Supplementary Information (SI) for New Journal of Chemistry.

Succinic Anhydride-Functionalized Corncob Biosorbent for Rapid and Selective Removal of Cationic Dyes from Water

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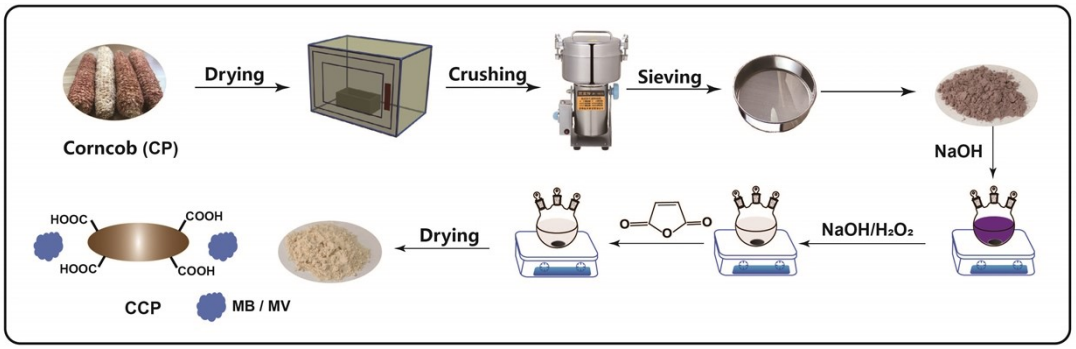


Figure S1. Schematic illustration of the preparation procedure for CCP.

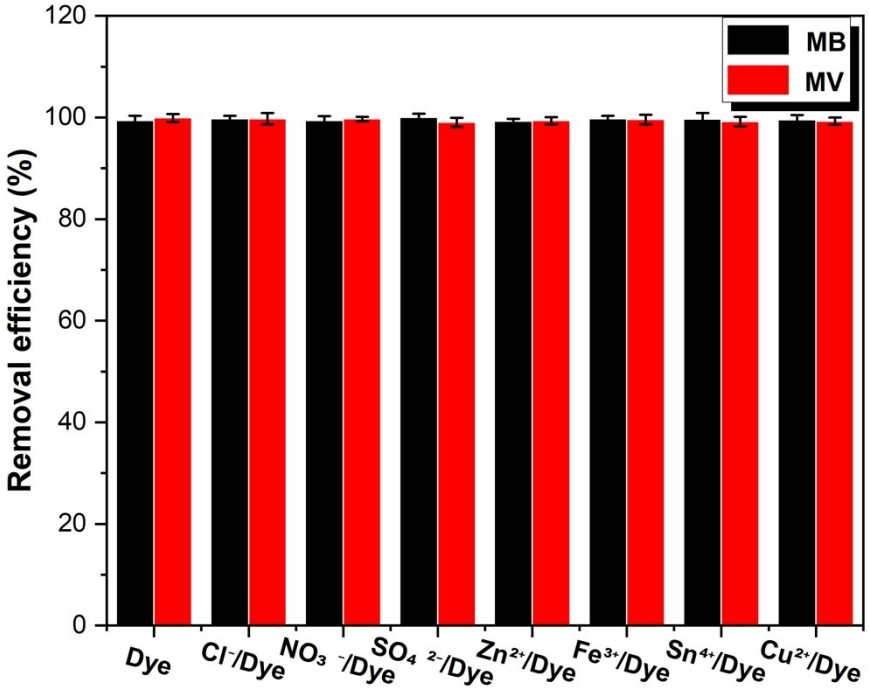


Figure S2. The adsorption performance of CCP in the presence of coexisting ions for MB and MV.

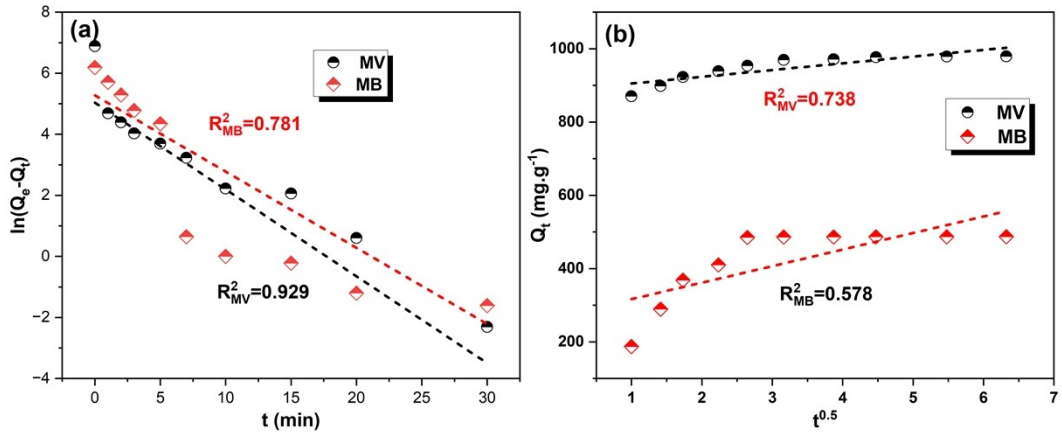


Figure S3. (a) Pseudo-first-order kinetic model. (b) Intraparticle diffusion model.

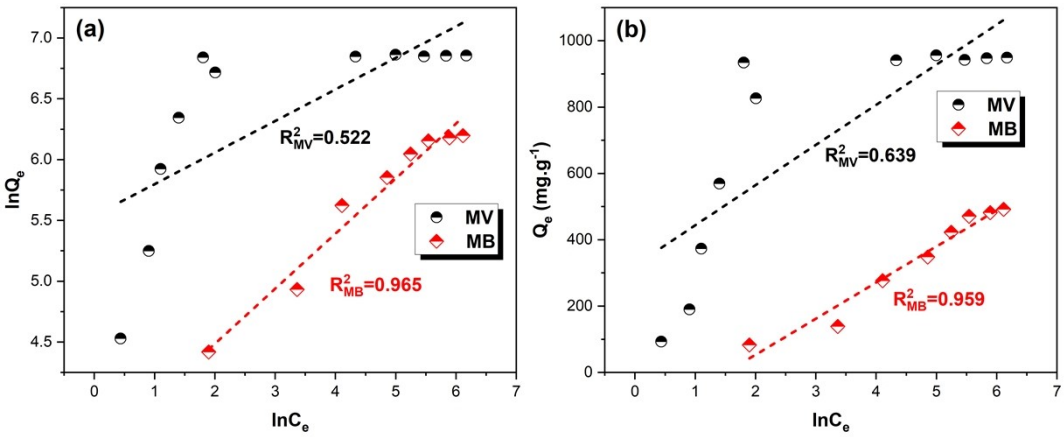


Figure S4. (a) Freundlich isotherm model. (b) Temkin isotherm model.

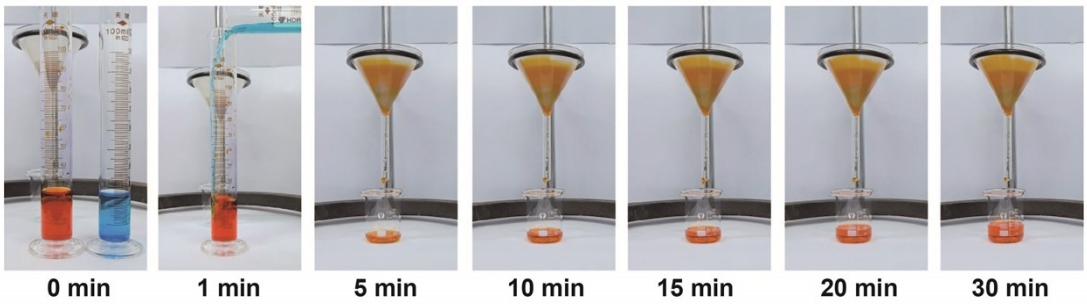


Figure S5. Video snapshots of an MB/MO mixed solution flowing through a packed column filled with CCP powder (MB and MO concentrations: 10 mg·L^{-1}).

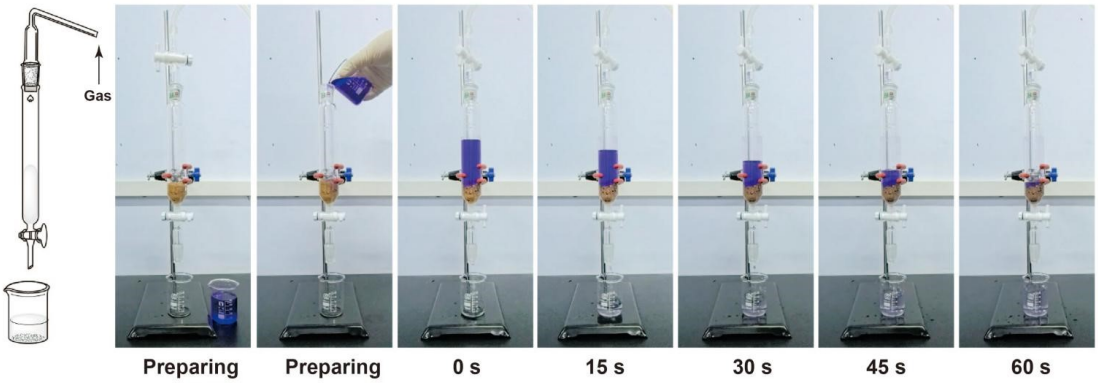


Figure S6. Video snapshots of MB solution flowing through a flash column filled with CCP powder (MB: 10 mg·L^{-1}).

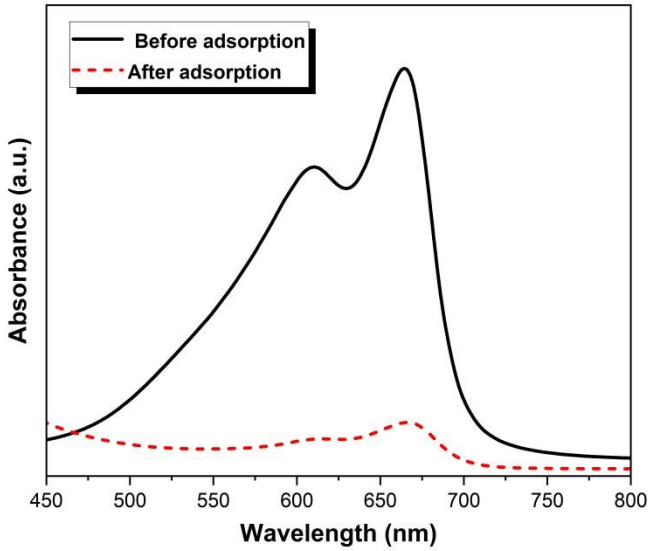
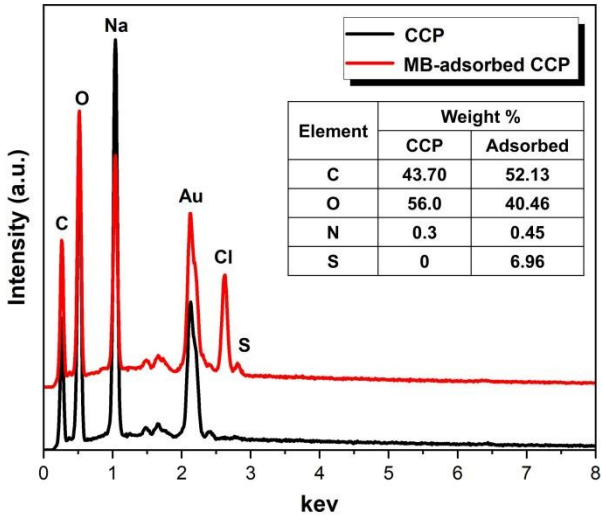


Figure S7. The absorption spectra of real textile wastewater before and after adsorption by CCP.



Element	Weight %	
	CCP	Adsorbed
C	43.70	52.13
O	56.0	40.46
N	0.3	0.45
S	0	6.96

Figure S8. The EDS spectra of CCP and MB-adsorbed CCP.

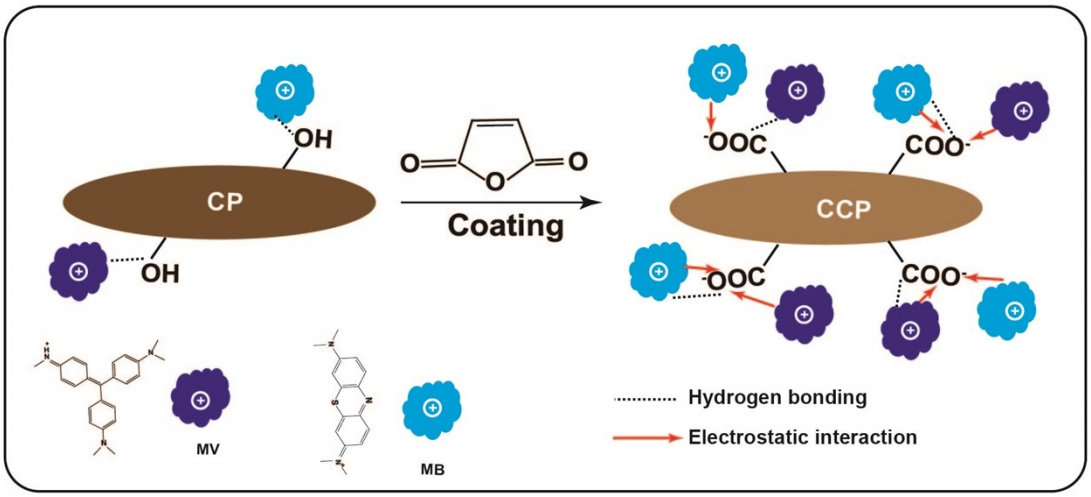


Figure S9. Proposed adsorption mechanism of MB and MV on CCP.

Table S1. Physicochemical properties of four dyes

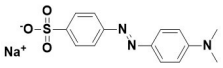
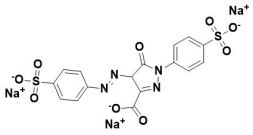
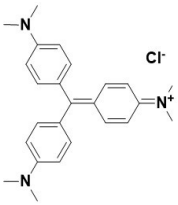
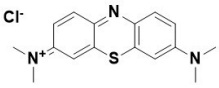
Physicochemical Index	MO	TTZ	MV	MB
molecular structure				
molecular weight ($g \cdot mol^{-1}$)	327.33	492.41	393.95	319.85
maximum wavelength (nm)	464	428	584	664
water solubility (25 ℃)	~ 4 g/100 mL	≥ 20 g/100 mL	~ 1.5 g/100 mL	~ 4.5 g/100 mL
ionic type	anionic dye	anionic dye	cationic dye	cationic dye
appearance	orange-yellow crystalline powder	orange-yellow powder	dark green crystalline powder	dark green lustrous crystal

Table S2. Comparison of the adsorption capacities of CCP with those of reported biosorbents.

Adsorbents	Dye types	Q_{max} ($mg \cdot g^{-1}$)	References
Nile water algae cross-linked cellulose microsphere	MB	200	[1]
Ipomoea carnea wood	MB	39.38	[2]
Poplar waste	MB	254.21	[3]
Chitosan cross-linked with glutaraldehyde/methylene bis(acrylamide)	MB	270.0	[4]
Bananapeel biochar	MB	94.95	[5]
Chitosan-based zeolitic imidazolate framework-8	MB	499.42	[6]
GG/PAAm/RH/Sarg	MB	68.02	[7]
CMGG/PAAc	MB	95.7	[8]
CCP	MB	468.18	**Present study**
Sulfonated pennisetum glaucum biosorbent	MV	190.83	[9]
Calcined lotus leaf	MV	26.315	[10]
Palm tree flowers	MV	87.93	[11]
CCP	MV	961.54	**Present study**

References

[1] Moghazy R M, Bakr A M, El-Wakeel S T, et al. Porous cellulose microspheres loaded with dry Nile water algae for removal of MB dye and copper ions from aqueous media[J]. Polymer Engineering & Science, 2023, 63(7): 2002-2014.

[2] Mathivanan M, Syed Abdul Rahman S, Vedachalam R, et al. Ipomoea carnea: a novel biosorbent for the removal of methylene blue (MB) from aqueous dye solution: kinetic, equilibrium and statistical approach[J]. International Journal of Phytoremediation, 2021, 23(9): 982-1000.

[3] Qin X, Zeng X, Cheng S, et al. Preparation and evaluation of poplar waste derived adsorbent for dye removal[J]. Arabian Journal of Chemistry, 2023, 16(8): 104913.

[4] Abdel-Raouf M E S, Farag R K, Farag A A, et al. Optimization, kinetics, and isotherm studies of methyl thioninium chloride removal from simulated solutions using chitosan derivatives[J]. ACS omega, 2023, 8(37): 33580-33592.

[5] Sayed A, Behalo M, Feteha A, et al. Unveiling the removal performance of banana peel biochar and rice husk nanoparticles for crystal violet and methylene blue dyes from aqueous media[J]. Discover Environment, 2025, 3(1): 143.

[6] Abdelaziz A I E, Farag R K, Hasan A M A, et al. Chitosan-based Zeolitic Imidazolate

Framework-8 for water remediation: kinetic and isotherm insights into the removal of organic and inorganic pollutants[J]. Environmental Science and Pollution Research, 2025, 32: 1-26.

[7] Keshawy M, Kamal R S, Abdelhamid A E, et al. Novel green sustainable hydrogel composites based on guar gum and algal species for wastewater remediation[J]. International Journal of Environmental Science and Technology, 2025, 22(10): 8895-8918.

[8] Yousry R, Sayed A, Behalo M S, et al. Tailoring of carboxymethyl guar gum hydrogels via gamma irradiation for remarkable removal of cationic and anionic dyes from simulated solutions[J]. International Journal of Biological Macromolecules, 2025, 284: 137867.

[9] Grewal A, Singh A, Sharma N, et al. Simultaneous Adsorptive Removal of Three Cationic Dyes by Using a Sulfonated Pennisetum Glaucum Biosorbent: Statistical Optimization and Adsorption Dynamics[J]. International Journal of Environmental Research, 2026, 20(1): 32.

[10] Sharafzad A, Tamjidi S, Esmaeili H. Calcined lotus leaf as a low-cost and highly efficient biosorbent for removal of methyl violet dye from aqueous media[J]. International Journal of Environmental analytical chemistry, 2021, 101(15): 2761-2784.

[11] Sivaguru P, Balakumar S, Rajeshkannan R, et al. Preparation and characterization of palm tree flower biomass-based biochar and its application for the effective removal of methyl violet dye[J]. Biomass Conversion and Biorefinery, 2025, 15(9): 14457-14471.