Electronic Supporting Information

Critical role of anions on porous biochar structure and potassium release during potassium–assisted pyrolysis process

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Number of Figures: 5; Number of Tables: 4

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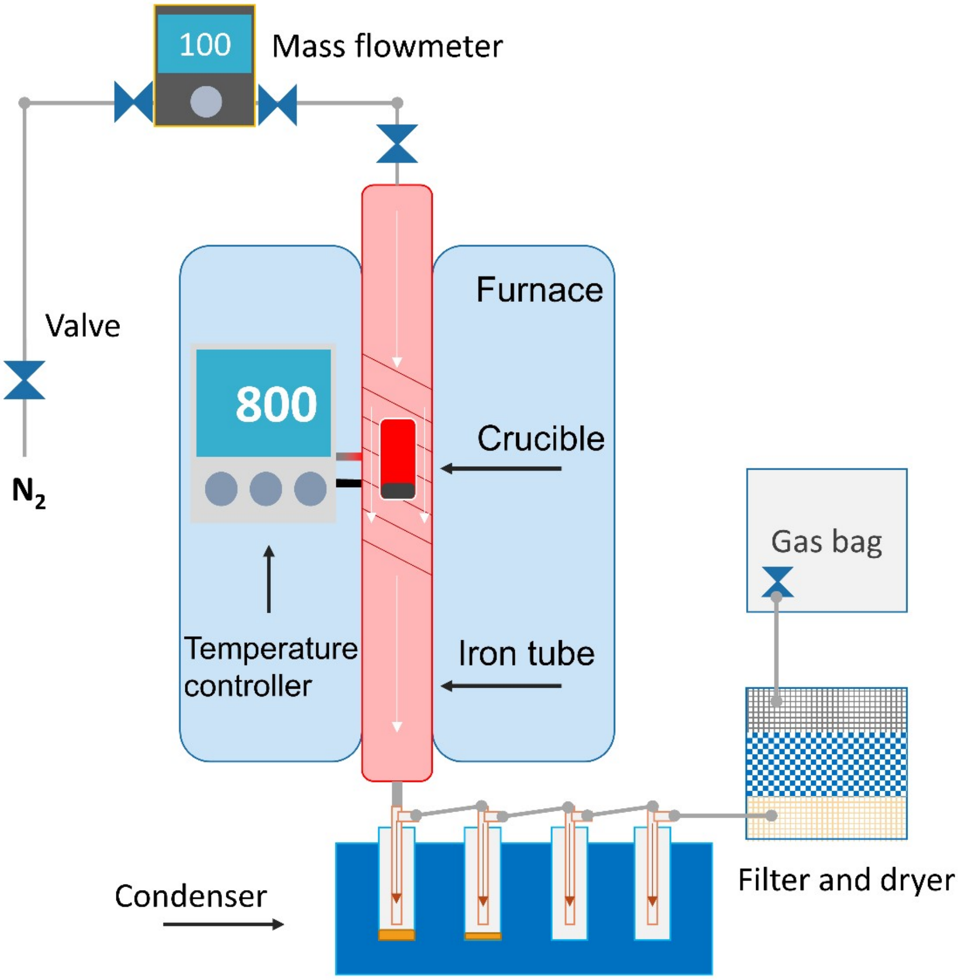

Figure S1. Diagram of vertical fixed bed reactor for potassium-assisted pyrolysis process

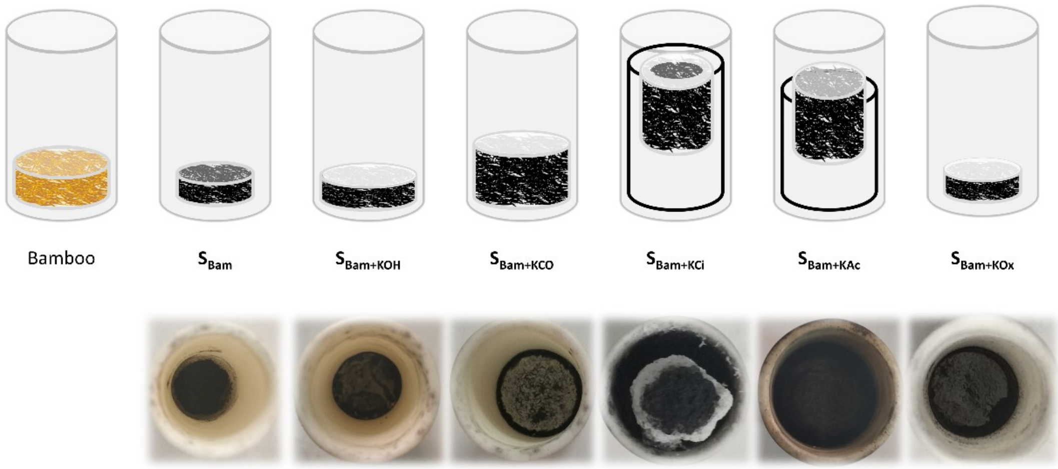

Figure S2. Diagrams and digital pictures of as-prepared solid products (S: solid product, $S_{Bam+KOH}$: solid product from bamboo and KOH)

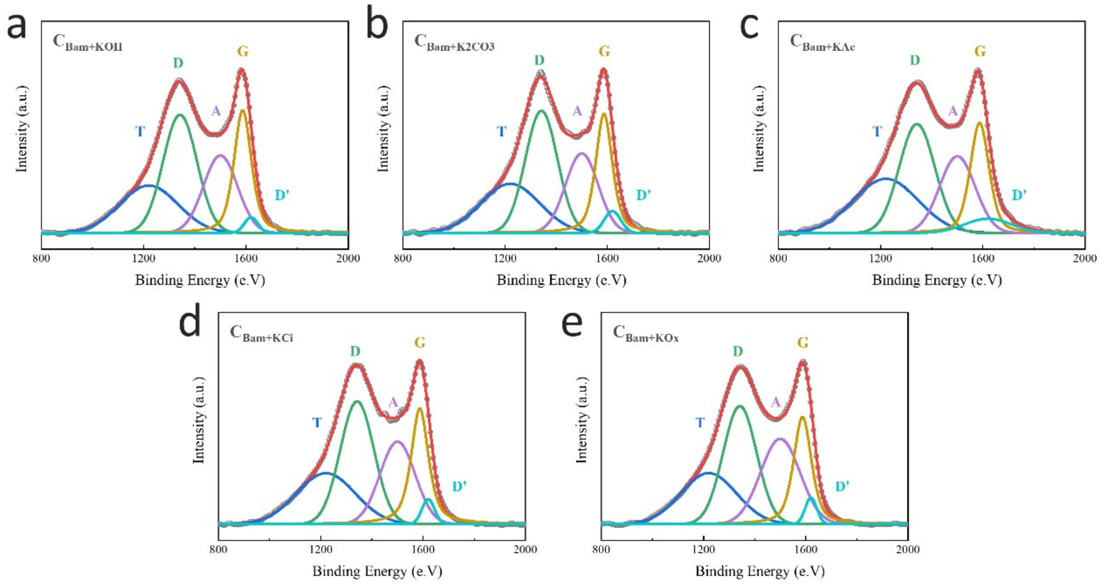

Figure S3. Raman spectra of as-prepared biochar and their deconvolution.

(a) $C_{Bam+KOH}$, (b) $C_{Bam+K2CO3}$, (c) $C_{Bam+KAc}$, (d) $C_{Bam+KCi}$, (e) $C_{Bam+KOx}$

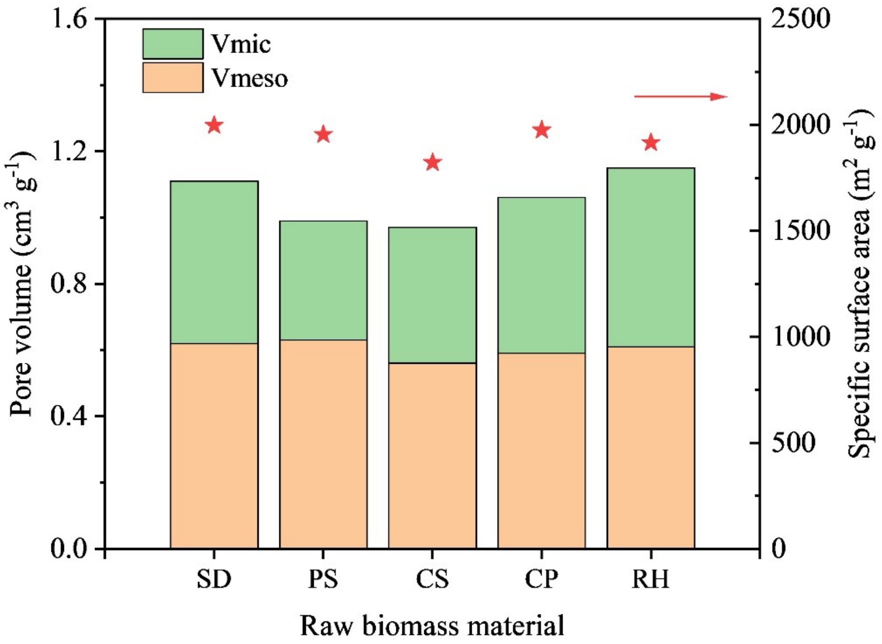

Figure S4. Textural properties of porous biochars from KAc-assisted pyrolysis

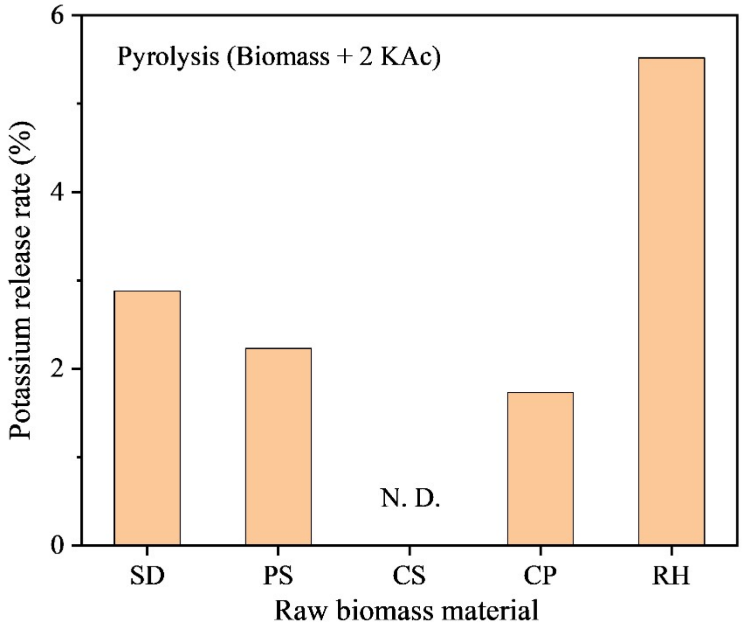

Figure S5. Potassium release rate during KAc-assisted pyrolysis (N. D.: Not Detected)

Table list

Table S1. Biomass compositions analysis

Precursors	Ash (wt.%), dry basis	Biochemical composition (wt.%), dry basis			
		Cellulose	Hemicellulose	Lignin[a]	Extractives
Bamboo (Bam)	5.47	40.36	23.05	28.47	2.65
Sawdust (SD)	1.19	43.19	18.83	12.89	23.90
Peanut shell (PS)	3.83	31.81	14.41	45.15	4.80
Cotton straw (CS)	3.14	36.56	15.67	31.25	13.38
Corn pith (CP)	10.36	42.73	22.09	0.23	24.59
Rice husk (RH)	17.05	38.14	18.73	20.32	5.76

	Inorganic composition (%) as oxide from XRF								
	K_2O	CaO	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl_2O	Fe_2O_3
Bamboo (Bam)	36.23	7.14	14.02	2.62	9.23	11.71	15.44	n. d.	0.59
Sawdust (SD)	1.71	53.09	35.69	n. d.	1.96	2.52	4.21		0.24
Peanut shell (PS)	14.00	27.92	22.52	4.42	10.38	9.26	7.29	1.87	0.82
Cotton straw (CS)	30.51	27.94	9.06	2.24	3.87	11.59	11.74	2.37	0.58
Corn pith (CP)	27.27	27.41	3.63	3.40	21.49	8.06	1.95	5.36	1.15
Rice husk (RH)	1.80	0.88	n. d.	n. d.	96.36	n. d.	0.55	n. d.	0.24

a- by difference, Lignin (wt.%) = 100– Ash- Cellulose- Hemicellulose- Extractives (wt.%).

n. d.: not detected.

Table S2. Selected potassium additives and their added amounts

Potassium additive	Abbreviation	Content of potassium mol/g	Added amount[a] g
Potassium Hydroxide (85%)	KOH	0.01515	0.34
Potassium Carbonate	K2CO3	0.01447	0.35
Potassium Acetate (92%)	KAc	0.00937	0.54
Potassium Citrate Monohydrate	KCi	0.00925	0.55
Potassium Oxalate Monohydrate	KOx	0.01086	0.47

a- the added amount was determined by 5 mmol potassium content in a chemical.

Table S3. Yields and textural properties of porous biochars from cornpith with larger dosage of additives

Sample[a]	Yield wt.%	SSA $m^2\ g^{-1}$	V_t $cm^3\ g^{-1}$	V_{mic}[b] $cm^3\ g^{-1}$	V_{mic}/ V_t %	V_{mes} $cm^3\ g^{-1}$
C_{CP+KOH}	1.8	1762	0.90	0.62	69	0.28
$C_{CP+K2CO3}$	12.4	1720	0.76	0.64	84	0.12
C_{CP+KAc}	20.0	1521	0.71	0.56	79	0.15
C_{CP+KCi}	16.4	1462	0.64	0.48	75	0.16
C_{CP+KOx}	14.2	1440	0.76	0.64	84	0.12

a- Biochar samples were prepared from cornpith pyrolysis with 10 mmol potassium additive.

b- V_{mic}, V_{mic}/V_t and V_{mes} were calculated by t-plot method.

Table S4. Yields and textural properties of porous biochars from different biomass raw materials via KAc-assisted pyrolysis

Sample	Yield wt.%	SSA $m^2\ g^{-1}$	V_t $cm^3\ g^{-1}$	V_{mic}[b] $cm^3\ g^{-1}$	V_{mic}/V_t %	V_{mes} $cm^3\ g^{-1}$
C_{SD}[a]	21.6	1997	1.11	0.62	56	0.49
C_{PS}	28.1	1954	0.99	0.63	64	0.36
C_{CS}	17.7	1822	0.97	0.56	58	0.41
C_{CP}	15.7	1975	1.06	0.59	56	0.47
C_{RH}	23.0	1916	1.15	0.61	51	0.54

a- for C_X, X indicates the precursor, C_Xs were prepared from pyrolysis of various biomass raw materials with 10 mmol KAc under 800 °C at heating rate of 15 °C min^{-1};

b- V_{mic}, V_{mic}/V_t and V_{mes} were calculated by t-plot method.