SUPPLEMENTARY INFORMATION

Preparation of neutral red functionalized Fe_3O_4@SiO_2 and its application for magnetic solid phase extraction of trace Hg(II) from environmental water samples

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Pseudo first order and pseudo second order models

The pseudo first order and pseudo second order models can be expressed by Eqs. (S1) and (S2) [1], respectively:

$$\ln\frac{(q_e - q_t)}{q_e} = -k_1 t \quad \text{(S1)}$$

$$\frac{t}{q_t} = \frac{1}{k_2 {q_e}^2} + \frac{t}{q_e} \quad \text{(S2)}$$

Here, in Eq. (S1), k_1 is the pseudo first order rate constant (min^{-1}) of the adsorption, and q_e and q_t ($mg\ g^{-1}$) are the amounts of metal ion adsorbed at equilibrium time and at time t, respectively. The values of $\ln(q_e-q_t)$ were calculated from the experimental data and used to plot against t (min). In Eq. (S2), k_2 is the pseudo second order rate constant of the adsorption. The values of q_e and k_2 could be calculated from slope and intercept of the linear plot of t/q_t vs. t. The kinetic parameters acquired from fitting results were summarized in Table S1.

Table S1. Kinetic parameters for the pseudo first order and pseudo second order models for Hg(II) adsorption by Fe_3O_4@SiO_2-NR

C_0 mg L^{-1}	q_e(exp) (mg g^{-1})	Pseudo first order kinetics			Pseudo second order kinetics		
		k_1	q_e,cal	R_1^2	k_2	q_e,cal	R_2^2
2	1.93	0.004	0.226	0.665	1.41	1.92	0.999

Langmuir and Freundlich adsorption isotherm models

The Langmuir isotherm [2] is given as:

$$\frac{C_e}{q_e} = \frac{C_e}{q_m} + \frac{1}{q_m K_L} \quad \text{(S3)}$$

where q_e is the equilibrium amount of Cd(II) adsorbed on the absorbent (mg g^{-1}), q_m is the maximum adsorption capacity of Cd(II) on the adsorbent (mg g^{-1}), C_e describes the equilibrium concentration of Cd(II) (mg L^{-1}), and K_L (L mg^{-1}) is a Langmuir adsorption constant related to the adsorption energy.

The Freundlich model [2] can be presented by

$$\ln q_e = \ln K_F + \frac{1}{n}\ln C_e \quad \text{(S4)}$$

where q_e and C_e have the same meanings with those in the Langmuir model, and K_F and n are

Freundlich constants related to the maximum adsorption capacity and the adsorption intensity, respectively.

Table S2. Langmuir and Freundlich parameters for Hg(II) adsorption by Fe_3O_4@SiO_2-NR

T(℃)	Langmuir model			Freundlich model		
	K_L (L mg^{-1})	q_m(mg g^{-1})	R^2	K_F	n	R^2
30	0.05	83.71	0.997	5.62	1.91	0.971

References

[1] R.R. Shan, L.G. Yan, K. Yang, Y.F. Hao, B. Du, Adsorption of Cd(II) by Mg–Al–CO_3^- and magnetic Fe_3O_4/Mg–Al–CO_3^-layered double hydroxides: Kinetic, isothermal, thermodynamic and mechanistic studies, J. Hazard. Mater. 299 (2015) 42-49.

[2] W. Song, B. Gao, X. Xu, F. Wang, N. Xue, S. Sun, W. Song, R. Jia, Adsorption of nitrate from aqueous solution by magnetic amine-crosslinked biopolymer based corn stalk and its chemical regeneration property, J. Hazard. Mater. 304 (2016) 280-290