (0.1 M) and HCl (0.1 M) solution. The residual arsenic concentration was determined by the ICP-AES measurements.

S3.4 Effect of co-existing ions

The effect of competing anions (SO₄²⁻, Cl⁻, NO₃⁻, PO₄³⁻) on As(III) adsorption capacity was studied by adding 10 mg of the as-obtained samples into As(III) solution (10 mg·L⁻¹, 20 mL). The experiments were carried out by adding the SO₄²⁻, Cl⁻, NO₃⁻, PO₄³⁻ ions in different concentrations (0.1 mM or 1 mM).

S3.5 Adsorption-regeneration cycles

In order to evaluate the recyclability of the as-obtained absorbents, the successive desorption and regeneration processes experiments were conducted. After the as-obtained absorbents were saturated with the As(III), the block absorbents were withdrawn from the As(III) solution and regenerated by NaOH solution (0.5 M) to remove As(III) from the as-obtained absorbents surface, followed by carefully washing with DI water, HCl solution (0.05 M) and again DI water. After desorption, the recovered block absorbent were sequentially gone through the next four cycles of adsorption–desorption experiments with the similar procedure as conducted above.

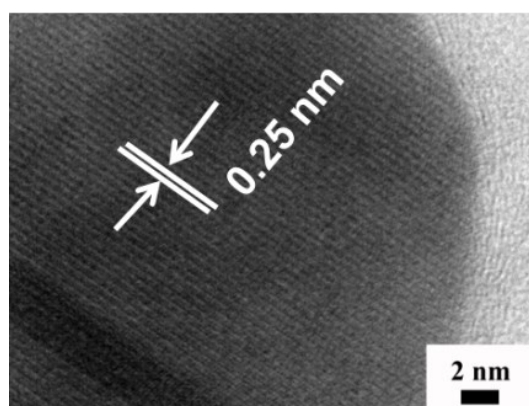


Fig. S1 HRTEM image of Fe₃O₄ nanoparticle.