Prominent biosorption of anionic and cationic dyes via raw and chitosan oligosaccharide-modified Huai Flos Chrysanthemum at different condition

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Fig. S2 SEM analysis

Fig. S3 FTIR spectra of biosorbents: (a) HFC, (b) HFC@CO and (c) HFC@CO after adsorption of dyes

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Table S1 The BET and BJH analysis of raw diatomite and DE@C

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Table S1 The BET and BJH analysis of raw diatomite and DE@C

| Name     | BET/ m²·g⁻¹ | Average pore/nm | Total pore volume/ cm³·g⁻¹ | N₂ adsorption/desorption |
|----------|-------------|----------------|----------------------------|--------------------------|
| Raw HFC  | 47.67       | 21.63          | 0.4919                     |                          |
| HFC@CO   | 40.17       | 18.61          | 0.4398                     | Type IV                  |
TEXT S1 The representation of adsorption equilibrium equations in batch adsorption

The assumed prerequisite of Langmuir Adsorption Isotherm is that: the surfaces of the biosorbent are even and consist of monomolecular layer; and no interaction force exists between the adsorbed molecules.

\[
\frac{1}{q_e} = \frac{1}{q_m} + \frac{1}{C_e \times b \times q_m}
\]  \hspace{1cm} (7)

In this case, \( C_e \) is the liquid-phase dye concentration at equilibrium, mg/L; \( q_e \) is the equilibrium adsorption capacity of the biosorbent, mg/g; \( q_m \) is the maximum adsorbing capacity, mg/g; \( b \) refers to Langmuir constant, L/mg.

Freundlich Adsorption Isotherm is an empirical equation to describe heterogeneous systems and adsorption capacity is based on the concentration of dyes at equilibrium. This isotherm is given in the following equation:

\[
\ln q_e = \ln K_F - \frac{1}{n} \ln C_e
\]  \hspace{1cm} (8)

In this case; \( K_F \) is the Freundlich constant, (mg/g)·(L/mg)\(^{1/n}\), which related to the adsorption capacity. If 0<\text{\(n^{-1}\)<1}, the adsorption process is available and works well.
TEXT S2 The representation of kinetics equilibrium equations in batch adsorption

Pseudo-First-Order Kinetic Model was expressed as follows:

\[
\log(q_e - q_t) = \log(q_{e1}) - \frac{k_1 t}{2.303} \tag{9}
\]

where \( q_e \) is the experimental equilibrium adsorption capacity of the biosorbent, mg/g; \( q_t \) is the adsorption capacity during period \( t \), mg/g; \( q_{e,\text{cal}} \) is the theoretical equilibrium adsorption capacity, mg/g; \( k_1 \) is the Pseudo-First-Order Kinetic Model constant, 1/min.

Pseudo-second order kinetic model can be used into deep analysis of kinetic data. The model is expressed as:

\[
\frac{t}{q_t} = \frac{1}{k_2 q_{e,\text{cal}}} + \frac{t}{q_e} \tag{10}
\]

Where \( k_2 \) is the Pseudo-Second-Order Kinetic Model constant, g/(mg·min).
