Effectiveness Comparison of Octyltrimethoxysilane and Hexadecyltrimethoxysilane Functionalized on Natural Silica-Coated Magnetic Materials for Ciprofloxacin and Chloramphenicol Adsorption

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Table S1 Mathematical models used to study adsorption kinetics.

Kinetic Model	Linear Form	Graph Plot	Parameter	References
PFO	$\ln(q_e - q_t) = -k_1 t + \ln(q$	ln (qe-qt) vs t	$q_e = e^{intersep}$ k_1= -slope	Neolaka et al. (2018)[1]
PSO	$\frac{t}{q_t} = \left(\frac{1}{q_e}\right)t + \frac{1}{k_2 q_e^2}$	t/qt vs t	q_e=1/slope; k_2= slope^2/intersep	Movasaghi et al. (2019)[2]
Elovich	$q_t = \frac{1}{\beta}\ln(t) + \frac{1}{\beta}\ln(\alpha\beta)$	q_t vs ln t	β = 1/slope; ln (βα) = intersep x β	Tran et al. (2022)[3]

Table S2 The mathematical model used to study adsorption isotherms

Isoterm Model	Linear Equation	Graph Plot	Parameter	References
Langmuir	$\frac{c_e}{q_e} = \frac{1}{q_{maks} K_L} + \frac{1}{q_{max}} c_e$	$\frac{c_e}{q_e}$ vs c_e	q_{max} = 1/slope K_L= 1/$_{qmaks}$.intersep	Ji et al. (2024)[4]
Freundlich	$\ln q_e = \ln K_f + \frac{1}{n}\ln C_e$	ln q_e vs ln c_e	In K_f = intersep 1/n_f= slope	Naat et al. (2023)[5]
Redlich-Peterson	$\ln\frac{C_e}{q_e} = g \ln C_e - \ln K_R$	$\ln\frac{C_e}{q_e}$ vs lnC_e	g = slope K_R = intersep	Han et al. (2009)[6]

Thermodynamic parameters

The thermodynamic parameters were evaluated at 3 different temperature variations, 303, 313, and 323 K, with each antibiotic assessed at concentrations of 50, 100, 150, 200, and 250 mg L^{-1}. The quantity of K_c was determined for each antibiotic at each temperature variation. Each of these thermodynamic parameters can be determined using Eq. S1 and S2.

$$\Delta G^0 = -RT\, lnKc \quad (1)$$

The relationship between ΔG^o, ΔH^o, and ΔS^o is presented in Eq. S2:

$$\Delta G^o = \Delta H - T\Delta S^o \quad (2)$$

The van't Hoff Eq. is obtained by substituting Eq. S1 into Eq. S2, resulting in Eq. S3.

$$\ln Kc = \frac{-\Delta H^0 1}{R \quad T} + \left(\frac{-\Delta S^0}{R}\right) \quad (3)$$

where K_c is the equilibrium constant determined for each temperature variation, R is the ideal gas constant (8.314 JK^{-1} mol^{-1}), and T is the absolute temperature (K). The values of ΔS^o and ΔH^o can be determined from the slope and intercept of the plot between ln K_c versus 1/T. [7 8 9]

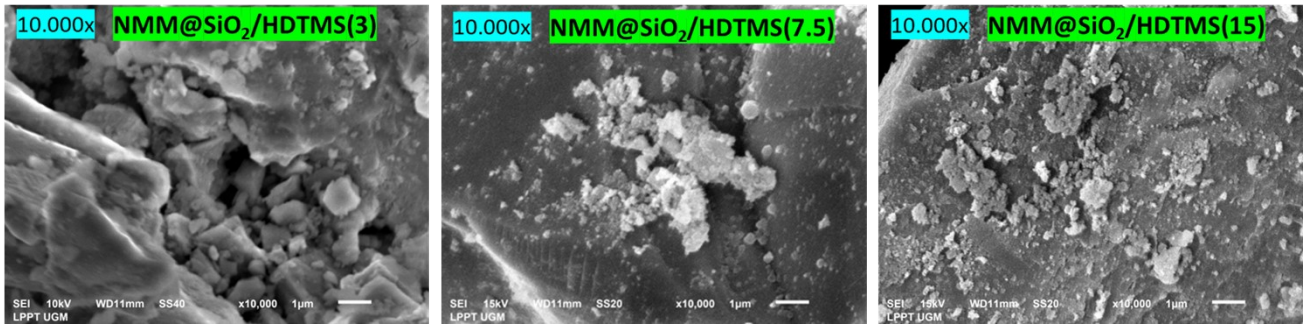

Fig. S1 NMM@SiO_2/HDTMS(3, 7.5, and 15)

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