Supporting Information

Effects of magnesium hydroxide morphology on Pb(II) removal from aqueous solutions

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Adsorption experiments

The Pb(II) ion removal efficiency (E%) and the adsorption capacity (q_t) of MH were calculated using Eqs. (1) and (2), respectively.

$$E = \frac{(C_0 - C_t)}{C_0} \times 100\% \quad (1)$$

$$q_t = \frac{(C_0 - C_t)V}{m} \quad (2)$$

where C_0 (mg/L) represents the initial Pb(II) ion concentration, C_t (mg/L) denotes the concentration in solution at a given time t, V (L) is the volume of the Pb(II) ion solution, and m (g) signifies the weight of MH added.

To further investigate adsorption kinetics, the experimental data were fitted with the pseudo-first-order and pseudo-second-order kinetic models, as expressed below:

$$ln(q_e - q_t) = lnq_e - k_1 t \quad (3)$$

$$\frac{t}{q_t} = \frac{1}{k_2 \cdot {q_e}^2} + \frac{1}{q_e}t \quad (4)$$

where q_t (mg·g^{-1}) and q_e (mg·g^{-1}) represent the adsorption amount of Pb(II) by MH at time t (min) and equilibrium, respectively. K_1 (min^{-1}) and K_2 (g·mg^{-1}·min^{-1})) denote the equilibrium rate constants in the pseudo-first-order and pseudo-second-order kinetic models, respectively.

The adsorption isotherms of Pb(II) on both FGMH and HPMH were evaluated using the Langmuir model (Eq. (5)) and the Freundlich model (Eq. (6)).

$$\frac{c_e}{q_e} = \frac{c_e}{q_m} + \frac{1}{q_m k_L} \quad (5)$$

$$ln\, q_e = ln\, k_F + \frac{1}{n} ln\, c_e \quad (6)$$

where C_e (mg·L^{-1}) signifies the equilibrium concentration of Pb(II), q_m (mg·g^{-1}) denotes the calculated maximum adsorption capacity of MH, and q_e (mg·g^{-1}) represents the adsorption capacity of MH measured experimentally at equilibrium. K_L (L·mg^{-1}) and K_F (mg·g^{-1}) correspond to the Langmuir constant and Freundlich constant, respectively. The Freundlich exponent 'n' reflects the adsorption strength.

Acid dissolution-electrolysis experiments

In the acid dissolution-electrolysis experiments, 30 mg of the solid product containing adsorbed lead by FGMH was dissolved in dilute nitric acid. Subsequently, the solution was diluted to a final volume of 50 mL using deionized water, and its pH was adjusted to approximately 5.0. This solution served as the electrolyte, and a polytetrafluoroethylene electrolytic cell was employed as the reactor. A stainless steel electrode (1 × 2 cm) was utilized as the cathode, while a ruthenium-coated titanium sheet electrode (1 × 2 cm) was employed as the anode. The electrolysis experiment was conducted with a fixed electrode spacing of 20 mm and a constant voltage of 4 V.

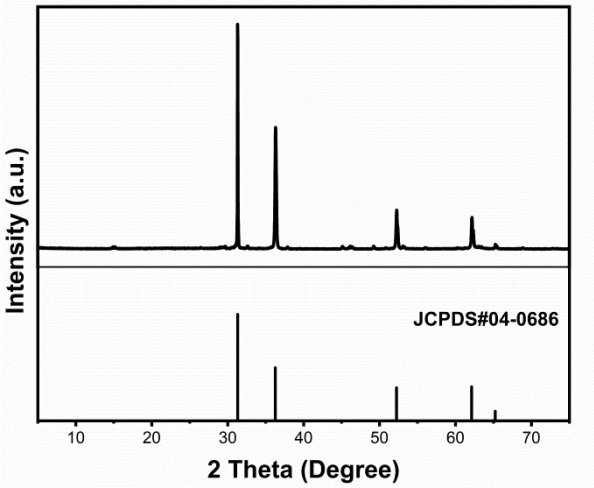

Fig. S1. XRD patterns of the obtained metallic Pb recycled from adsorbed product.