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Supporting Information

Synthesis of Surface Ion-Imprinted Magnetic Microspheres by Locating Polymerization for Rapid and Selective Separation of Uranium (VI)

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Synthesis of Fe_3O_4@SiO_2-C=C microspheres

A typical process of synthesis of Fe_3O_4 particles was depicted as below [1]: $FeCl_3 \cdot 6H_2O$ (0.81 g , 3 mmol), CH_3COONa (2.04 g, 24.8 mmol), polyethylene glycol (0.24 g, M_n = 2000 g/mol) and sodium dodecyl sulfonate (1.09 g, 3.13 mmol) were dissolved in 25 mL of ethylene glycol under vigorous stirring. Subsequently, the mixture was transferred into a Teflon-lined stainless-steel autoclave. The autoclave was heated at 180 ^{o}C and maintained for 6 h. Then, it was cooled to room temperature. The resulting black magnetite particles were washed three times with ethanol and dried in vacuum at room temperature for 12 h.

Fe_3O_4@SiO_2 particles were prepared via a typical process [2]: 0.6g of the as-prepared Fe_3O_4 particles were dispersed in a mixture of ethanol (320 mL), water (80 mL), and $NH_3 \cdot H_2O$ (4 mL, 28 wt%) under ultrasonication. Then, 2 mL tetraorthosilicate was added dropwise and the reaction was allowed to proceed at room temperature for 6 h under stirring. Afterwards, the product was washed several times with ethanol and dried in vacuum at room temperature for 12 h.

Fe_3O_4@SiO_2-C=C microspheres were prepared by the modified literature method [3]: the as-prepared Fe_3O_4@SiO_2particles (0.50 g) were suspended in ethanol (70 mL) with the help of ultrasonication. After addition of 3-(methacryloxy)propyltrimethoxysilane (0.5 mL), the mixture was allowed to react at room temperature for 48 h with continuous stirring under argon atmosphere. Then, the product was washed several times with ethanol, and dried in vacuum at room temperature for 12 h to give Fe_3O_4@SiO_2-C=C microspheres.

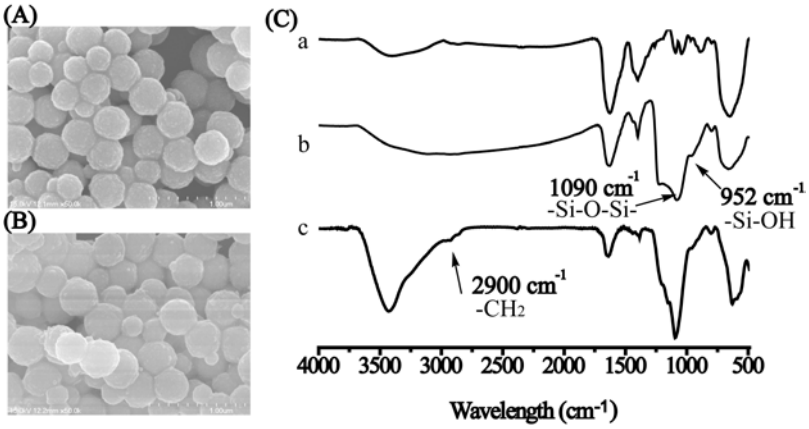

Figure S1. SEM images of (A) Fe_3O_4 and (B) Fe_3O_4@SiO_2. (C) FTIR spectra of (a) Fe_3O_4, (b) Fe_3O_4@SiO_2, and (c) Fe_3O_4@SiO_2-C=C.

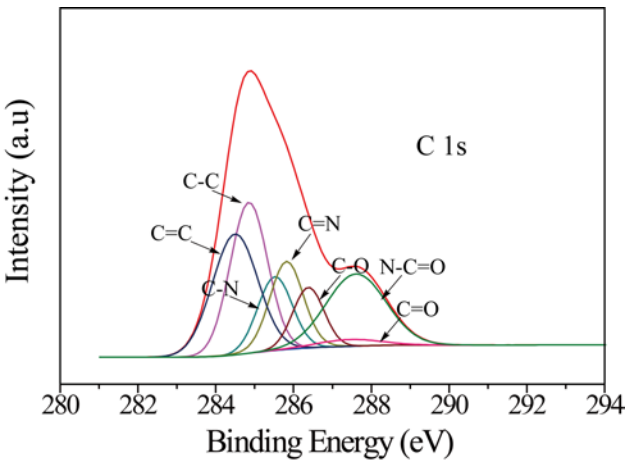

Figure S2. XPS spectrum of C 1s of SII-MM1.

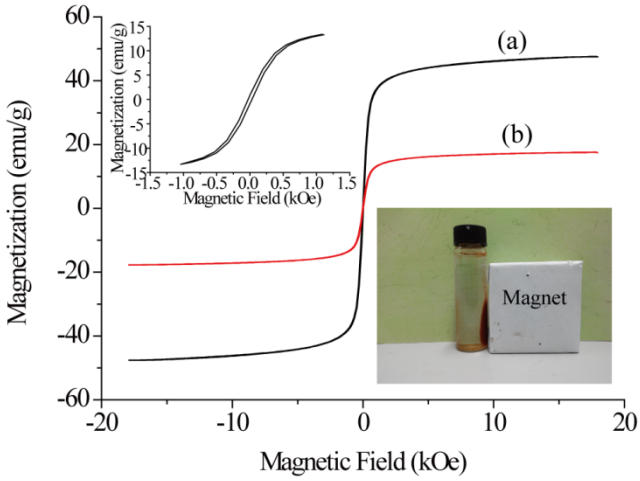

Figure S3. Magnetization curves of (a) Fe_3O_4@SiO_2-C=C, and (b) SII-MM1. The left inset shows the magnified magnetization curve of SII-MM1, and the below inset shows the magnetic separation of SII-MM1.

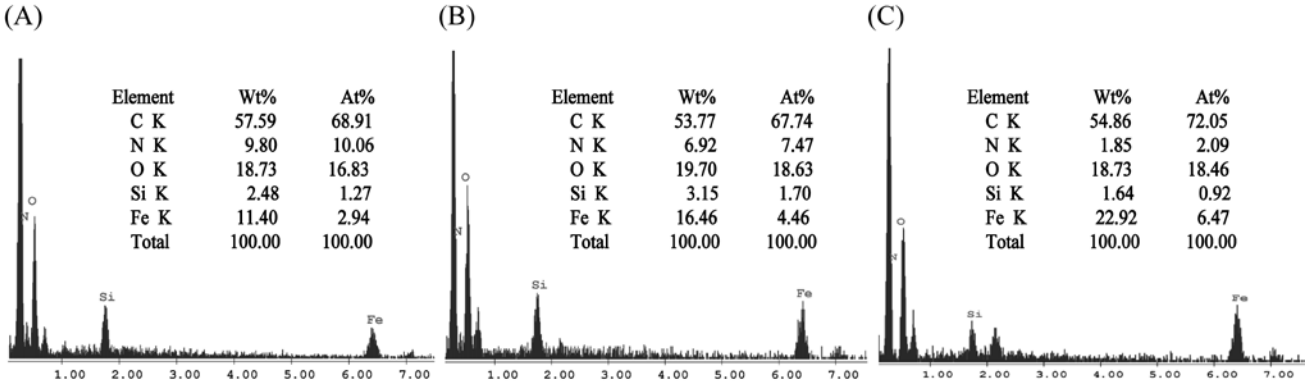

Figure S4. EDX spectra of (A) SII-MM1, (B) SII-MM2, and (C) SII-MM3.

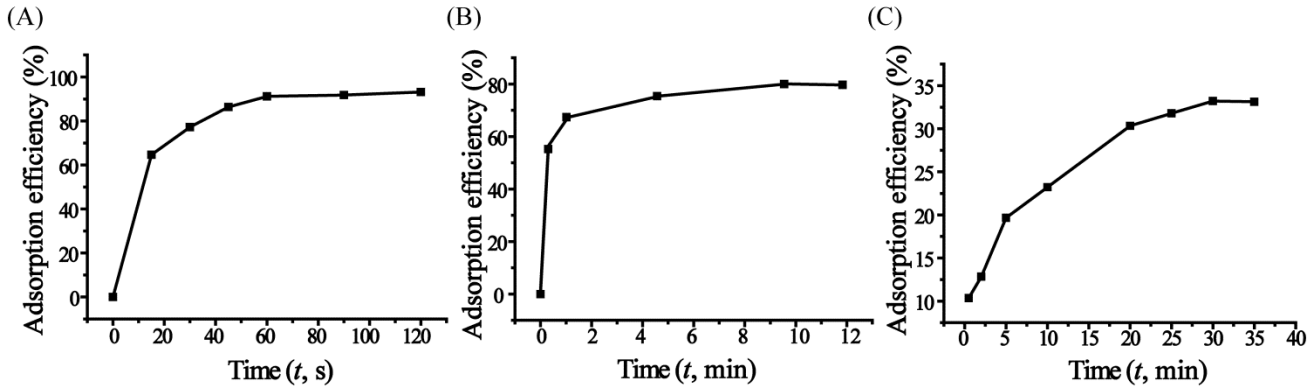

Figure S5. Effect of chemical composition of SII-MM on the adsorption of uranyl ions: (A) SII-MM1, (B) SII-MM2, and (C) SII-MM3. (Experiment condition: 5 mL solution, 10^{-4} mol/L uranyl ion, 298.15 K, 0.5 g/L SII-MM.)

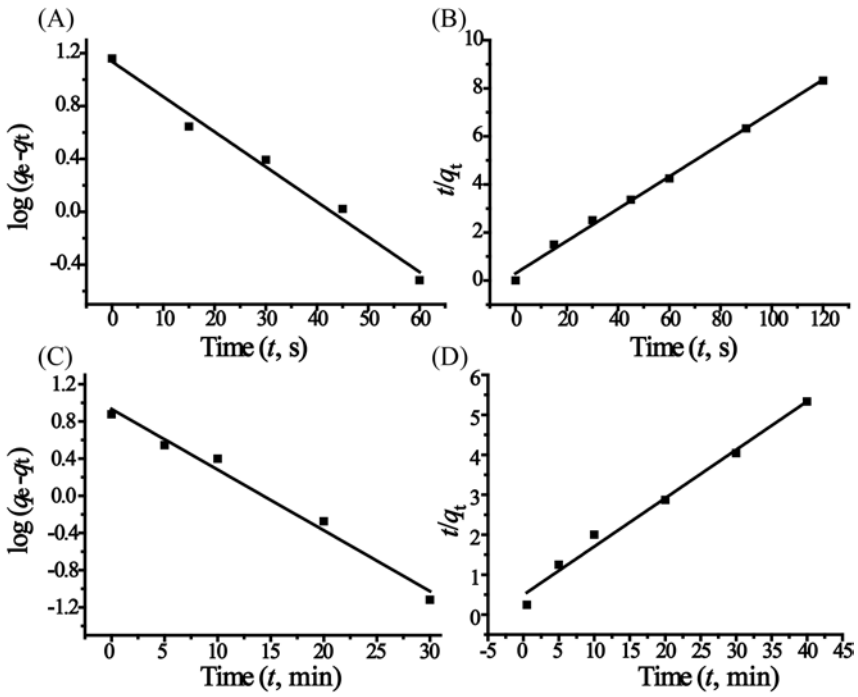

Figure S6. Pseudo-first-order kinetics of U (VI) adsorption by SII-MM (A) and SNI-MM (C), and pseudo-second-order kinetics of U (VI) adsorption by SII-MM (B) and SNI-MM (D).

Table S1. Surface area of different samples.

Sample*	BET Surface Area (m^2/g)
SII-MM1	16.23
SII-MM2	15.85
SII-MM3	9.41
SNI-MM	9.67

* Surface ion-imprinted magnetic microspheres with different content of 1-vinylimidazole: 0.2g, 0.1g and 0.05g for SII-MM1, SII-MM2, and SII-MM3, respectively; SNI-MM is surface non-imprinted microspheres with the same recipe of SII-MM1.

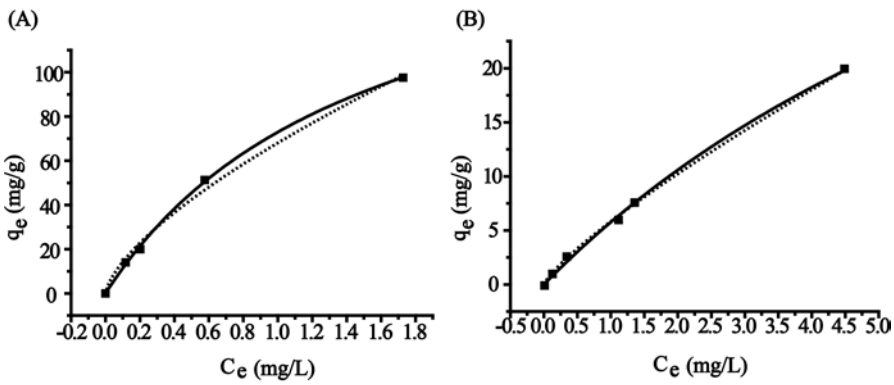

Figure S7. Adsorption isotherms of uranium (VI) on SII-MM1. The scattered points represent experiment data, and the dashed lines represent the Freundlich model and the solid lines represent the Langmuir model.

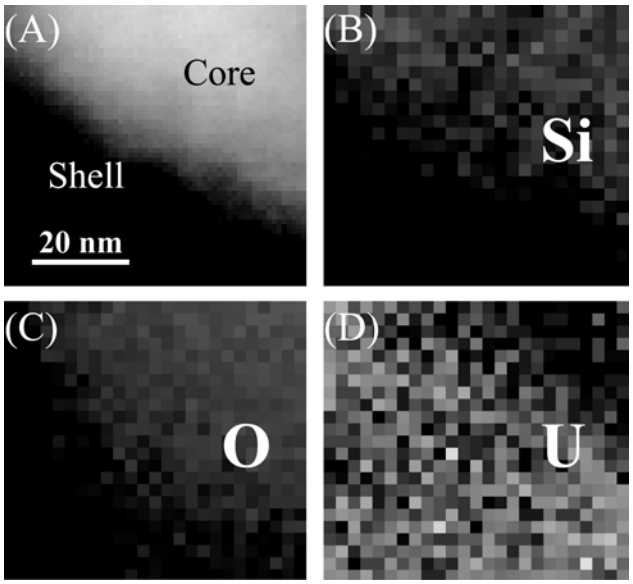

Figure S8. (A) TEM image of the core-shell structure of SII-MM1 with uranium (VI) on the surface; and elemental mappings of (B) Si, (C) O and (D) U. In elemental mapping, the brighter, the more elemental content.

Reference

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