Supporting Information

Facile preparation of S-doped magnetite hollow spheres for highly efficient sorption of uranium (VI)

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Adsorption kinetics

Adsorption kinetics studies of S-doped MHS were investigated by two models as pseudo first-order model and the pseudo second-order model. The pseudo first-order model could indicate the initial stage of adsorption process, which is expressed by the following equation:

$$ln(q_e - q_t) = lnq_e - k_1 t \quad (1)$$

where k_1 is the rate constant of pseudo-first-order adsorption, q_e and q_t (mg g^{-1}) is the amount of uranium adsorbed at equilibrium and at time (t), respectively.

For the pseudo-second-order the equation is given as:

$$t/q_t = 1/k_2 \cdot q_e^{\,2} + t/q_e \quad (2)$$

where k_2 is the rate constant of pseudo-second-order adsorption.

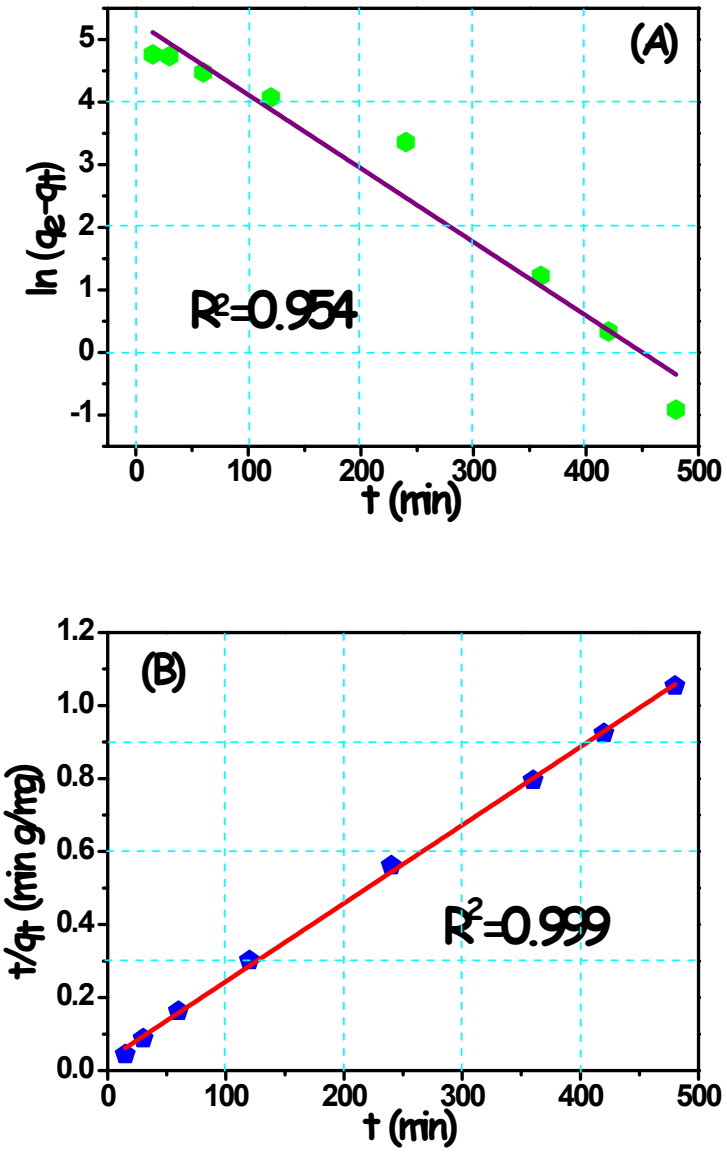


Fig. S1 Pseudo-first-order kinetics and pseudo-second-order kinetics for removal of uranium by S-

doped MHS.

Table S1 Pseudo-first-order and pseudo-second-order constants and values of R^2 for S-doped MHS.

Kinetic model	T (°C)	C_0 (mg/L)	$Q_{e,exp}$ (mg U/g)	$Q_{e,cal}$ (mg U/g)	k_1(min^{-1})/k_2 (g/mg·min)	R^2
Pseudo-first order	25	110.0	455.9	198.9	0.0117	0.9540
Pseudo-second order	25	110.0	455.9	476.2	0.0002	0.9990

Adsorption isotherm model

In the study of adsorption equilibrium isotherm, the Langmuir model and Freundlich model were chosen. The linear equation of Langmuir model is expressed as:

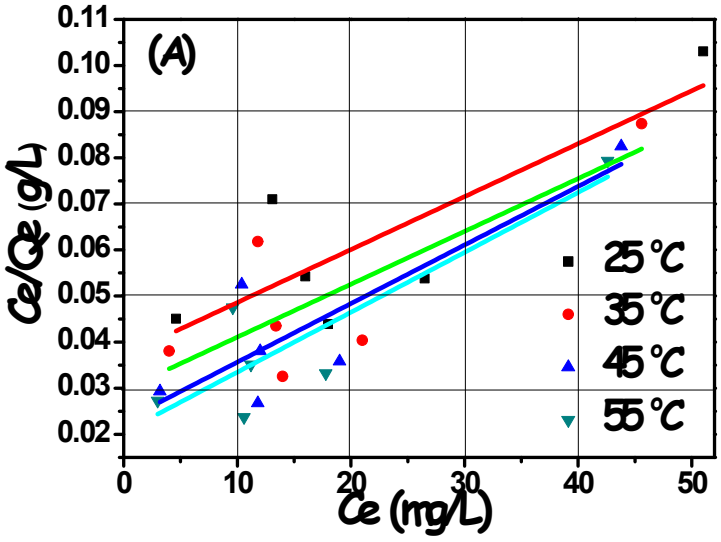
$$C_e / q_e = 1/b \cdot q_m + C_e / q_m \tag{3}$$

where C_e (mg L^{-1}) is the equilibrium concentration of UO_2^{2+} remained in solution, q_e (mg g^{-1}) is the amount of solution adsorbed per unit mass of the adsorbent, q_m (mg g^{-1}) is the maximum adsorption capacity, b is the Langmuir adsorption equilibrium constant.

The Freundlich mode in linear form is based on the assumption that the adsorption process on heterogeneous surface with different adsorption energies. This model is expressed by

$$lnq_e = lnk + \frac{1}{n} lnC_e \tag{4}$$

where k and n are the Freundlich constants related to the adsorption capacity and adsorption intensity, respectively. They are determined from the intercept and slope of the linear plot of ln q_e vs. ln C_e.



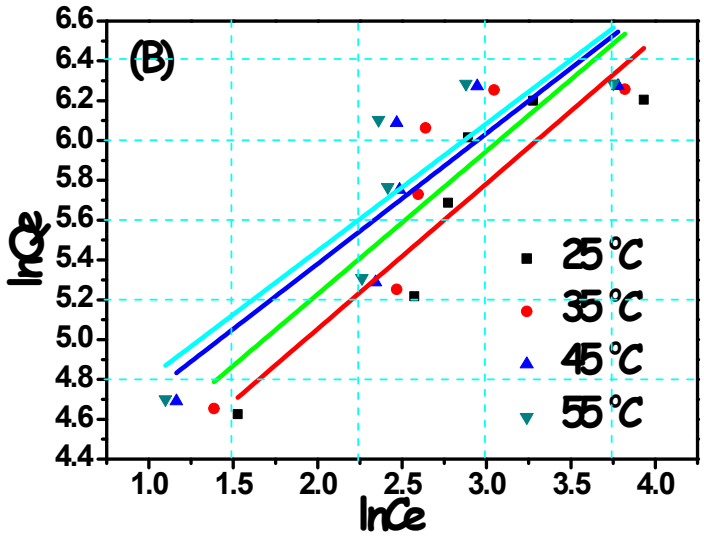


Fig. S2 Langmuir and Freundlich isotherms for removal of uranium by S-doped MHS.

Table S2 Isotherm constants and values of R^2 for S-doped MHS.

T(K)	Langmuir isotherm			Freundlich isotherm		
	Q_m (mg Ug^{-1})	b (L mg^{-1})	R^2	K (L g^{-1})	n	R^2
298	833.3	0.0323	0.6011	36.43	1.371	0.8192
308	833.3	0.0405	0.5602	44.32	1.391	0.7461
318	769.2	0.0567	0.6886	58.62	1.527	0.7287
328	769.2	0.0634	0.7302	64.54	1.653	0.7112