Supplementary material

Thermal behavior of the hydrochar from co-hydrothermal carbonization of swine manure and sawdust: Effect of process water recirculation

Qianqian Lang,[ab] Hainan Luo,[c] Yi Li,[d] Dong Li, [ab] Zhengang Liu,[*ab] Tianxue Yang[e]

[a] *Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Beijing 100085, China*

[b] *University of Chinese Academy of Sciences, Beijing 100049, China*

[c] *College of Chemical Engineering and Material Science, Zaozhuang University, Zaozhuang, Shandong Province 277160,China*

[d] *State Key Laboratory of Multiphase Complex Systems, Institute of Process Engineering (IPE), Chinese Academy of Sciences (CAS), Beijing 100190, PR China*

[e]*State Key Laboratory of Environmental Criteria and Risk Assessment, Chinese Research Academy of Environmental Sciences, Beijing 100012, China*

* Corresponding author: Tel: +86 010-62915966, E-mail: zgliu@rcees.ac.cn,

Address: 18 Shuangqing Road, Beijing 100085, China

There are two figures and two tables in the supplementary material:

Fig. S1. The isoconversional plots of the hydrochars at various conversion rates by FWO

Fig. S2. The isoconversional plots of the hydrochars at various conversion rates by KAS

Fig. S1.

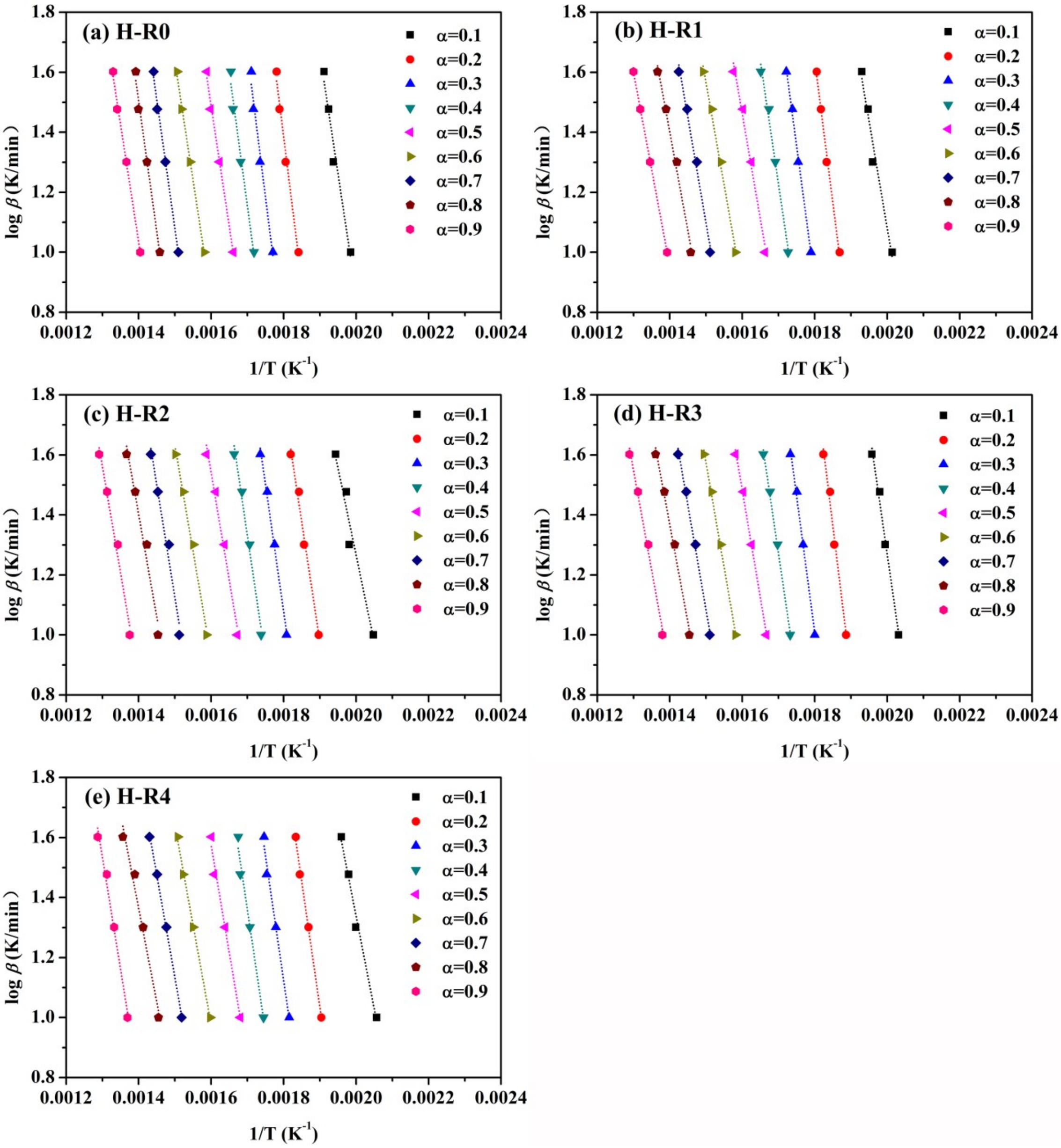
(a) H-R0
(b) H-R1
(c) H-R2
(d) H-R3
(e) H-R4
α=0.1
α=0.2
α=0.3
α=0.4
α=0.5
α=0.6
α=0.7
α=0.8
α=0.9
log β (K/min)
1/T (K⁻¹)
0.8
1.0
1.2
1.4
1.6
1.8
0.0012
0.0014
0.0016
0.0018
0.0020
0.0022
0.0024

Fig. S2.

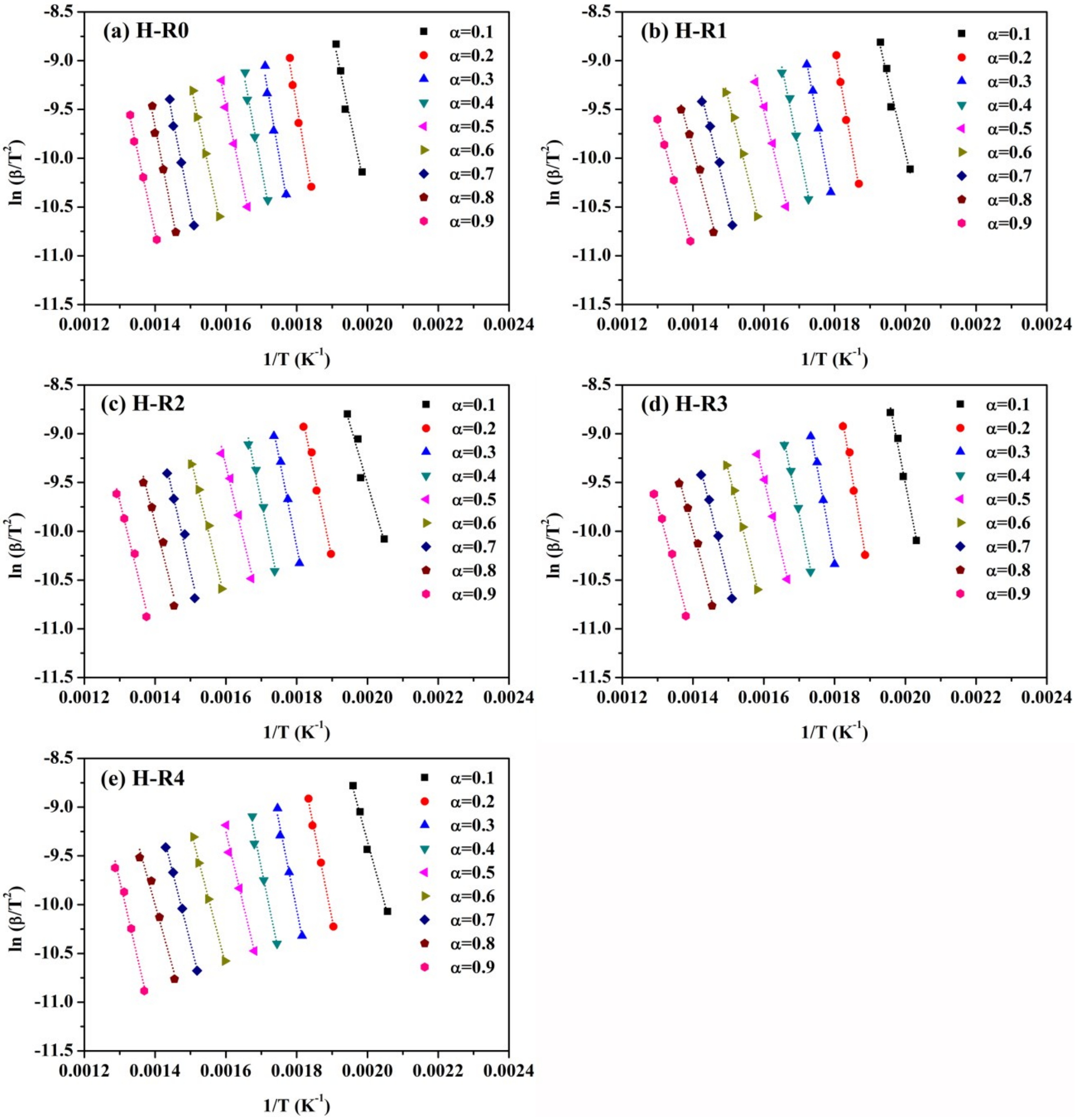
(a) H-R0
(b) H-R1
(c) H-R2
(d) H-R3
(e) H-R4
α=0.1
α=0.2
α=0.3
α=0.4
α=0.5
α=0.6
α=0.7
α=0.8
α=0.9
ln (β/T²)
1/T (K⁻¹)
-8.5
-9.0
-9.5
-10.0
-10.5
-11.0
-11.5
0.0012
0.0014
0.0016
0.0018
0.0020
0.0022
0.0024

Table S1 pH of the process water.

Sample	W-R0	W-R1	W-R2	W-R3	W-R4
pH	4.50±0.05	4.49±0.05	4.55±0.03	4.61±0.03	4.58±0.01

Table S2 Thermodynamic parameters of the hydrochars at heating rate of 20 °C/min by FWO.

Parameter	α	Sample				
		H-R0	H-R1	H-R2	H-R3	H-R4
A (s^{-1})	0.1	2.44×10^{11}	9.77×10^{9}	6.80×10^{7}	9.13×10^{8}	2.01×10^{8}
	0.2	1.59×10^{14}	9.67×10^{13}	3.63×10^{11}	1.69×10^{13}	1.48×10^{12}
	0.3	1.14×10^{14}	1.69×10^{13}	2.23×10^{12}	3.46×10^{11}	1.07×10^{12}
	0.4	9.68×10^{12}	6.19×10^{11}	8.42×10^{11}	2.53×10^{11}	6.01×10^{11}
	0.5	2.47×10^{11}	6.88×10^{9}	1.45×10^{10}	9.52×10^{9}	1.30×10^{10}
	0.6	1.65×10^{11}	3.34×10^{9}	8.78×10^{9}	4.61×10^{9}	1.60×10^{9}
	0.7	2.41×10^{12}	6.90×10^{9}	5.47×10^{10}	4.33×10^{9}	3.75×10^{9}
	0.8	3.67×10^{12}	1.21×10^{9}	3.84×10^{9}	7.18×10^{8}	3.21×10^{8}
	0.9	1.29×10^{11}	7.56×10^{8}	1.06×10^{10}	1.27×10^{9}	3.21×10^{10}
H (KJ/mol)	0.1	141.50	125.21	101.50	115.23	107.17
	0.2	171.85	168.01	140.92	161.20	148.38
	0.3	170.10	159.61	149.17	142.60	146.65
	0.4	158.24	143.92	144.44	140.93	143.75
	0.5	140.73	122.71	125.38	125.28	125.62
	0.6	138.56	119.06	122.77	121.59	115.59
	0.7	150.97	122.19	131.01	121.05	119.28
	0.8	152.76	113.88	118.45	112.39	107.63
	0.9	136.71	111.37	122.81	114.73	128.70

G (KJ/mol)	0.1	155.96	147.66	136.22	144.04	139.44
	0.2	169.79	167.24	154.25	164.84	158.21
	0.3	169.09	163.50	158.12	156.55	157.52
	0.4	163.80	156.44	156.04	155.88	156.29
	0.5	155.99	146.92	147.43	148.96	148.16
	0.6	155.13	145.40	146.37	147.43	143.77
	0.7	160.83	146.92	150.24	147.30	145.55
	0.8	161.73	143.28	144.63	143.54	140.42
	0.9	154.61	142.29	146.77	144.73	150.08
S (J/mol)	0.1	-24.65	-38.60	-60.07	-49.16	-55.52
	0.2	3.50	1.33	-23.06	-6.21	-16.91
	0.3	1.73	-6.69	-15.47	-23.80	-18.70
	0.4	-9.46	-21.52	-20.06	-25.52	-21.57
	0.5	-26.01	-41.64	-38.16	-40.40	-38.79
	0.6	-28.25	-45.29	-40.84	-44.09	-48.48
	0.7	-16.80	-42.53	-33.27	-44.80	-45.20
	0.8	-15.28	-50.54	-45.30	-53.14	-56.41
□	0.9	-30.51	-53.17	-41.46	-51.18	-36.78