

Supplementary Material

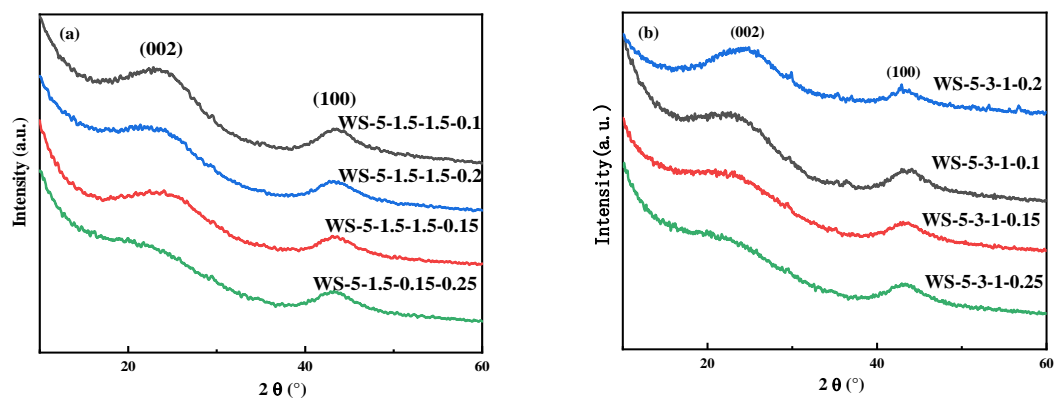


Figure S1. XRD spectra of (a) WS-5-1.5-1.5 and (b) WS-5-3-1 by different ratios of H₂O(g) activation.

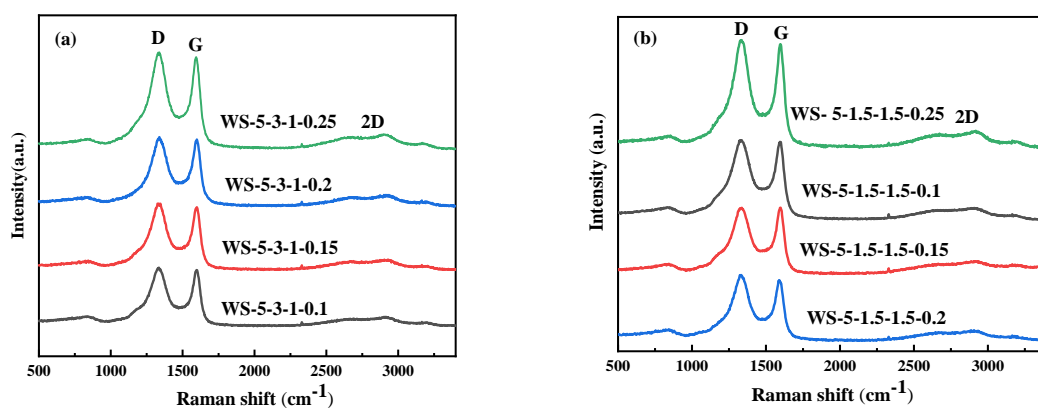


Figure S2. Raman spectra of (a) WS-5-1.5-1.5 and (b) WS-5-3-1 by different ratios of H₂O(g) activation.

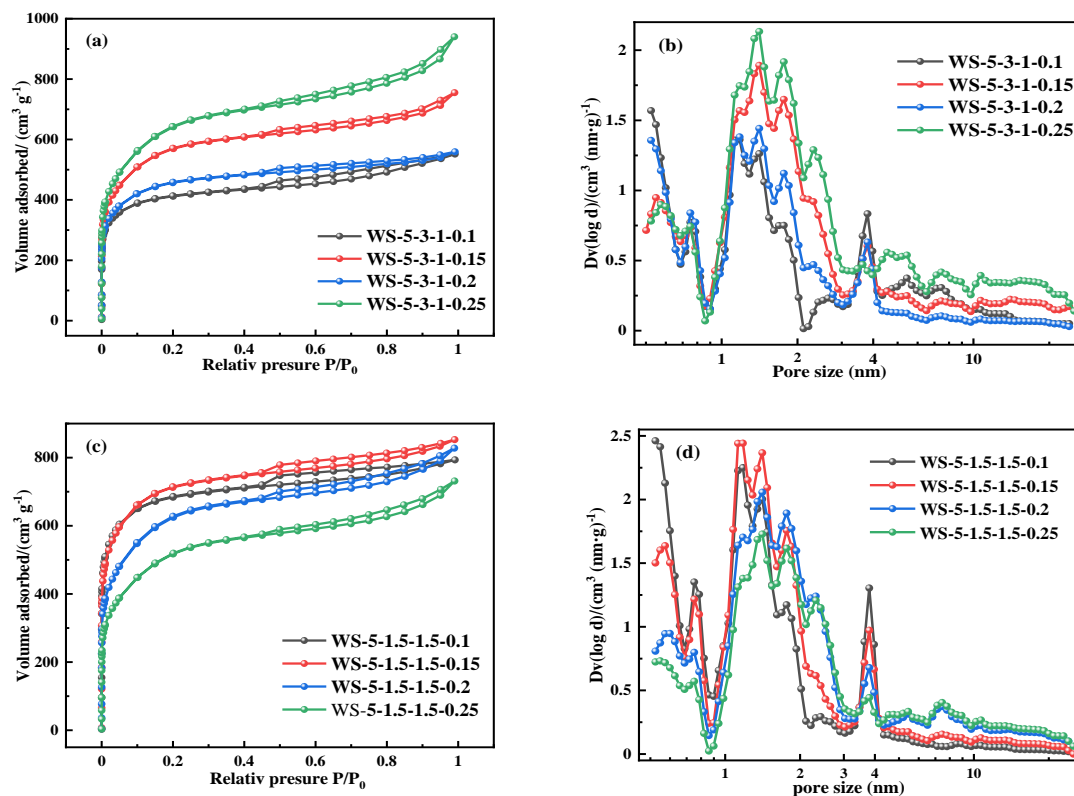


Figure S3. N₂ adsorption-desorption isotherms (a, c) and pore size distribution curves (b, d) of biochar.

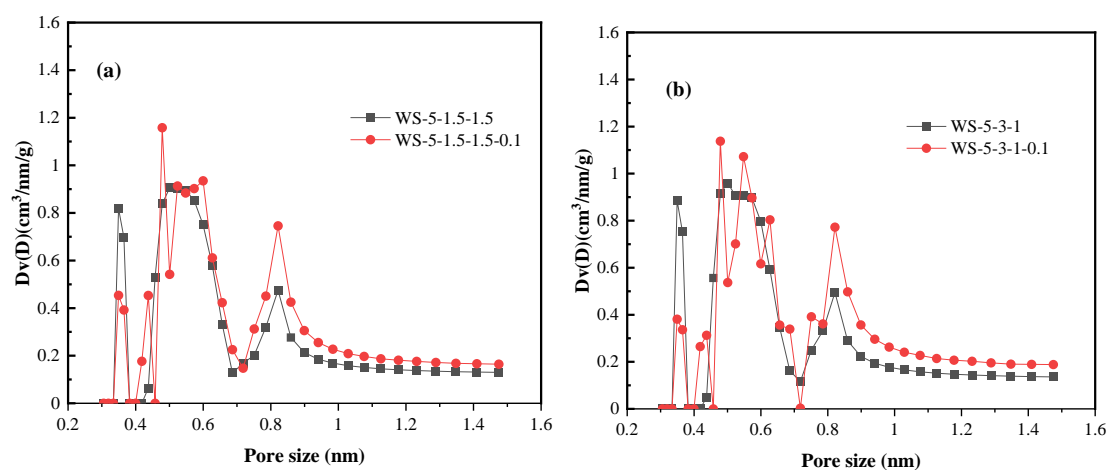


Figure S4. NMPD plot of (a) WS-5-1.5-1.5 and WS-5-1.5-1.5-0.1 and (b) WS-5-3-1 and WS-5-3-1-0.1.

Table S1. The effect of the activation ratio of biomass, metal salts and H₂O (g) on the surface properties of biochar.

Samples	$S_{\text{BET}}/(\text{m}^2/\text{g})$	$V_{\text{total}}(\text{cm}^3/\text{g})$	$S_{\text{meso}}/(\text{m}^2/\text{g})$	$V_{\text{meso}}(\text{cm}^3/\text{g})$	$S_{\text{mic}}/(\text{m}^2/\text{g})$	$V_{\text{mic}}(\text{cm}^3/\text{g})$	$D_p(\text{nm})$
WS-5-1-3	1370.35	0.63	45.37	0.06	1307.71	0.54	1.84
WS-5-1.5-1.5	1267.47	0.54	24.96	0.03	1235.02	0.49	1.69
WS-5-3-1	1111.41	0.49	30.15	0.05	1073.17	0.43	1.75
WS-5-3-0	836.55	0.43	68.37	0.11	762.67	0.31	2.07
WS-5-0-3	960.93	0.45	40.80	0.06	909.68	0.37	1.85
WS-5-1-3-0.1	1693.68	0.94	146.25	0.25	1500.28	0.64	2.23
WS-5-1.5-1.5-0.1	2584.91	1.28	171.75	0.21	2434.54	1.01	1.90
WS-5-3-1-0.1	1548.45	0.85	177.31	0.27	1368.74	0.58	2.20
WS-5-3-0-0.1	1388.39	0.64	79.92	0.11	1315.58	0.53	1.85
WS-5-0-3-0.1	1793.70	1.03	158.54	0.30	1566.15	0.67	2.30
WS-5-3-1-0.15	2074.61	1.17	158.28	0.31	1307.71	0.54	2.25
WS-5-3-1-0.2	1683.07	0.87	128.84	0.18	1235.02	0.49	2.06
WS-5-3-1-0.25	2316.76	1.46	252.81	0.51	1073.17	0.43	2.51
WS-5-1.5-1.5-0.15	2647.78	1.32	178.95	0.25	2008.72	0.54	1.99
WS-5-1.5-1.5-0.2	2261.46	2.58	174.42	0.33	1581.73	0.40	2.26
WS-5-1.5-1.5-0.25	1862.89	1.13	166.81	0.34	1588.63	0.69	2.42