Supplementary material for

One-step synthesis of magnetic biochar from alkali-activated rice straw for removal of rhodamine B from aqueous solution

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Fig. S1. Representations of synthesis route for the AMBC.

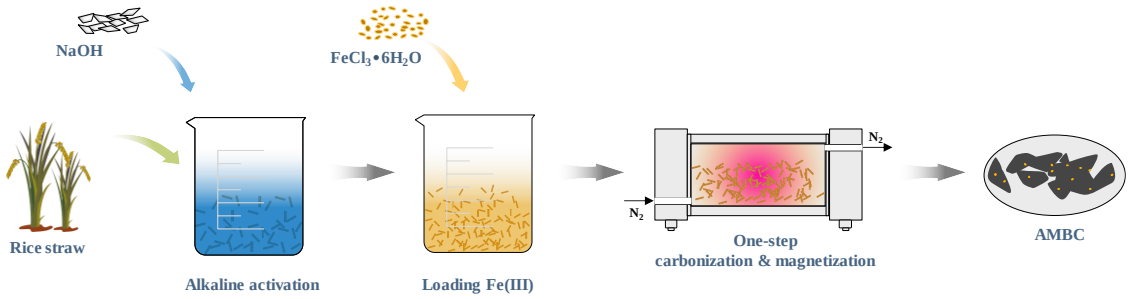

Fig. S2. The standard curve for RhB concentration correction.

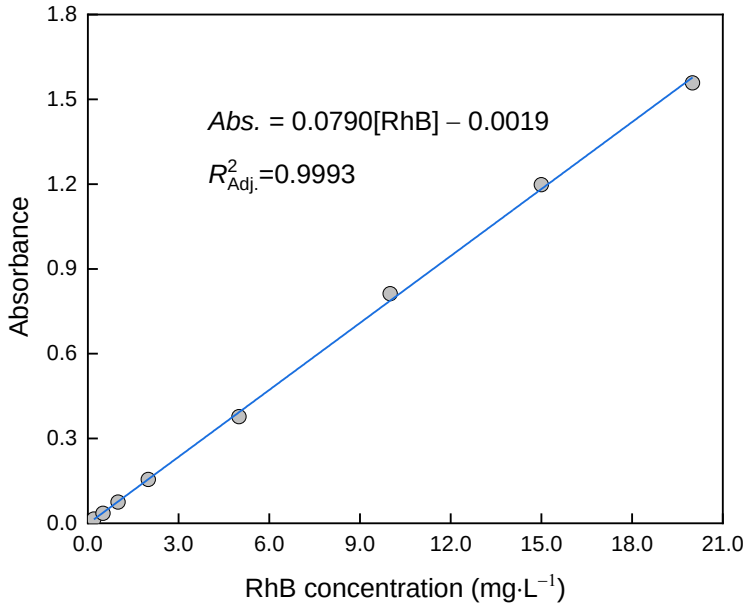

Fig. S3. Magnetic hysteresis loops of the MBC and AMBC.

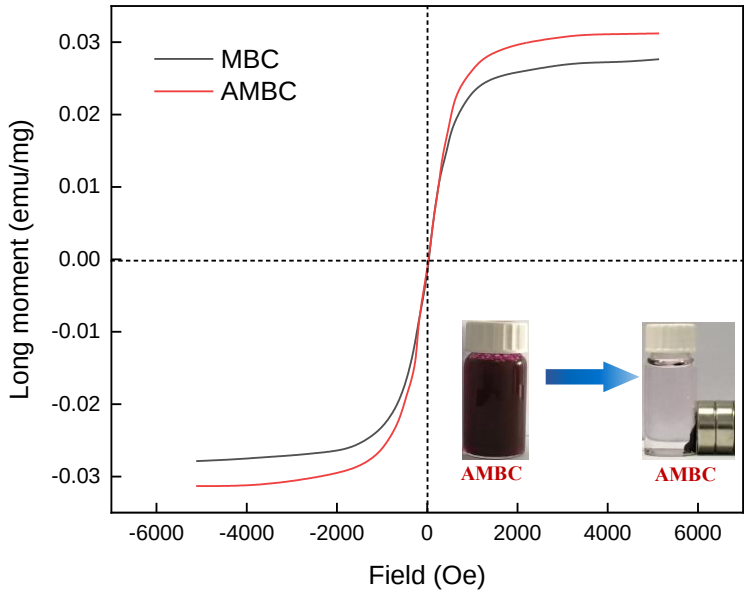

Fig. S4. Variation of the pH aroused by the BC, MBC and AMBC at pH 2.0–11.0.

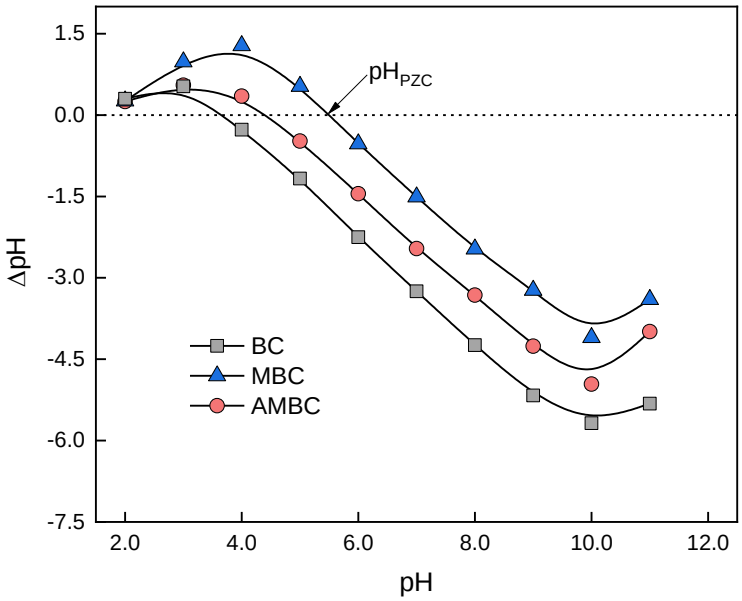

Fig. S5. Adsorption kinetics and (a) Intra-particle diffusion model for (b) RhB by the BC and MBC.

Experimental conditions were controlled as $C_{BC} = C_{MBC} = 1.0$ mg mL^{-1}, $C_{RhB} = 50.0$ mg L^{-1}, pH = 6.5 and temperature = 25°C.

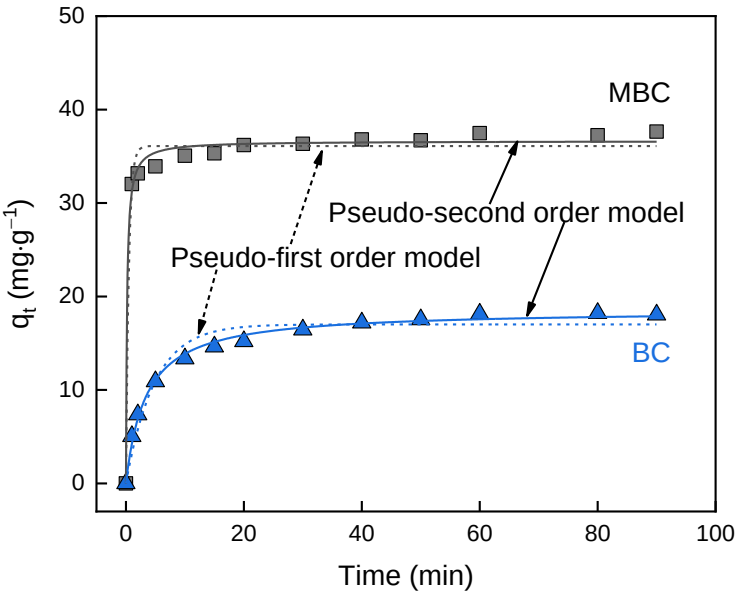

Fig. S6. Intra-particle diffusion model for RhB by the BC and MBC. Experimental conditions were controlled as $C_{BC} = C_{MBC} = 1.0$ mg mL^{-1}, $C_{RhB} = 50.0$ mg L^{-1}, pH = 6.5 and temperature = 25°C.

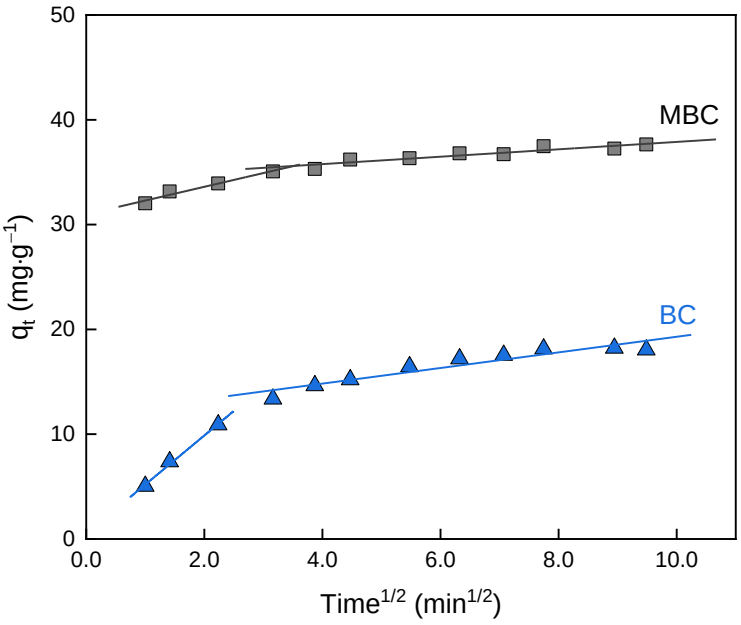

Fig. S7. Adsorption isotherms for RhB by the MBC and (A) BC at (B) 10°C, 25°C and 40°C. The solid and dash lines present the fitted Freundlich and Langmuir models, respectively. The $C_{MBC} = C_{BC} = 1.0$ mg mL L^{-1}, $C_{RhB} = 50.0$ mg L^{-1}, pH = 6.5 and equilibrium time = 90 min.

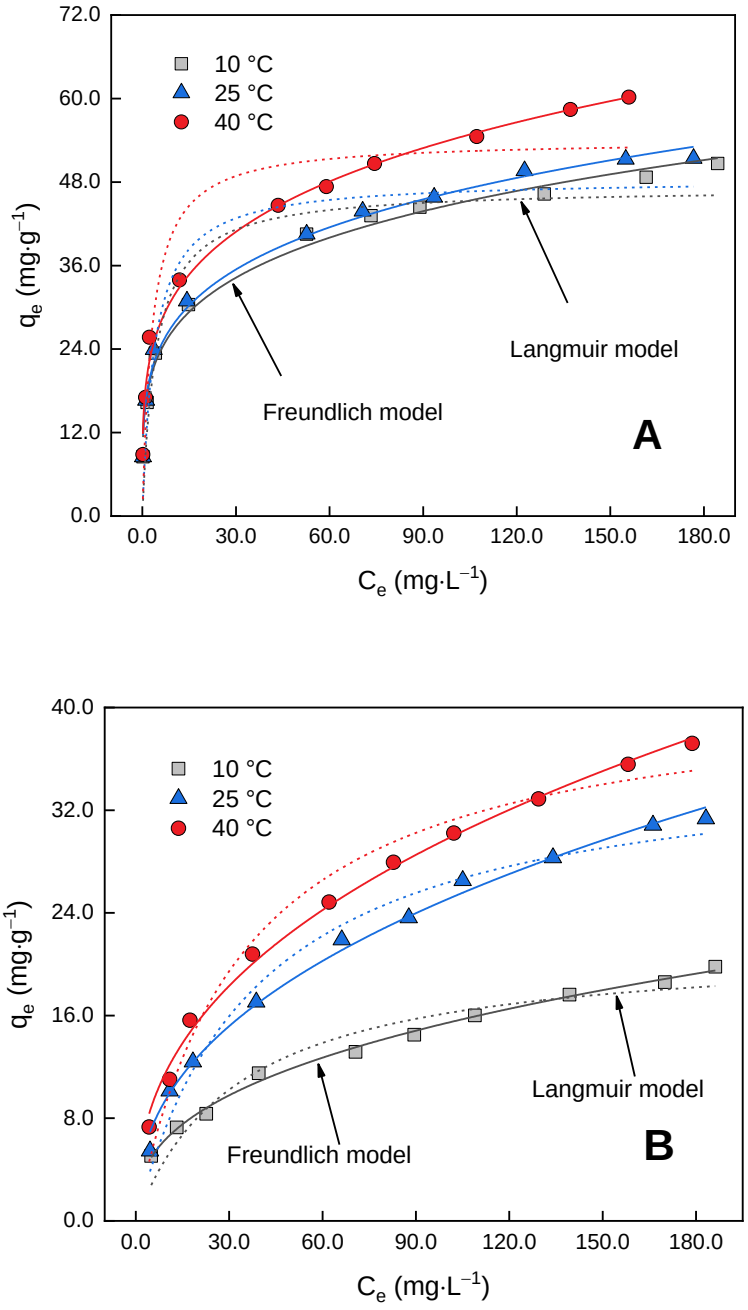

Table S1. Selected Compositions and Physicochemical Properties of the BC, MBC and AMBC

Composition/Property	Type of adsorbents		
	BC	MBC	AMBC
C (%)	81.30	78.92	76.48
H (%)	3.89	2.51	2.67
O (%)	13.72	11.47	16.20
N (%)	0.13	0.11	0.16
S (%)	0.26	0.14	0.08
H/C	0.0479	0.0318	0.0349
O/C	0.1688	0.1453	0.2118
Fe (mg g^{-1})	N.D.	30.60	37.49
pH_{PZC}	3.66	5.51	4.42
SSA (m^2 g^{-1})	188.2	283.1	396.9
Pore Volume (cm^3 g^{-1})	0.07	0.11	0.18
Average pore size (nm)	1.93	2.46	2.97

Note: SSA is the abbreviation of the specific surface area; N.D. represents not detected.

Table S2. Adsorption Kinetic Model Parameters for the Adsorption of RhB onto the MBC and BC

Adsorbents	q_e (mg g^{-1})	Pseudo-first order			Pseudo-second order			
		$q_{e,\,cal}$ (mg g^{-1})	k_1 (min^{-1})	$R^2_{Adj.}$	$q_{e,\,cal}$ (mg g^{-1})	k_2 (g (mg min)$^{-1}$)	r (mg (g min)$^{-1}$)	$R^2_{Adj.}$
AMBC	53.54	52.03	0.89	0.989	53.66	0.03	86.32	0.999
MBC	37.65	36.09	2.04	0.983	36.63	0.15	201.26	0.994
BC	18.21	17.01	0.03	0.952	18.56	0.016	5.51	0.993

Table S3. Freundlich and Langmuir Isotherm Parameters for the Adsorption of RhB onto the MBC and BC

Adsorbents	Temperature (°C)	Freundlich Model			Langmuir Model		
		K_F ((mg g^{-1})·(L mg^{-1}))	1/n	Adjusted R^2	Q_m (mg g^{-1})	K_L (L mg^{-1})	Adjusted R^2
MBC	10	12.01	0.224	0.988	47.2	0.228	0.923
	25	15.34	0.228	0.990	48.4	0.255	0.907
	40	16.87	0.241	0.990	55.3	0.290	0.884
BC	10	2.70	0.378	0.995	21.57	0.03	0.935
	25	3.68	0.416	0.993	36.56	0.026	0.976
	40	4.65	0.400	0.995	41.84	0.024	0.97

Table S4. Thermodynamic Parameters for the Adsorption of RhB onto MBC and BC

Types of adsorbents	Temperature (°C)	ΔG^0 (kJ mol^{-1})	ΔH^0 (kJ mol^{-1})	ΔS^0 (kJ mol^{-1} K^{-1})
MBC	10	−9.37	6.51	0.06
	25	−10.43		
	40	−11.06		
BC	10	−4.63	12.02	0.06
	25	−5.40		
	40	−6.39		