

Low-Cost Zeolite X as a High-Efficiency Adsorbent for Malachite Green Removal from aqueous solutions

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Supplementary data

Table S1. Equations of the kinetic and isotherm models used for the fitting of the experimental data of the MG removal by the Z-X

	Model	Equation
Kinetic	Pseudo-first-order	$q_t = q_e[1 - \exp(-k_1 t)]$
	Pseudo-second-order	$q_t = \frac{k_2 t q_e^2}{1 + k_2 t q_e}$
	Intra-particle diffusion	$q_t = K_{diff} t^{1/2} + C$
	Elovich	$q_t = \frac{1}{\beta} \ln(\alpha\beta) + \frac{1}{\beta} \ln(t)$
Isotherm	Langmuir	$q_e = \frac{q_m K_L C_e}{1 + K_L C_e}$
	Freundlich	$q_e = K_F C_e^{1/n}$
	Temkin	$q_e = \frac{RT}{B} \ln(AC_e)$

Note: k_1 (min^{-1}) and k_2 ($\text{g} \cdot \text{mg}^{-1} \cdot \text{min}^{-1}$) are the Pseudo-first-order and Pseudo-second-order adsorption rate constants, respectively, q_t and q_e ($\text{mg} \cdot \text{g}^{-1}$) are the MG adsorbed amount at time “t” equilibrium. K_{diff} is the intraparticle diffusion rate constant and C (mg g^{-1}) is the intercept, α is the initial adsorption rate ($\text{mg g}^{-1} \text{min}^{-1}$), β is activation constant (mg g^{-1}), q_m ($\text{mg} \cdot \text{g}^{-1}$) was the maximum amount of MG adsorption in the Langmuir isotherm model, respectively; K_L ($\text{L} \cdot \text{mg}^{-1}$) is Langmuir isotherm constant; K_F ($\text{mg}^{(1-1/n)} \cdot \text{L}^{1/n} \cdot \text{g}^{-1}$) and n are the Freundlich constants.

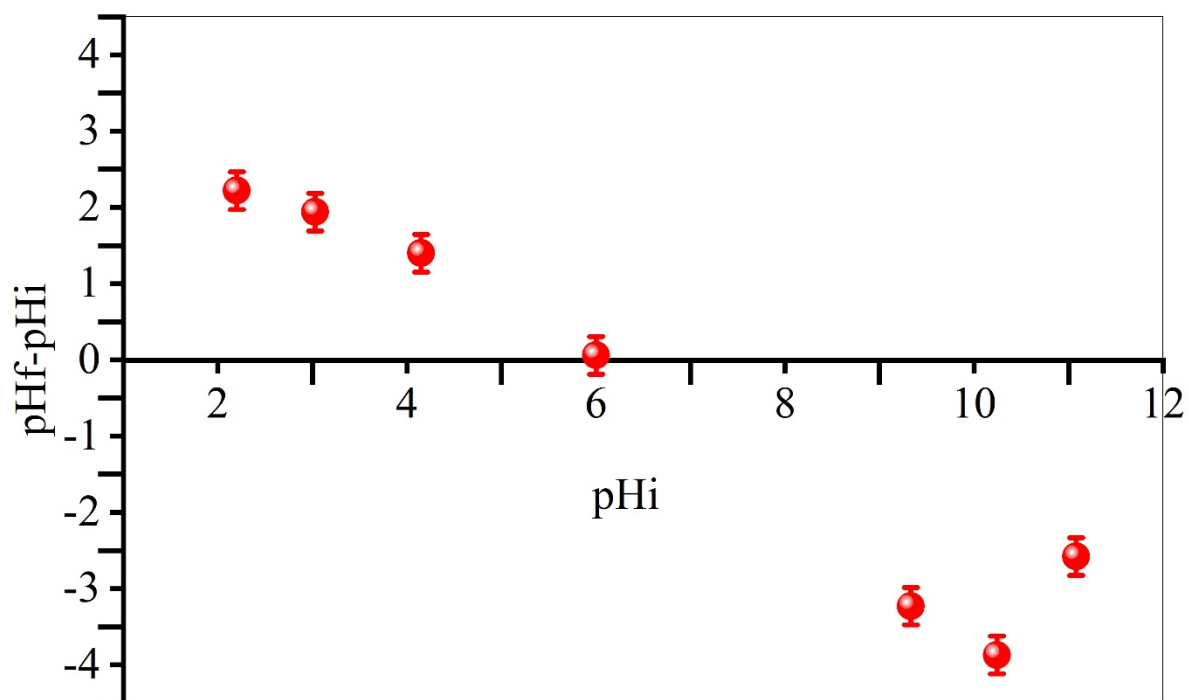


Fig. S1. Assessment of the pH_{pzc} of the Z-X

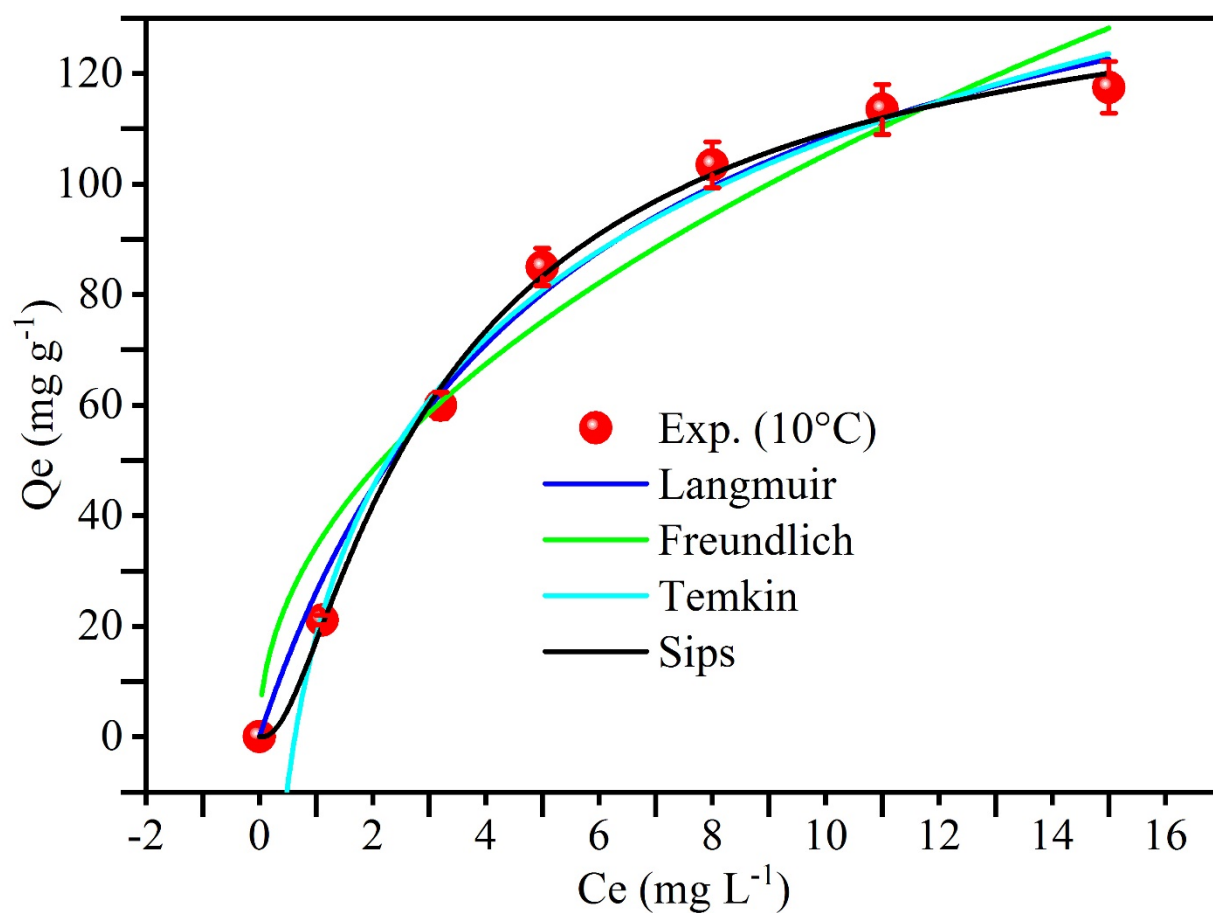


Fig. S2. Isotherm experimental and fitted data of MG removal using zeolite X at 10°C (Time: 60 min, Volume: 25 mL, pH: 6.06, time: 60 min, adsorbent 0.4 g L^{-1})

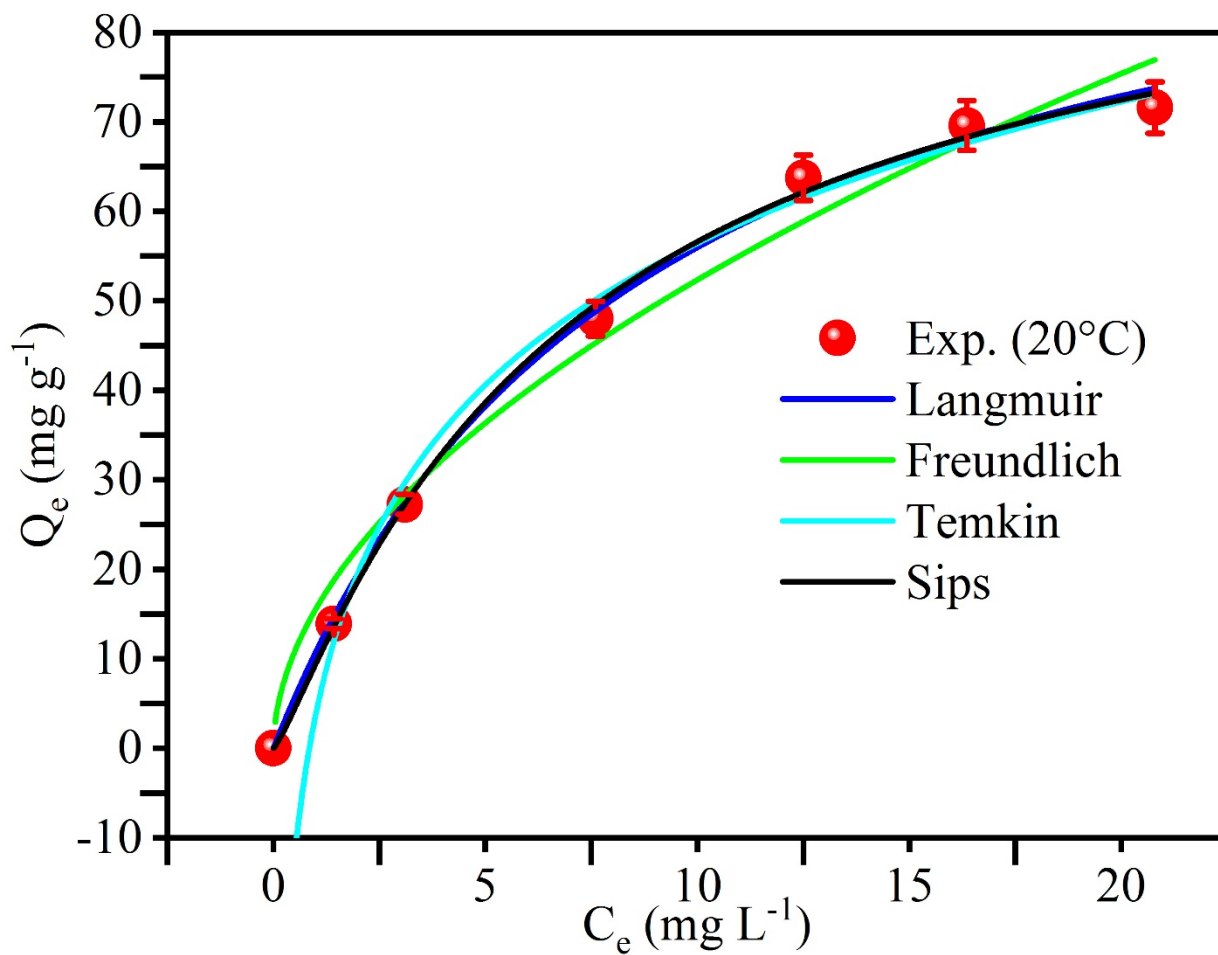


Fig. S3. Isotherm experimental and fitted data of MG removal using zeolite X at 20 °C (Time: 60 min, Volume: 25 mL, pH: 6.06, time: 60 min, adsorbent 0.4 g L⁻¹)

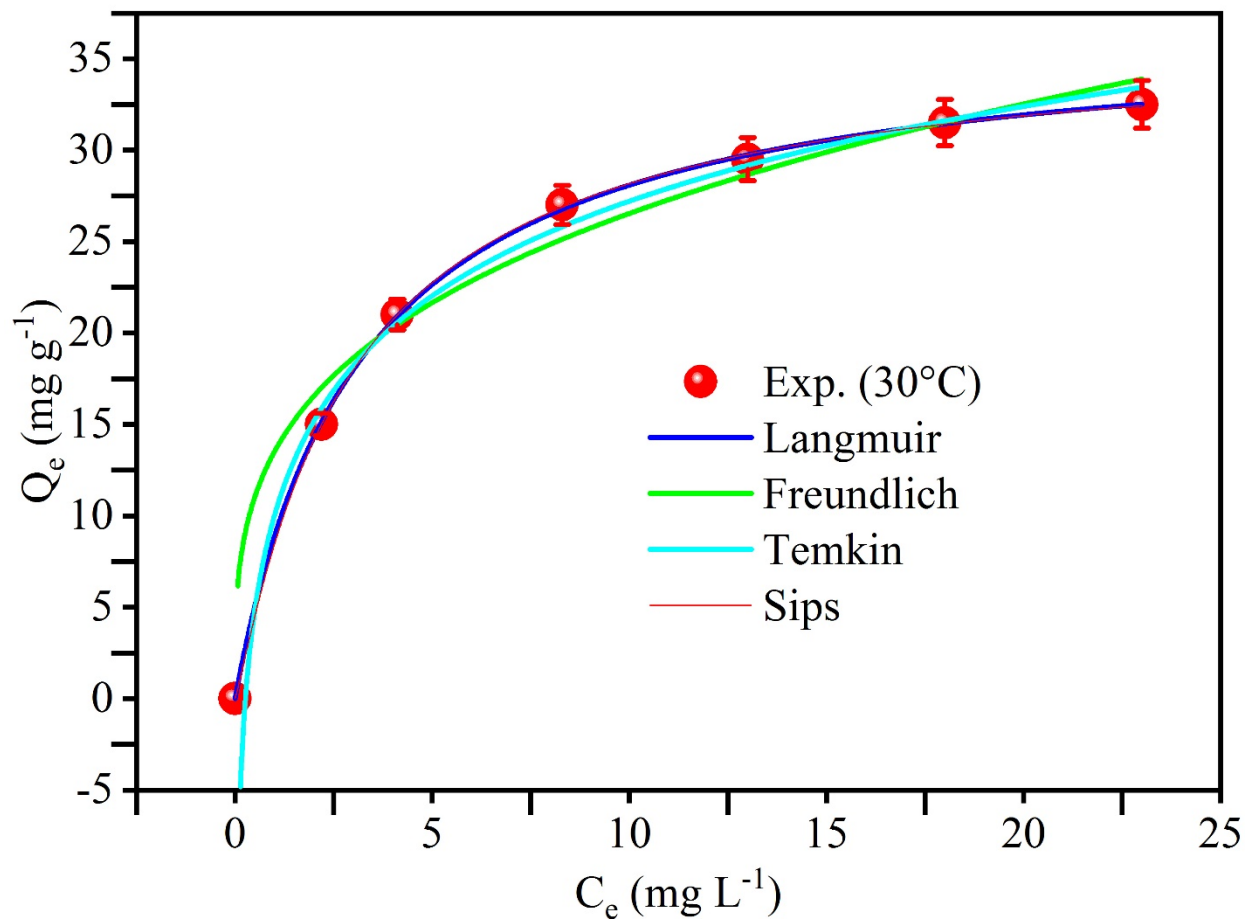


Fig. S4. Isotherm experimental and fitted data of MG removal using zeolite X at 30 °C (Time: 60 min, Volume: 25 mL, pH: 6.06, time: 60 min, adsorbent 0.4 g L⁻¹)

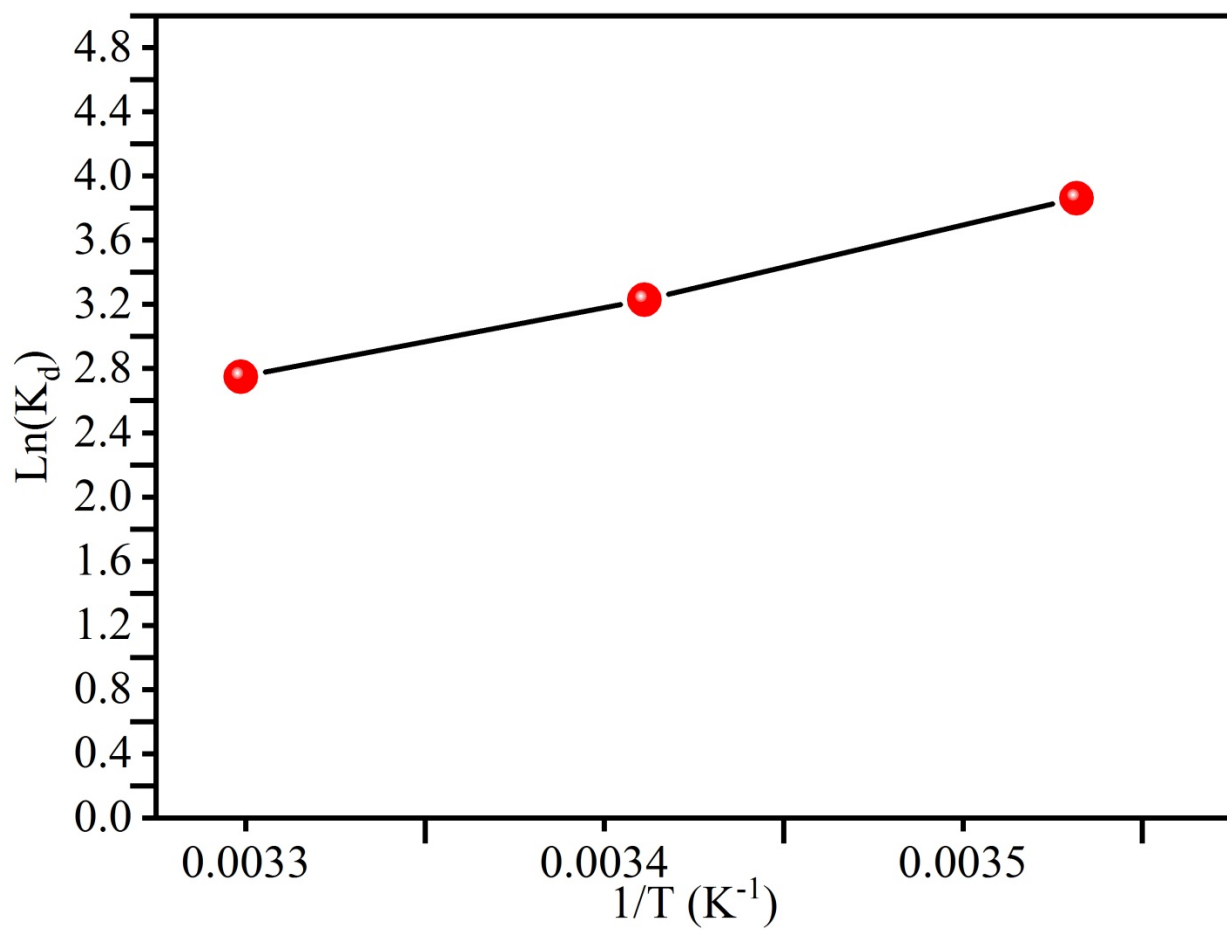


Fig. S5. Plot of $\ln(K_d)$ versus $1/T$