Electronic Supplementary Information for

Removal of methyl violet dye by adsorption onto *N*-benzyltriazole derivatized dextran

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S1. Standard Methods

S1.1. Equilibrium studies

The prepared polysaccharide adsorbent was added to the dye solution and stirred at the fixed temperature in a sealed container ¹. After the equilibrium was reached, the solution was separated by centrifugation at 13,000 rpm for 5 min. The absorbance of the supernatant was measured spectrophotometrically, and the residual dye concentration was measured both at time t = 0 and after equilibrium, at a wavelength of 583 nm. The amount of adsorption of the dye onto the adsorbent at equilibrium, q_e (mg/g), was calculated by:

$$q_{\rm e} = \left[(C_0 - C_{\rm e}) \times V \right] / m \tag{1}$$

where C_0 and C_e (mg/L) are the liquid phase concentrations of the dye initially and at equilibrium, respectively, V is the volume of the solution (L), and m is the mass of the adsorbent used (g).

The dye removal percentage was calculated as follows:

% Removal =
$$[(C_0 - C_e)/C_0] \times 100$$
 (2)

S1.2. Adsorption isotherm

The equilibrium sorption of the absorbate by the adsorbent was correlated with the Langmuir ², Freundlich , and Temkin isotherm models; they are represented by the following equations, (3), (4), and (5), respectively:

$$1/q_{\rm e} = 1/q_{\rm m} + 1/(q_{\rm m} K_{\rm L} C_{\rm e}) \tag{3}$$

$$\ln q_{\rm e} = \ln K_{\rm F} + (1/n) (\ln C_{\rm e}) \tag{4}$$

$$q_e = B \ln A_{\rm T} + B \ln C_{\rm e} \tag{5}$$

where q_m is the maximum adsorption capacity of the adsorbent (mg/g), K_L is the Langmuir isotherm constant (L/mg), K_F is the Freundlich isotherm constant (mg/g), *n* represents the intensity of adsorption, *B* is a constant related to the heat of sorption (J/mol), and A_T is the Temkin isotherm equilibrium binding constant (L/g).

The essential characteristics of the Langmuir isotherm may be expressed in terms of an equilibrium parameter, R_L , which is a dimensionless constant, also referred to as the separation factor:

$$R_{\rm L} = 1 / (1 + K_{\rm L} C_0) \tag{6}$$

where R_L values indicate whether the isotherm will be irreversible ($R_L = 0$), favorable ($0 < R_L < 1$), linear ($R_L = 1$), or unfavorable ($R_L > 1$).

S1.3. Adsorption kinetics

The pseudo-second order kinetic model was used to analyze the experimental data . The rate of a pseudo-second order reaction is dependent on the amount of sorbate adsorbed on the surface of the adsorbent and the amount adsorbed at equilibrium. The pseudo-second order model can be represented by the following equation:

$$t/q_{\rm t} = q/k_2 \, q_{\rm e}^2 + t/q_{\rm e} \tag{7}$$

where k_2 (g/mg min) is the second-order rate constant of adsorption.

Table S1. Elemental analysis and atomic ratios of carbohydrates.

	C[%]	H[%]	N[%]	O[%]	(N+O)/C	H/C
Dextran	39.47	6.78	0	50.75	0.96	2.06
N-benzyltriazole derivatized dextran	54.80	6.67	8.56	26.70	0.50	1.46
Succinoglycan	38.56	6.35	0	47.55	0.92	1.98
N-benzyltriazole derivatized succinoglycan	56.53	6.44	9.71	26.22	0.50	1.37

Table S2. Comparison of maximum adsorption capacities of *N*-benzyltriazole derivatized dextran with other adsorbents for methyl violet in aqueous solutions.

Adsorbent	q _{max} (mg/g)	Reference	
Sugarcane dust	50.4	(Ho et al., 2005) ⁷	
Bagasse fly ash	26.2	(Mall et al., 2006) ⁸	
Cross linked amphoteric starch	333.3	(Xu et al., 2006) ⁹	
Sunflower seed hull	92.6	(Hameed et al., 2008) ¹⁰	
Granular activated carbon	95	(Azizian et al., 2009) ¹¹	
Magnetic baker's yeast biomass	60.8	(Tian et al., 2010) ¹²	
Almond shell	76.3	(Duran et al., 2011) ¹³	
Halloysite nanotubes	113.6	(Liu et al., 2011) ¹⁴	
Peanut straw char	101	(Xu et al., 2011) ¹⁵	
Exfoliated graphene oxide	2.47	(Ramesha et al., 2011) ¹⁶	
h-XG/SiO ₂ -2 nanocomposite	378.8	(Ghorai, et al., 2014) ¹⁷	
N-benzyltriazole derivatized dextran	95.24	Present study	

Wavenumber (cm ⁻¹)		Differences	Assignment
Before adsorption	After adsorption		
3418	3420	+2	O-H stretch
3141	3139	-2	=C-H aromatic stretch
2927	2928	+1	C-H stretch
2097	-		C=C stretch
1643	1637	-6	C=C alkene, aromatic stretch
-	1587		C=C aromatic stretch
1435	1436	+1	CH ₂ bend
1354	1361	+7	CH ₃ bend
1282	1285	+3	C-N stretch
1155	1153	-2	C-N stretch
1017	1020	+3	C-O stretch
698	699	+1	Monosubstituted oop

Table S3. FT-IR absorption bands of N-benzyltriazole derivatized dextran before and after adsorption.

Fig. S1. FT-IR spectrum of methyl violet 2B.



Fig. S2. SEM image (A) and particle size distribution (B) of original dextran.



Fig. S3. Langmuir (A), Freundlich (B), and Tempkin adsorption isotherms (C) for methyl violet 2B on *N*-benzyltriazole derivatized dextran.



Fig. S4. Separation factor for methyl violet 2B onto *N*-benzyltriazole derivatized dextran.

Fig. S5. Effect of temperature on adsorption capacity of *N*-benzyltriazole derivatized dextran.

Fig. S6. Arrhenius plot (A) for determination of activation energy (E_a) of adsorption and plot of $\ln(k_2/t)$ against 1/T (B) for the determination of free energy of activation $\Delta G^{\#}$.

(A)

Fig. S7. Determination of the thermodynamic parameters for the adsorption of methyl violet 2B onto *N*-benzyltriazole derivatized dextran.

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