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# Ecofriendly Composite as a Promising Material for Highly-Performance Uranium Recovery from Different Solutions

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**Table S1.** Reminder on equations used for modeling uptake kinetics [1,2].

| Model | Equation | Parameters | Ref. |
|---|---|---|---|
| PFORE | $q(t) = q_{eq,1}(1 - e^{-k_1 t})$ | $q_{eq,1}$ (mmol $g^{-1}$): sorption capacity at equilibrium<br>$k_1$ ($min^{-1}$): apparent rate constant of PFORE | [1] |
| PSORE | $q(t) = \frac{q_{eq,2}^2 k_2 t}{1 + k_2 q_{eq,2} t}$ | $q_{eq,2}$ (mmol $g^{-1}$): sorption capacity at equilibrium<br>$k_2$ (g $mmol^{-1}$ $min^{-1}$): apparent rate constant of PSORE | [1] |
| RIDE | $\frac{q(t)}{q_{eq}} = 1 - \sum_{n=1}^{\infty} \frac{6\alpha(\alpha+1)\exp\left(\frac{-D_e q_n^2}{r^2} t\right)}{9 + 9\alpha + q_n^2 \alpha^2}$<br>With $q_n$ being the non-zero roots of<br>$\tan q_n = \frac{3 q_n}{3 + \alpha q_n^2}$ and $\frac{m q}{V C_0} = \frac{1}{1+\alpha}$ | $D_e$ ($m^2$ $min^{-1}$) : Effective diffusivity coefficient | [2] |

(m (g): mass of sorbent; V (L): volume of solution; $C_0$ (mmol $L^{-1}$): initial concentration of the solution).

**Table S2.** Reminder on equations used for modeling sorption isotherms.

| Model | Equation | Parameters | Ref. |
|---|---|---|---|
| Langmuir | $q_{eq} = \frac{q_{m,L} C_{eq}}{1 + b_L C_{eq}}$ | $q_{m,L}$ (mmol $g^{-1}$): Sorption capacity at saturation of monolayer<br>$b_L$ (L $mmol^{-1}$): Affinity coefficient | [3] |
| Freundlich | $q_{eq} = k_F C_{eq}^{1/n_F}$ | $k_F$ (mmol $g^{-1}$)/(mmol $L^{-1})^{n_F}$ and $n_F$: empirical parameters of Freundlich equation | [4] |
| Sips | $q_{eq} = \frac{q_{m,S} b_S C_{eq}^{1/n_S}}{1 + b_S C_{eq}^{1/n_S}}$ | $q_{m,L}$ (mmol $g^{-1}$), $b_S$ (mmol $L^{-1})^{n_S}$, and $n_S$: empirical parameters of Sips equation (based on Langmuir and Freundlich equations) | [5] |
| Temkin | $q_{eq} = \frac{RT}{b_T} \ln(A_T\, C_{eq})$ | $A_T$ (L $mmol^{-1}$): equilibrium binding capacity;<br>$b_T$: Temkin constant related to sorption heat (J $kg^{-1}$ $mol^{-2}$) | [6] |
| D-R* | $q_{eq} = q_{m,DR} exp\left\{-\beta_{DR}\left[RT\, ln\left(1 + \frac{1}{C_{eq}}\right)\right]^2\right\}$ | $q_{m,DR}$ (mmol $g^{-1}$): maximum adsorption capacity;<br>$\beta_{DR}$ ($mol^2$ $kJ^{-2}$): constant associated with adsorption energy.<br>$E_{DR} = \frac{1}{\sqrt{2\beta_{DR}}}$: mean free energy of sorption (kJ $mol^{-1}$) | [7] |

*, herein $C_{eq}$ must be expressed in molar unit for respecting the dimensionless term ($1/C_{eq} = C^*/Ceq$, where $C^*$ is the arbitrary concentration

Akaike Information Criterion, AIC [8]:

$$AIC = N \ln\left(\frac{\sum_{i=0}^{N}\left(y_{i,exp.} - y_{i,model}\right)^2}{N}\right) + 2N_p + \frac{2N_p\left(N_p + 1\right)}{N - N_p - 1}$$

Where N is the number of experimental points, $N_p$ the number of model parameters, $y_{i,exp.}$ and $y_{i,model}$ the experimental and calculated values of the tested variable.

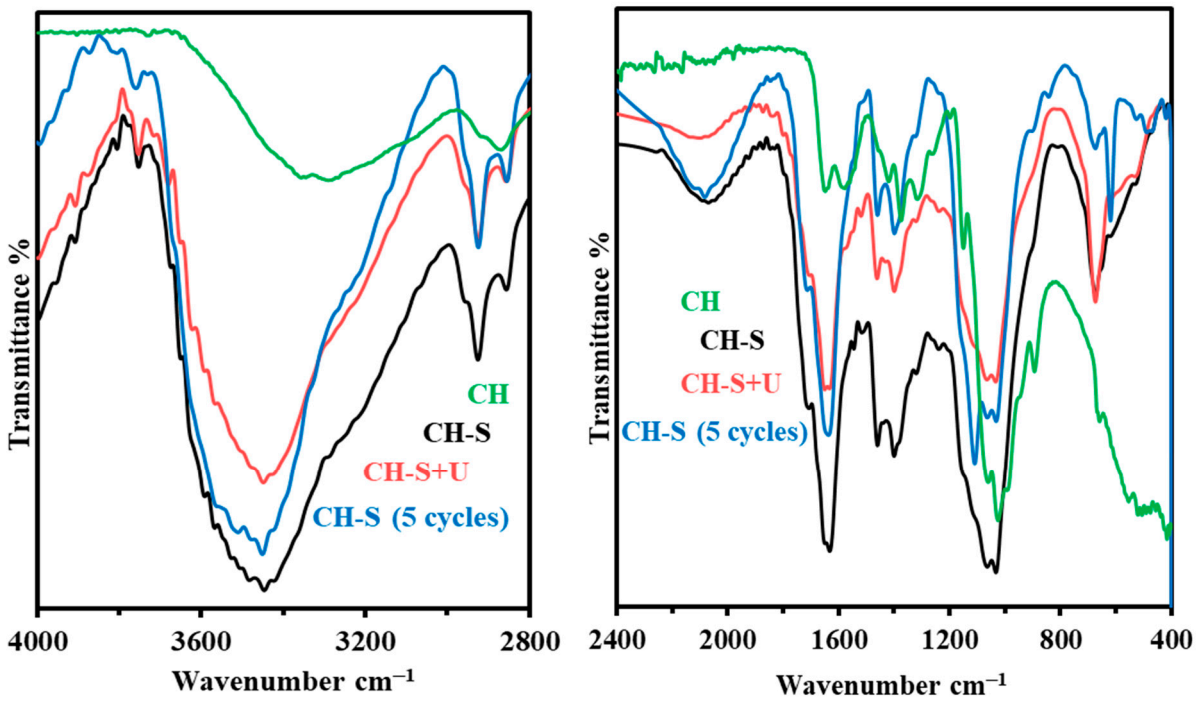


**Figure S1.** FTIR spectra of most interested vibrational bands for CH, CH-S, after loading and after 5 cycles of sorption desorption process.

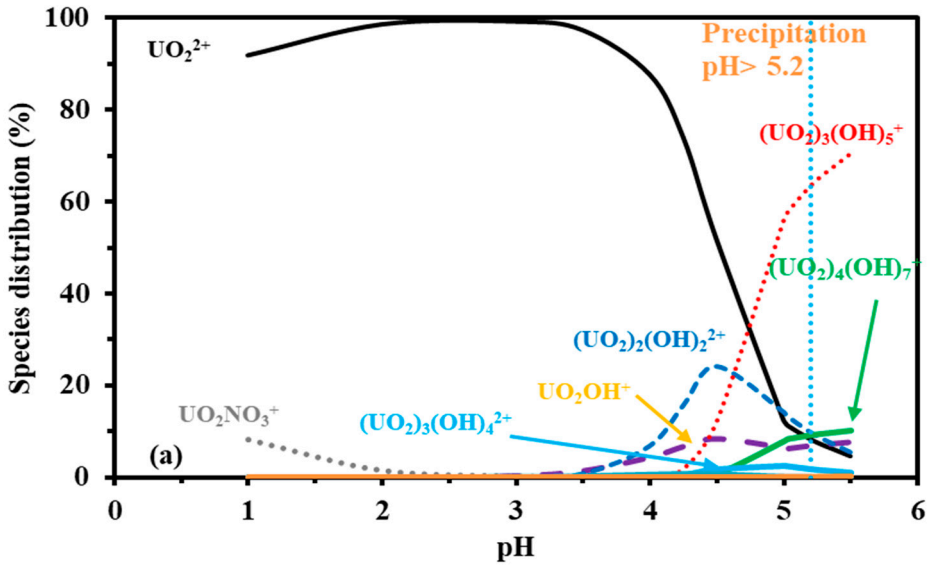


**Figure S2.** Uranyl species with different pH values.

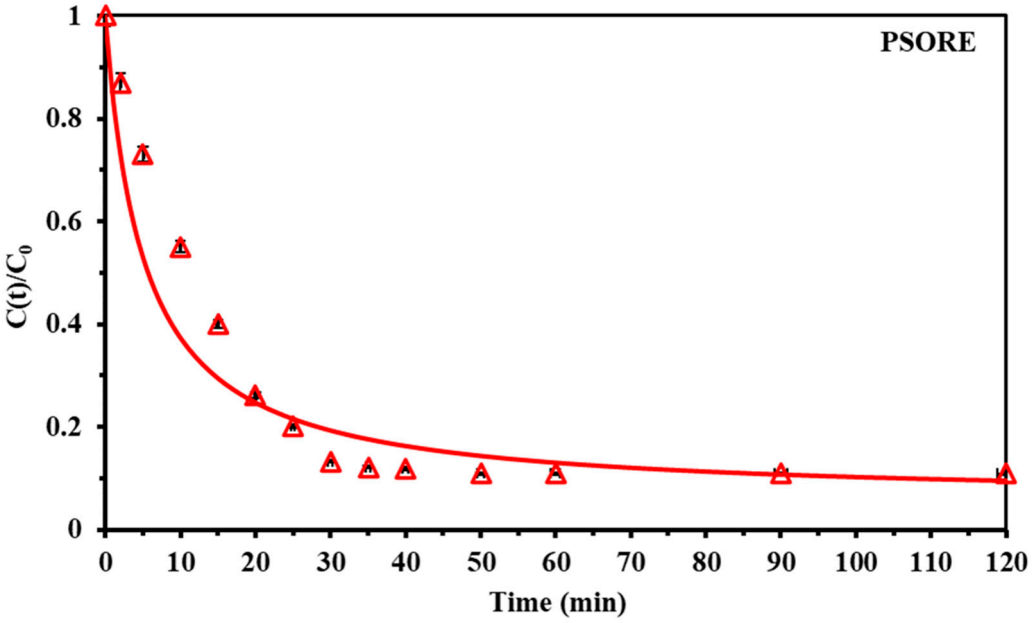


**Figure S3.** The PSORE of the uptake kinetics.

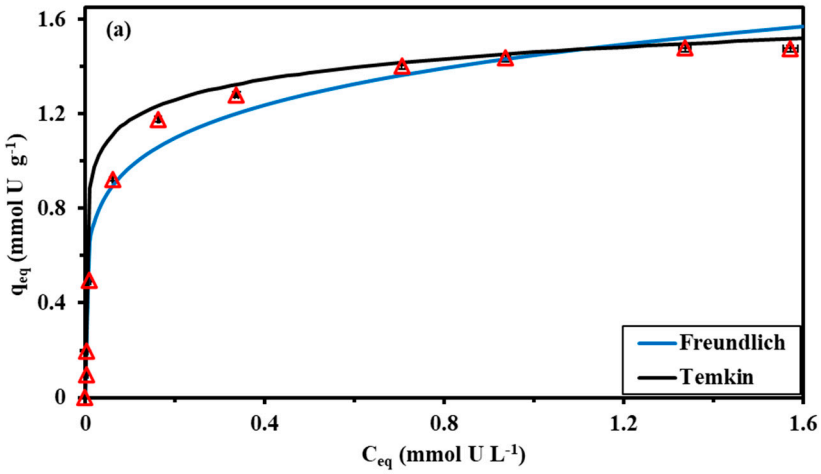


**Figure S4.** The Freundlich and Tamkin models for application to fit the sorption isotherms.

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