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Supplementary Material

Research on the sustainable effect of ZnS and MoS_2 decorated biochar nanocomposites for removing quinolones from antibiotic-polluted aqueous solutions

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The field emission scanning electron microscope (SEM, SU8010, Japan) equipped with an energy-dispersive X-ray analyzer (EDS, SU8010, Japan) was used to examine the surface morphology and elemental compositions of the ZMMBC. The structural details of the composite were characterized by transmission electron microscopy (TEM). The X-ray diffraction (XRD, D/MAX2500PC) to characterize the crystal structures of as-synthesized composite. The specific surface area and pore characteristics were calculated based on the N_2 adsorption–desorption isotherms at 77.3 K by BET. Fourier transform infrared spectrum (FT-IR) in the range of 4000–400 cm^{-1} was performed in KBr pellet by TENSOR-27 Spectrometer (Germany). The Binding energy of material elements was conducted based on the X-ray photoelectron spectroscopy (XPS, AXIS NOVA), and C 1s is calibrated at 284.8 eV.

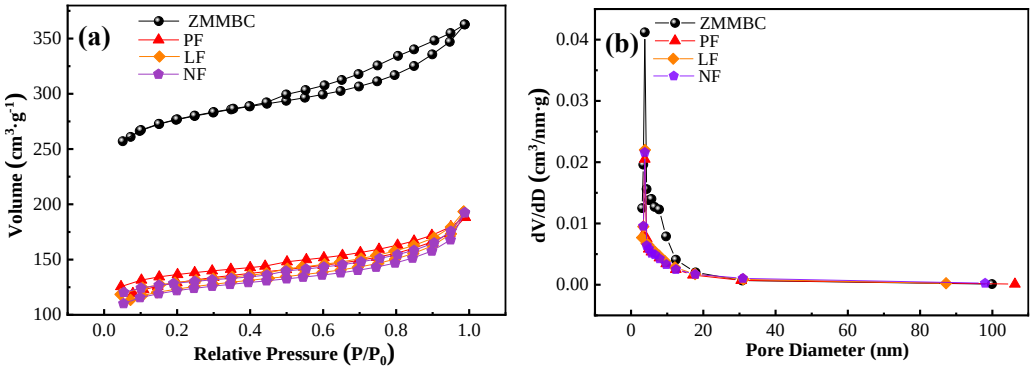

Fig. S1. The N_2 adsorption desorption isotherm and pore size distribution curves of ZMMBC before and after adsorption.

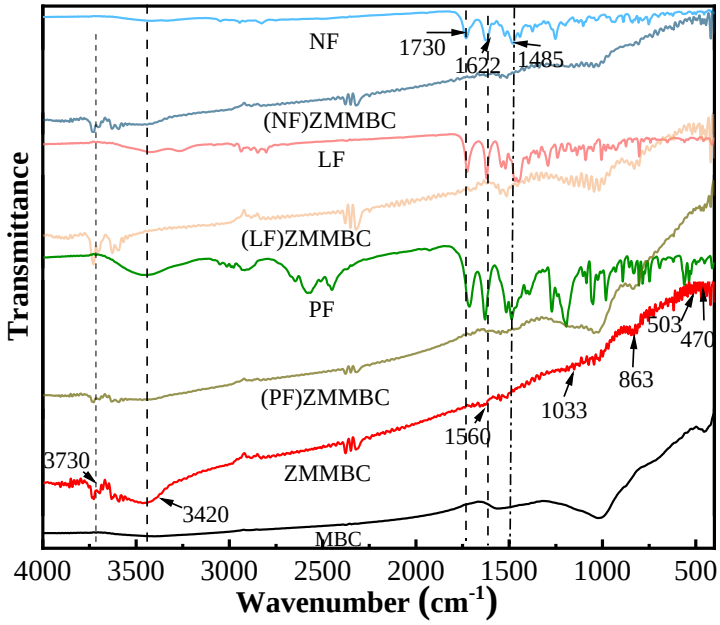

Fig. S2. FTIR spectra of ZMMBC before and after adsorption.

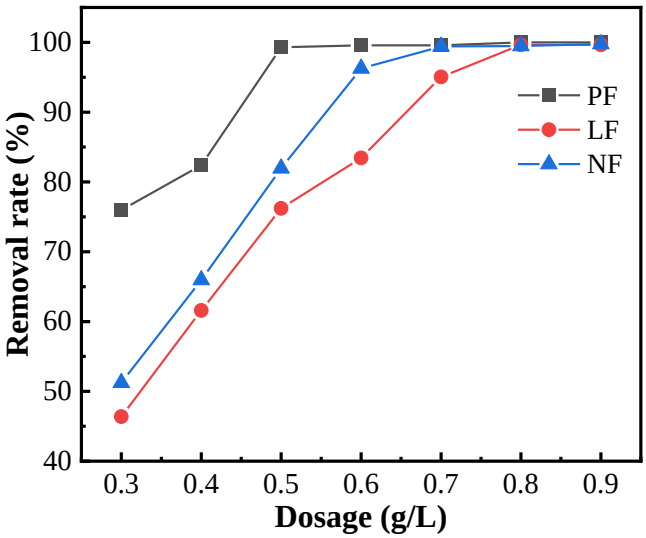

Fig. S3. Effect of solid/liquid ratio on adsorption capacity of ZMMBC for PF, LF and NF.

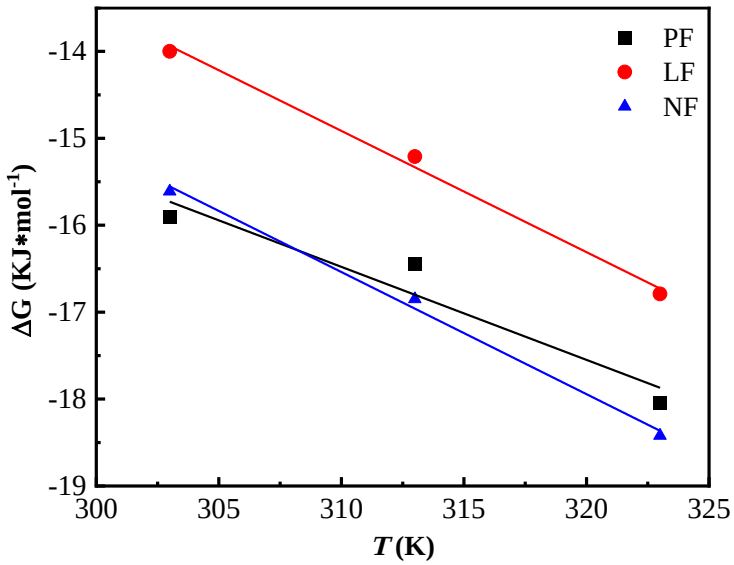

Fig. S4. Thermodynamic Δ*G* and *T* diagram of ZMMBC.

Table S1. Adsorption kinetics fitting parameters of PF, LF and NF on ZMMBC.

Adsorption kinetics model	Parameter	PF	LF	NF
Pseudo-first-order	k_1 (min^{-1})	0.2328	0.2829	0.2121
	R^2	0.9912	0.9979	0.9796
	q_e (mg g^{-1})	193.54	123.57	134.53
Pseudo-second-order	K_2 (g mg^{-1} min^{-1})	0.0033	0.0093	0.0034
	R^2	0.9979	0.9997	0.9924
	q_e (mg g^{-1})	199.79	125.84	140.50
Liquid film diffusion	K_f (h^{-1})	0.03729	0.05532	0.02788
	A	-1.6849	-2.0604	-1.4003
	R^2	0.9940	0.9829	0.9539
Intra particle diffusion	K_d (mg g^{-1} $h^{-1/2}$)	0.4847	0.3078	0.4582
	c	177.7344	116.0916	119.4983
	R^2	0.8574	0.9057	0.9142

Table S2. The parameters of the isothermal adsorption model for the pseudo first order kinetics and pseudo second order kinetics of ZMMBC.

Isotherm models	Temperature (K)	Langmuir				Freundich		
		q_m (mg g^{-1})	k_L (L mg^{-1})	R_L	R^2	k_F (mg g^{-1})	$1/n$	R^2
PF	303	277.0083	0.8587	0.01151	0.9910	220.4057	0.05009	0.6945
	313	323.6246	0.3916	0.02490	0.9992	234.0231	0.09692	0.9320
	323	342.4658	0.3425	0.02837	0.9969	251.9171	0.09543	0.8674
LF	303	200.4008	2.0202	0.004926	0.9994	139.0815	0.1073	0.9551
	313	210.0840	2.1636	0.004601	0.9993	144.0254	0.1175	0.9673
	323	238.0952	2.4432	0.004076	0.9987	152.4170	0.1247	0.9857
NF	303	221.2389	2.0452	0.004866	0.9947	168.2498	0.07309	0.8451
	313	226.7574	2.3967	0.004155	0.9958	173.3114	0.07382	0.8595
	323	233.1002	2.9384	0.003392	0.9955	179.1655	0.07538	0.8658

Table S3. The parameters of the isothermal adsorption model for the Temkin and Dubinin–Radushkevich of ZMMBC.

Isotherm models	Temperature (K)	Temkin			Dubinin–Radushkevich		
		k_T (L mg^{-1})	a	R^2	q_m (mg g^{-1})	E (kJ mol^{-1})	R^2
PF	303	171035026.3476	11.7224	0.6692	261.7396	141.4392	0.7297
	313	13465.7554	24.9651	0.9631	301.8439	115.7432	0.8891
	323	17964.6105	26.0782	0.9065	319.2166	140.9645	0.9219
LF	303	3387.5049	17.2334	0.9717	182.4744	99.1754	0.7386
	313	1949.2076	19.2476	0.9825	187.8061	116.0988	0.7104
	323	1488.3258	21.2005	0.9904	194.0333	97.4229	0.7099
NF	303	355497.6355	13.2974	0.8580	208.8445	135.8518	0.8716
	313	407786.6092	13.5825	0.8787	213.7057	160.3240	0.8766
	323	365453.6163	14.2063	0.8925	218.4943	190.0433	0.8872