Supplementary Information

Facile synthesis of MgAl layered double hydroxides by co-precipitation method for efficient nitrate removal from water: Kinetics and mechanisms

Zhuwu Jiang[1,2], Jiangnan Wu[1], Xinru Liu[1], Hai Yu[1], Chengyuan Jiao[1], Jyunhong Shen[1], Yanyan Pei[1*]

[1] College of Ecological Environment and Urban Construction, Fujian University of Technology, Fuzhou, Fujian, 350118, China

[2] College of Civil Engineering, Fuzhou University, Fuzhou 350116, China

*Corresponding authors.

E-mail address: peiyanyan715@outlook.com (Y. Pei)

Fifteen Expressions and One Figure Included

(Expression 1-14 and Figure S1)

The calculation expressions related to adsorption is as follows:

$$RE=(C_0-C_t)/C_0 \quad (1)$$

$$Q_t = (C_0-C_t)V/m \quad (2)$$

$$Q_e = (C_0-C_e)V/m \quad (3)$$

Where *RE* is removal rate, C_0 is the NO_3^- initial concentration ($mg \cdot L^{-1}$), C_t and C_e are the NO_3^- concentration at time t and equilibrium ($mg \cdot L^{-1}$), *m* is the mass of adsorbent (g), *V* is the volume of the aqueous solution (L), Q_t and Q_e are the adsorption capacity at time t and equilibrium ($mg \cdot g^{-1}$).

Pseudo-first-order model:

$$Q_t = Q_e(1-e^{-k1t}) \quad (4)$$

Pseudo-second-order model:

$$Q_t = k_2Q_e^2t/(1+k_2Q_et) \quad (5)$$

Intraparticle diffusion model:

$$Q_t = k_it^{0.5}+C \quad (6)$$

Where k_1 (min^{-1}), k_2 ($g\ mg^{-1}\ min^{-1}$), k_i ($mg\ g^{-1}\ min^{-1/2}$) are the rate constant individually for the corresponding model in the Exp 4-6, *C* ($mg\ g^{-1}$) is the intercept.

Langmuir model:

$$Q_e = Q_mK_LC_e/(1+K_LC_e) \quad (7)$$

Freundlich model:

$$Q_e = K_FC_e^n \quad (8)$$

Temkin model:

$$Q_e = b_Tln(K_TC_e) \quad (9)$$

D-R model:

$$Q_e = Q_me^{(-K_{D-R}\varepsilon^2)} \quad (10)$$

$$E = RTln(1+1/C_e) \quad (11)$$

$$E = 1/(2K_{D-R}^{1/2}) \quad (12)$$

Where C_e is the equilibrium concentration ($mg \cdot L^{-1}$), Q_m is the maximum adsorption capacity ($mg \cdot g^{-1}$), K_L is the adsorption equilibrium constant of Langmuir adsorption isotherm mode ($L \cdot mg^{-1}$), K_F is the empirical constant of Freundlich model ($mg \cdot g^{-1}$), K_T is the equilibrium binding constant ($L \cdot mg^{-1}$), b_T is the Temkin constant ($J \cdot mol^{-1}$), $K_{D\text{-}R}$ is the constant of D-R model ($mol^2 \cdot J^{-2}$), ε is the Polanyi adsorption potential energy ($J \cdot mol^{-1}$), E is the adsorption free energy ($kJ \cdot mol^{-1}$).

Van't Hoff equation:

$$\Delta G° = -RT\ln(Q_e/C_e) \quad (13)$$

Gibbs-Helmholtz equation:

$$\Delta G° = \Delta H° - T\Delta S° \quad (14)$$

Where $\Delta G°$ is the free energy change (kJ mol^{-1}), R is the universal gas constant (8.314 kJ mol^{-1} K^{-1}), T is the absolute temperature (K), $\Delta H°$ is the enthalpy change (kJ mol^{-1}), $\Delta S°$ is the entropy change (kJ mol^{-1} K^{-1}).

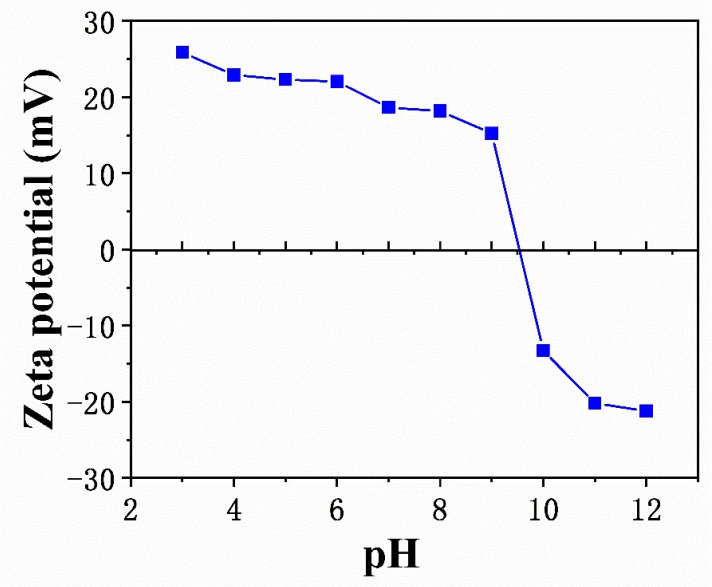

Fig. S1. Zeta potential of Mg_5Al-LDH.