Supporting Information

Instantaneous adsorption of synthetic dyes from the aqueous environment using kaolinite nanotubes; equilibrium and thermodynamic studies

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Content

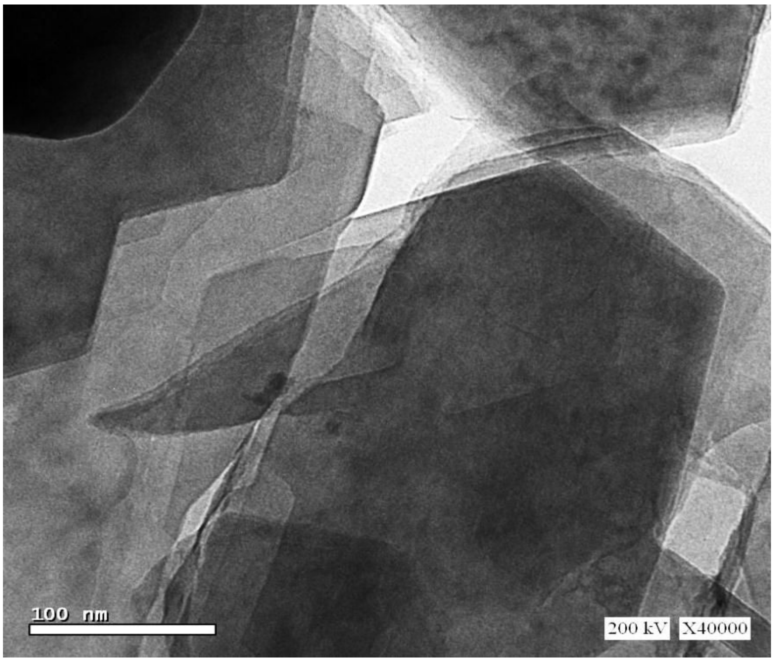

Figure S1. TEM image of raw kaolinite mineral

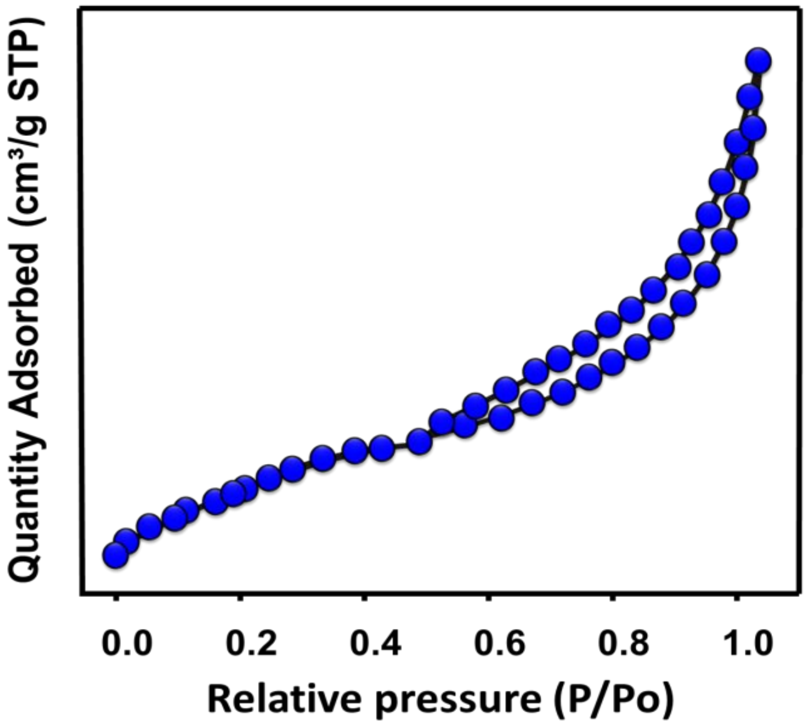

Figure S2. the nitrogen adsorption/desorption isotherm curves of KNTs

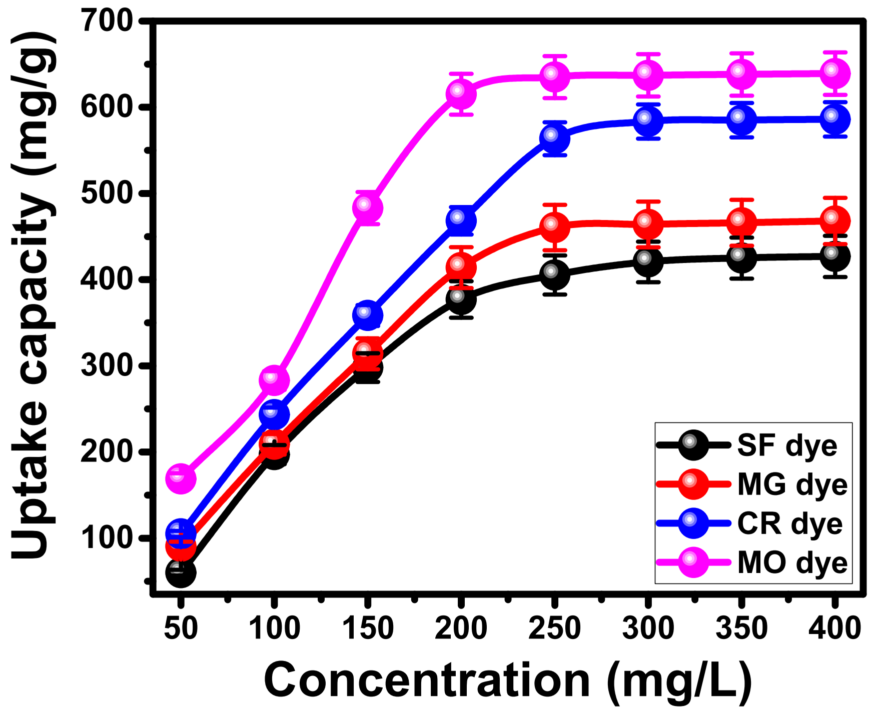

Figure S3. the uptake capacity of KNTs at different concentrations of SF, MG, CR, and MO dyes

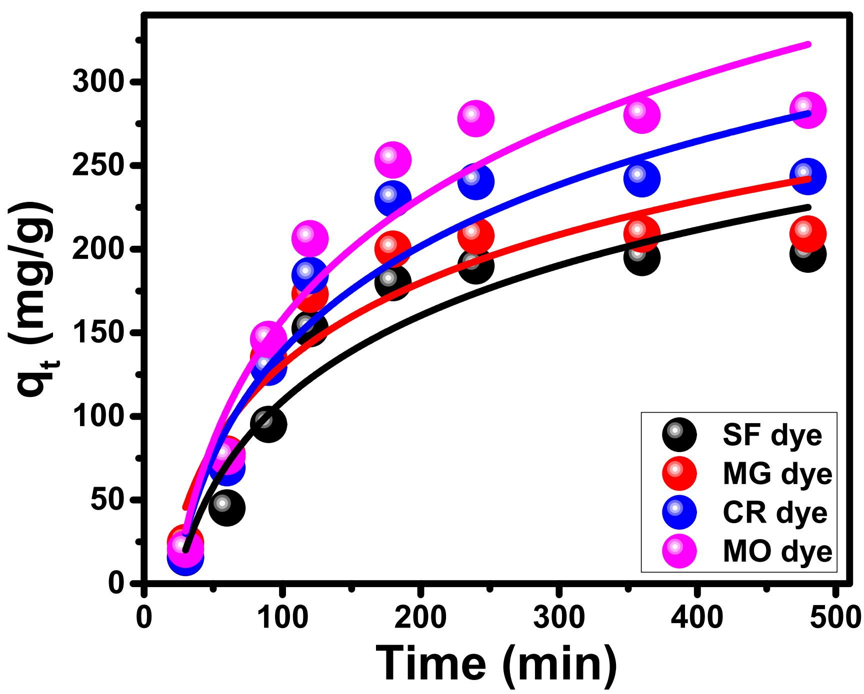

Figure S4. Fitting of the dyes adsorption results with Elovich kinetic model

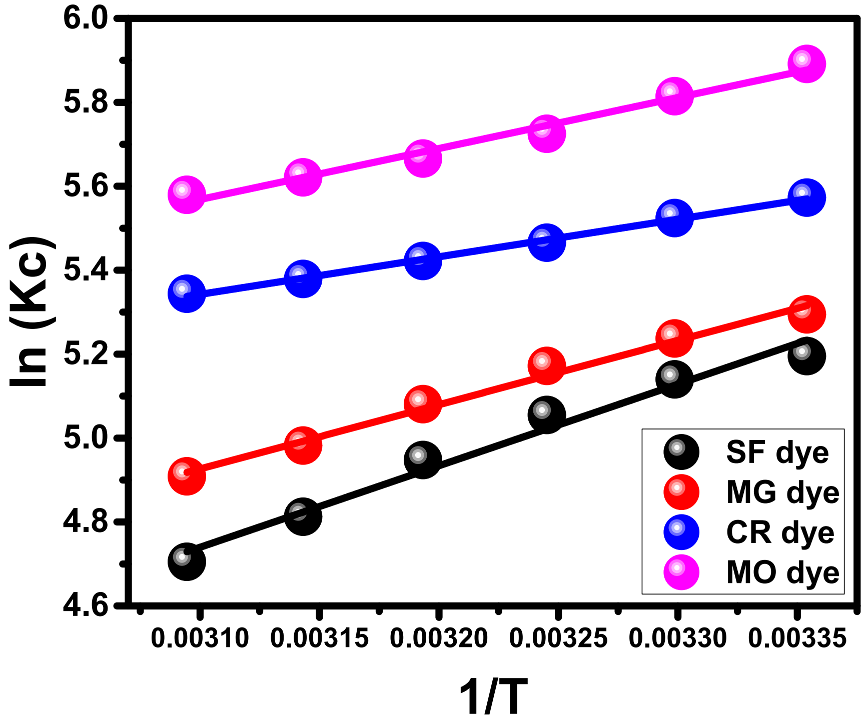

Figure S5. fitting of the dyes adsorption results with Van't Hoff Hof equation

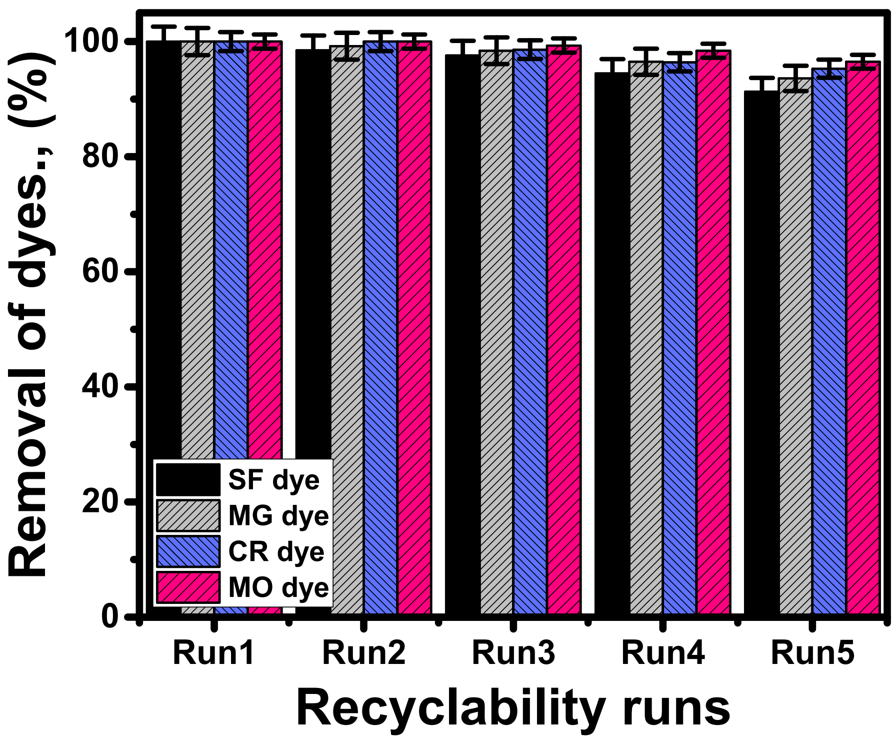

Figure S6. the removal percentages of SF, MG, CR, and MO dyes at the recyclability tests of KNTs

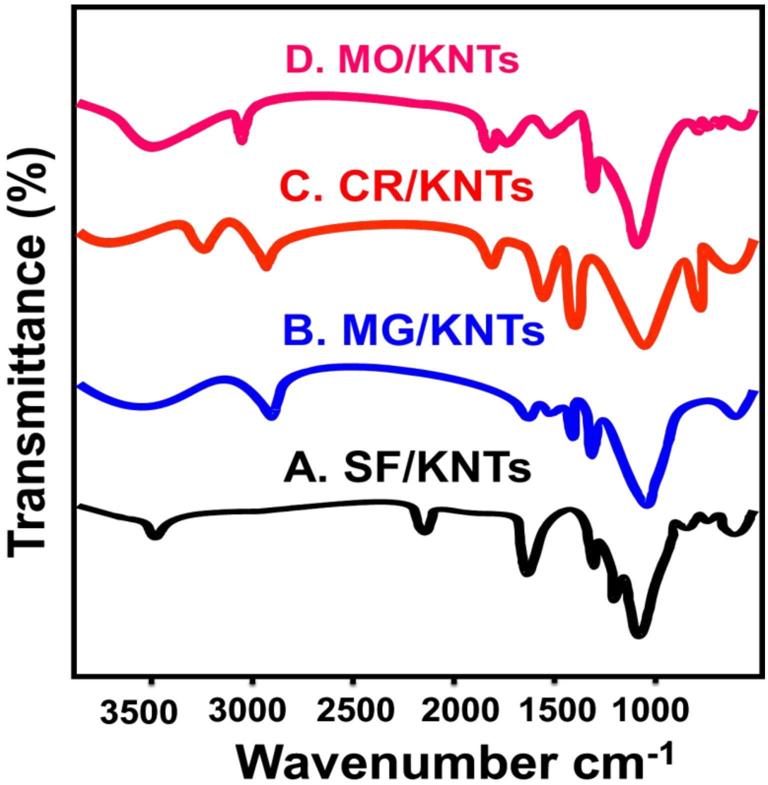

Figure S7. the FT-IR spectra of KNTs after the adsorption of SF (A), MG (B), CR (C), and MO dyes (D)

Table S1. the representative equations of the studied kinetic and isotherm model and their parameters

Kinetic models		
Model	**Linear equation**	**Parameters**
Pseudo-first-order	$\ln(q_e - q_t) = \ln\ q_e - k_1 t$ (linear) $q_t = q_e(1 - e^{-k_1.t})$ $(Nonlinear)$	q_t (mg/g) is the adsorbed ions at time (t), and K_1 is the rate constant of the first-order adsorption (min^{-1})
Pseudo-second-order	$\frac{t}{q_t} = \frac{1}{K_2 q_e^2} + \frac{t}{q_e}$ $(Linear)$ $q_t = \frac{q_e^2 k_2 t}{1 + q_e k_2 t}$ $(Nonlinear)$	qe is the quantity of adsorbed ions after equilibration (mg/g), and K_2 is Lagergren model rate constant (g/mg min).
Elovich model	$q_t = \frac{1}{\beta}\ln(\alpha\beta) + \frac{1}{\beta} In\,(t)$ $(Linear)$ $q_t = \frac{1}{\beta}\mathrm{Ln}\,(1 + \alpha\beta_t)$ (Nonlinear)	α is the initial adsorption rate (mg/min) and β is the surface saturation (g/mg)
Intra-particle diffusion	$q_t = K_P t^{1/2} + C$ (Linear) $q_t = kt^{0.5} + C$ (Nonlinear)	k_p (mg g^{-1} min $^{-0.5}$) is the intraparticle diffusion rate constant and C is the intercept of the line
Isotherm models		
Model	**Equation**	**Parameters**
Langmuir	$\frac{C_e}{q_e} = \frac{1}{b q_{max}} + \frac{C_e}{q_{max}}$ $(Linear)$ $q_e = \frac{q_{max}\, bC_e}{(1 + bC_e)}$ $(Nonlinar)$	C_e is the rest ions concentrations (mg/L), q_{max} is the theoritical maximum adsorption capacity (mg/g), and *b* is the Langmuir constant (L/mg)
Freundlich	$Log\ qe = (1/n)\ log\ Ce + log\ K_f$ *(Linear)* $q_e = K_f C_e^{1/n}$ *(Nonlinear)*	K_F is the constant of Freundlich model related to the adsorption capacity and n is the constant of Freundlich model related to the adsorption intensities
Dubinin–Radushkevich	$\ln(qe) = \ln(q_m) - \beta\varepsilon^2$ $(Linear)$ $q_e = q_m e^{-\beta\varepsilon^2}$ *(Nonlinear)*	β (mol^2/KJ^2) is the D-R constant, ε (KJ^2/mol^2) is the polanyil potential, and q_m is the adsorption capacity