

Ecofriendly Synthesis of Magnetic Composites Loaded on Rice Husks for Acid Blue 25 Decontamination: Adsorption Kinetics, Thermodynamics, and Isotherms

SUPPLEMENTARY DATA

Table S1. Equations used for Calculation of Thermodynamic Parameters

Thermodynamics	(Equation)	Plot	Reference
ΔG° (KJ/mol)	$\Delta G^\circ = -RT \ln K_L$	1/T vs. $\ln K_L$	[1]
ΔH° (KJ/mol)	$\Delta H^\circ = -\text{slope} \times R$		[1]
ΔS° (J/K*mol)	$\Delta S^\circ = \text{intercept} \times R$		

Table S2. Isothermal Models and Equations Applied on Adsorption of Acid Blue 25

Adsorption Isotherms				
	Linear Form	Non-Linear Form	Plot	Reference
Freundlich	$\ln(q_e) = \ln K_F + \left(\frac{1}{n}\right) \times \ln(C_e)$	$q_e = K_F C_e^{1/n}$	$\ln q_e$ vs. $\ln C_e$	[2]
Langmuir-I	$q_e = \frac{q_{mL} \cdot K_L \cdot C_e}{1 + K_L \cdot C_e}$	$\frac{C_e}{q_e} = \frac{1}{q_{mL}} C_e + \frac{1}{q_{mL} K_L}$	$\frac{C_e}{q_e}$ vs. C_e	[2]
Langmuir-II	-	$\frac{1}{q_e} = \frac{1}{q_{mL} K_L} \left(\frac{1}{C_e}\right) + \frac{1}{q_{mL}}$	$\frac{1}{q_e}$ vs. $\frac{1}{C_e}$	
Langmuir-III	-	$q_e = q_{mL} - \left(\frac{1}{K_L}\right) \frac{q_e}{C_e}$	q_e vs. $\frac{q_e}{C_e}$	
Langmuir-IV	-	$\frac{q_e}{C_e} = K_L q_{mL} - K_L q_e$	$\frac{q_e}{C_e}$ vs. q_e	
Dubinin-Radushkevich	$\ln q_e = \ln q_{mDR} - K_{DR} \varepsilon^2$	$q_e = q_{mDR} e^{-K_{DR} \varepsilon^2}$ $\varepsilon = RT \ln \left(1 + \frac{1}{C_e}\right)$ $E = \frac{1}{\sqrt{2K_{DR}}}$	$\ln q_e$ vs. ε^2	[3]
Temkin	$q_e = \frac{RT}{B_T} \ln K_T + \frac{RT}{B_T} \ln C_e$	$q_e = \frac{RT}{B_T} \ln K_T C_e$	q_e vs. $\ln C_e$	[4]

Table S3. Kinetic Models Applied on Adsorption of Acid Blue 25

Adsorption Kinetic Models			
Pseudo Second Order		Equation	Plot
Linear Forms	Type 1	$\frac{t}{q_t} = \frac{1}{k_2 q_e^2} + \left(\frac{1}{q_e}\right) t$	t/q_t vs. t
	Type2	$\frac{1}{q_t} = \left(\frac{1}{k_2 q_e^2}\right) \frac{1}{t} + \left(\frac{1}{q_e}\right)$	$1/q_t$ vs. $1/t$
	Type 3	$\frac{q_t}{t} = k q_e^2 - k q_e q_t$	q_t/t vs. q_t
	Type 4	$q_t = q_e - \left(\frac{1}{k q_e}\right) \frac{q_t}{t}$	q_t vs. q_t/t
Pseudo Second Order (Non-Linear Form)		$q_t = \frac{k_2 q_e^2 t}{1 + k_2 q_e t}$	$1/q_t$ vs. $1/t$
Pseudo First Order (Linear Form)		$\ln(q_e - q_t) = \ln(q_e) - k_1 t$	$\ln(q_e - q_t)$ vs. t
Pseudo First Order (Non-Linear Form)		$q_t = q_e (1 - e^{-k_1 t})$	q_t vs. t
Intraparticle Diffusion Kinetic Model (Linear and Non-Linear Form)		$q_t = K_{Diff} t^{1/2} + C$	q_t vs. $t^{1/2}$
Elovich Kinetic Model (Linear Form)		$q_t = \frac{1}{\beta} \ln(\alpha\beta) + \frac{1}{\beta} \ln t$	q_t vs. $\ln t$
Elovich Kinetic Model (Non-Linear Form)		$q_t = \frac{1}{\beta} \ln(\alpha\beta t + 1)$	q_t vs. t

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Table S4. Chemicals and Equipment used for the Work

Chemical/Equipment	Make
FeCl ₃ .6H ₂ O	Sigma Aldrich, Germany
NaOH	BDH
Millipore water	Sigma Aldrich, Germany
Acid Blue 25	Sigma Aldrich, Germany
TGA	Schimidzu (model = SDT Q 600 V8.2 Build 100)
FTIR	Model Shimadzu AIM-8800
SEM	JEOL model 2300

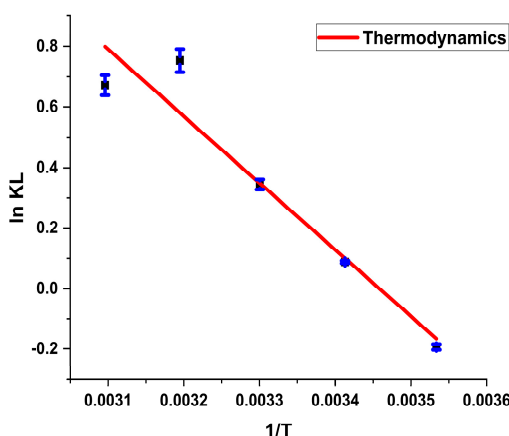


Figure S1. Thermodynamics for Acid Blue 25

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