Supporting Materials

Adsorption of carbamazepine on self-endowed magnetic biochar produced from iron-rich sludge

Yan Liu[a], Qianqian Li[c], Honghui Pan[a], Liying Liang[a], Liyang Zhao[a,b*], Qin Shi[a], Chuanqi Zhao[a], Xixiang Liu[a*]*

a Guangxi Colleges and Universities Key Laboratory of Environmental-friendly Materials and New Technology for Carbon Neutralization, Guangxi Key Laboratory of Advanced Structural Materials and Carbon Neutralization, School of Materials and Environment, Guangxi Minzu University, Nanning 530006, China

b College of New Energy and Environment, Jilin University, 130021, Changchun, China

c Huahong Water Group Co. Ltd., Nanning 530000, China.

*E-mail:20210011@gxmzu.edu.cn,240946929@qq.com,liuxx200208@163.com.

Supporting information includes a total of 7 tables, 1 text and 1 figure.

Table S1. Metal oxide content of iron-containing sludge

Sample	Fe_2O_3	SiO_2	Al_2O_3	P_2O_5	CaO	K_2O	MgO	Na_2O
iron-rich sludge sludge	35.6%	23.8%	9.5%	16.4%	5.4%	1.2%	1.4%	1.2%
Sludge	6.3%	49.8%	24.4%	8.9%	3.0%	2.4%	1.2%	0.3%

Table S2. The heavy metal level of the iron-rich sludge

Element	Mn	**Zn**	**Cr**	**Cu**	**Pb**
Amount (mg/kg)	4681.3	3731.3	193.8	131.2	82.3

Text S1. Characterization

In this study, the surface morphology of biochar was observed by scanning electron microscopy (SEM, SU 8010 Hitachi, JPN). The specific surface area, mean pore diameter and pore volume of the samples were measured by BET, ASAP 2ED-2300T460 Micromeritics, USA. Organic element analyzer (EA, Vario EL cube Elementar, GER) was used to measure the content of C, H, O, N, S in biochar. The distribution of elements and valence states on the surface of biochar was characterized by X-ray photoelectron spectroscopy (XPS, Thermo Fisher Scientific K-Alpha, USA). The types of functional groups and surface chemical structures of biochar were detected by Fourier infrared spectroscopy (FTIR, IRaffinia-1S Shimadzu, JPN). The surface charge properties of biochar were measured by Zeta potential analyzer (ZP, Zetasizer NANO ZS 90 Malvern). A vibrating sample magnetometer (VSM, Lake Shore 7410, USA) was used to detect the magnetic properties of the samples.

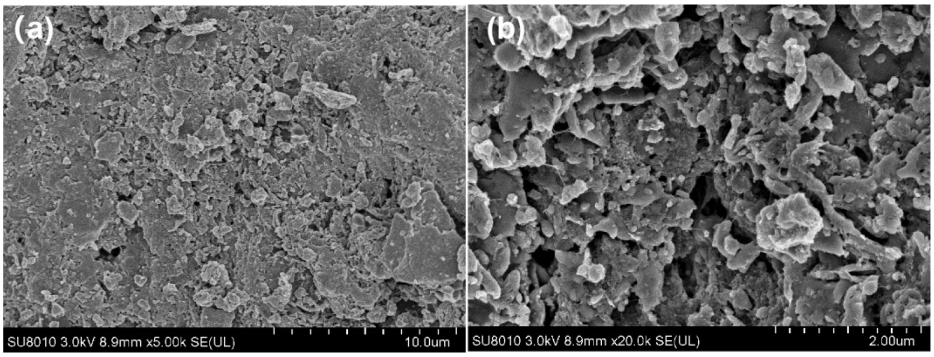

Figure S1. SEM images of CBZ adsorbed by PFBC (a, b)

Table S3 XPS spectrum analysis of FBC samples

Binding energy (eV)	Characteristic peak	%			
		FBC_{300}	FBC_{500}	FBC_{700}	FBC_{900}
284.8	C-C/C=C	60.5	66.6	66.7	57.8
286.2	C-O	24.7	22.2	22.7	36.7
288.6	C=O	14.8	11.2	10.6	5.5
711.1/724.2	Fe(II)	41.1	42.7	49.4	62.8
713.4/726.2	Fe(III)	58.9	57.3	50.6	37.2

Table S4. Fitting parameters of adsorption kinetics

Experimental adsorption capacity($mg\cdot g^{-1}$)	Pseudo–first–order			Pseudo–second–order		
	q_e	K_1	R^2	q_e	K_1	R^2
4.79	2.62	0.014	0.402	4.76	0.235	0.999

Table S5. Fitting parameters of adsorption isotherm

Experimental	Langmuir isotherm	Freundlich isotherm

adsorption capacity q_{max} ($mg\cdot g^{-1}$)	q_{max} ($mg\cdot g^{-1}$)	K_L	R^2	K_F	1/n	R^2
18.23	18.83	0.142	0.962	6.189	0.258	0.919

Table S6. Leaching characteristics of organic matter and heavy metals

Element (mg/L)	Cu	Zn	Cd	Cr	Pb	TOC (mg/L)
Dissolution amount	0.000	0.020	0.000	0.000	0.000	0.735

Table S7. Specific surface area and pore structure parameters of CBZ adsorbed by PFBC

Sample	Specific surface area(m^2/g)	Pore volume (cm^3/g)	Pore size (nm)
FBC_{900}-CBZ	29.55	0.08	11.70