Supplementary Information

Impact of mineral components in cow manure biochars on the adsorption and competitive adsorption of oxytetracycline and carbaryl

Mengwei Li[a], Zhendong Zhao[a], Xiaodan Wu[c], Wenjun Zhou[a,b,*], Lizhong Zhu[a, b]

[a]Department of Environmental Science, Zhejiang University, Hangzhou, Zhejiang 310058, China

[b]Zhejiang Provincial Key Laboratory of Organic Pollution Process and Control, Hangzhou, Zhejiang 310058, China

[c]Center of Analysis and Measurement, Zhejiang University, Hangzhou 310058, China

[*] **Corresponding author:** Tel: +86-571-88982591; Fax: +86-571-88982591; E-mail address: wenjunzhou@zju.edu.cn

Supplementary Information Summary:

- Number of tables: 2

- Number of figures: 3

Table S1

Surface elemental composition and the atomic ratios determined for the original (CMBCs) and demineralized (DCMBCs) biochars.

| Sorbent	Surface elemental composition (%)[a]									Atomic ratio	
	C	N	O	Si	Fe	Al	P	S	Ca	O/C	(O+N)/C
CMBC300	64.03	3.69	25.27	3.31	0.27	1.42	0.6	0.26	1.15	0.30	0.35
CMBC400	58.58	3.02	27.87	4.33	0.33	2.92	1.36	0.36	1.24	0.36	0.40
CMBC500	51.11	4.58	31.44	5.78	—	3.95	1.01	—	1.76	0.47	0.55
CMBC600	54.93	3.18	30.27	5.47	—	2.64	1.36	—	1.87	0.41	0.46
CMBC700	57.49	1.78	27.67	5.73	—	2.99	0.78	0.48	1.97	0.36	0.39
DCMBC600	66.07	3.38	24.57	4.51	0.13	1.05	0.3	—	—	0.28	0.32
DCMBC700	67.92	2.73	23.31	4.57	—	0.56	0.61	—	—	0.26	0.29

[a] Determined by X-ray photoelectron spectroscopy (XPS).

Table S2

Freundlich model parameters and concentration-dependent distribution coefficients (K_{oc}) for oxytetracycline (OTC) and carbaryl (CBL) sorption isotherms on original (CMBCs) and demineralized (DCMBCs) biochars.

| Sorbent	OTC						CBL					
	$\log K_f$	n	R^2	$\log K_{oc}^a$ at			$\log K_f$	n	R^2	$\log K_{oc}^a$ at		
				C_{e1}^b	C_{e2}^b	C_{e3}^b				C_{e1}^b	C_{e2}^b	C_{e3}^b
CMBC300	3.05	0.247	0.984	3.975	3.222	2.469	3.32	0.762	0.997	3.81	3.572	3.334
CMBC400	3.09	0.357	0.981	3.994	3.351	2.708	3.47	0.692	0.993	4.043	3.735	3.427
CMBC500	3.23	0.377	0.980	4.090	3.467	2.844	3.85	0.479	0.968	4.475	3.954	3.433
CMBC600	3.59	0.323	0.969	4.499	3.822	3.145	4.11	0.382	0.973	4.783	4.165	3.547
CMBC700	3.77	0.395	0.978	4.646	4.041	3.436	4.43	0.282	0.887	5.159	4.441	3.723
DCMBC600	4.15	0.171	0.989	5.038	4.209	3.380	4.02	0.213	0.997	4.630	3.843	3.056
DCMBC700	4.42	0.164	0.983	5.309	4.473	3.637	4.37	0.162	0.989	4.997	4.159	3.321

[a] K_{oc} represents the concentration-dependent carbon-normalized sorption distribution coefficient ($K_{oc} = K_F C_e^{n-1}/f_{oc}$), in units of L/kg of organic carbon, where f_{oc} is the percentage of carbon content of biochar.

b For OTC, C_{e1}, C_{e2}, and C_{e3} were 0.2, 2.0, and 20 mg/L, respectively; for CBL, C_{e1}, C_{e2}, and C_{e3} equaled to 0.005 S_w, 0.05 S_w, and 0.5 S_w, respectively. S_w (mg/L) is the solubility of carbaryl in water under neutral pH.
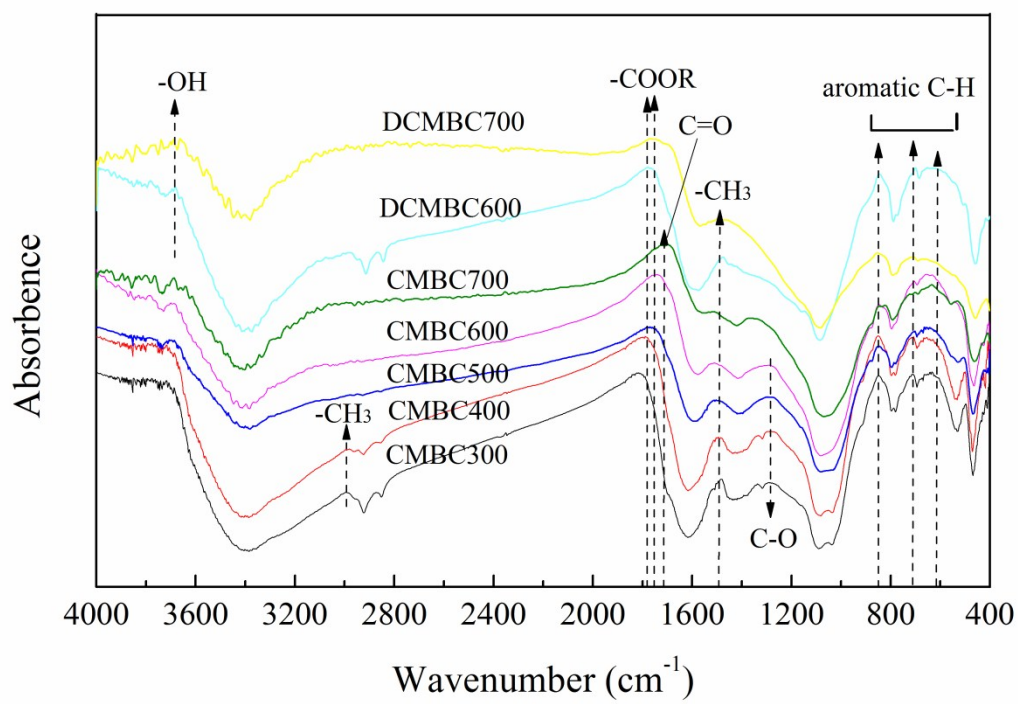
**Fig. S1.** FTIR spectra of the original (CMBCs) and demineralized (DCMBCs) biochars.
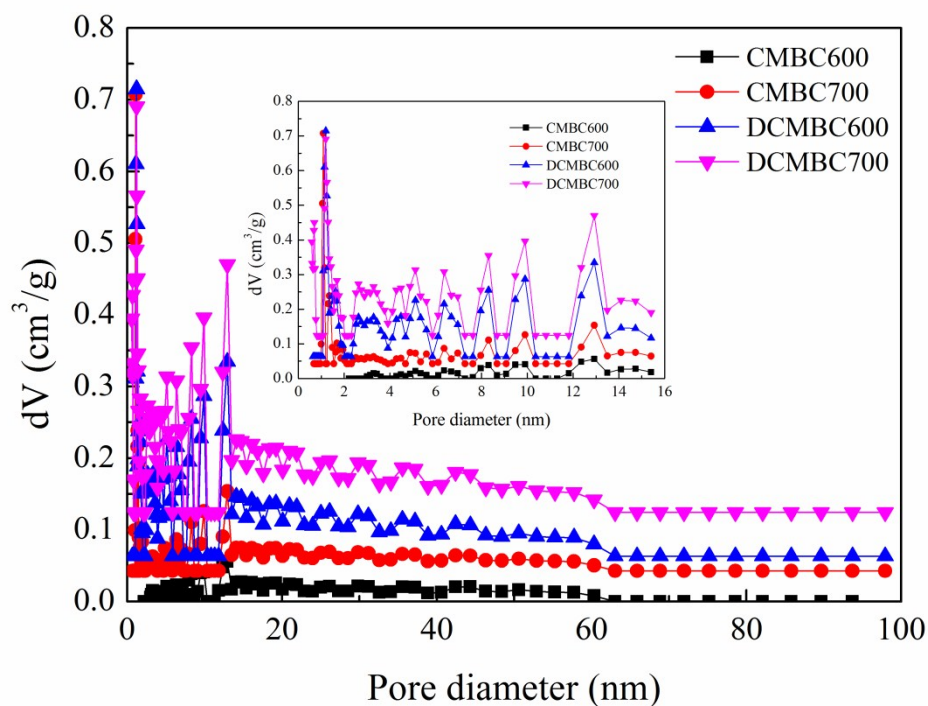
Fig. S2. Pore size distribution determined for selected original biochars(CMBC600 and CMBC700) and the corresponding demineralized ones (DCMBC600 and DCMBC700).
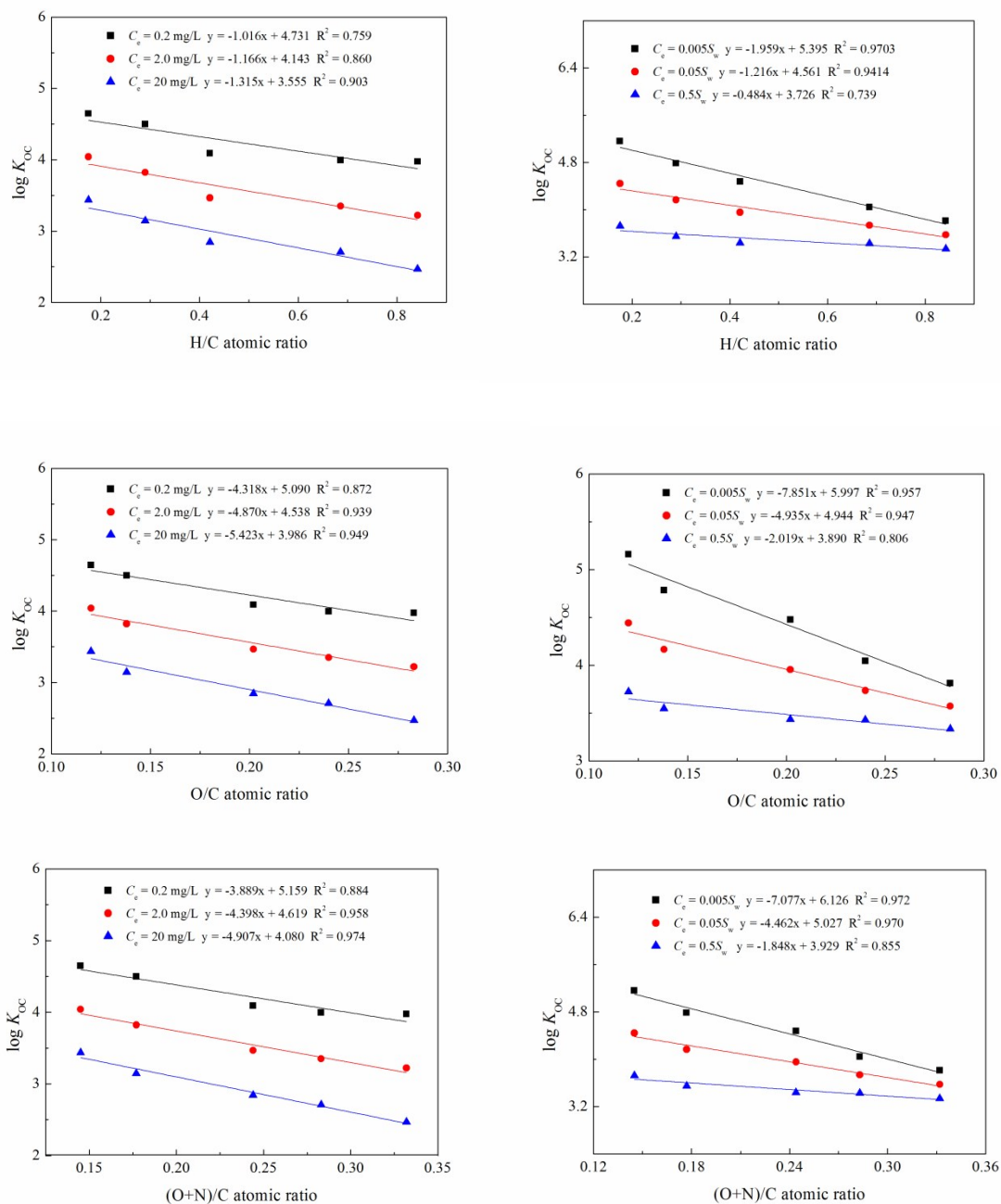
Fig. S3. Relationship between different atomic ratios of biochars and the Freundlich model sorption affinity index (log K_{oc} values at three different concentrations of sorbate)

determined for oxytetracycline (OTC) and carbaryl (CBL) on original biochars.
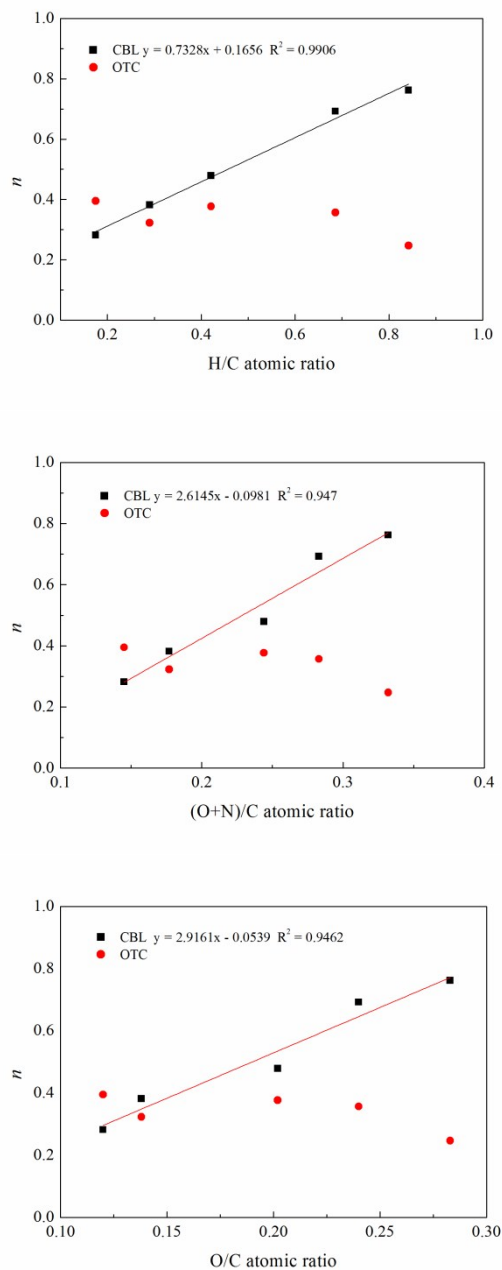
Fig. S4. Relationship between the different atomic ratios of biochars and the Freundlich model nonlinearity index (*n*) determined for oxytetracycline (OTC) and carbaryl (CBL) on original biochars.