Supplementary Online Material

Adsorption and desorption of ammonium by maple wood biochar as a function of oxidation and pH

Bing Wang[a,b,*], Johannes Lehmann[b,c], Kelly Hanley[b], Rachel Hestrin[b], Akio Enders[b]

[a] *State Key Laboratory of Environmental Geochemistry, Institute of Geochemistry, Chinese Academy of Sciences, Guiyang 550002, China*

[b] *Department of Crop and Soil Sciences, Cornell University, 909 Bradfield Hall, Ithaca, NY 14853, USA*

[c] *Atkinson Center for a Sustainable Future, Cornell University, Ithaca, NY, USA*

*Corresponding author. Tel.: +86 851 85891611
E-mail addresses: wangbing@vip.gyig.ac.cn (B. Wang)

Supplementary Online Table S1 Additional properties of unoxidized biochar.

Ash	**Fixed carbon**	**Volatile matter**	**Elemental contents** (mg g^{-1})					
	(%)		Ca	Mg	K	Na	Fe	Mn
1.38±0.06	19.68±1.14	78.94±0.01	3.45±0.04	0.50±0.02	2.48±0.05	0.05±0.00	0.04±0.00	0.72±0.03

Values are mean ± SE (mean of three replications).

Supplementary Online Table S2 Additional properties of both oxidized and unoxidized biochars.

Solute	**Concentration** (%)	**Oxidization time (hours)**	C_{tot}/N (mol mol^{-1})	**Elemental contents** Ca	Mg	K	Na	Fe	Mn
				(mg g^{-1})					
none	n/a	n/a	585	3.45	0.50	2.48	0.05	0.040	0.72
H_2O	n/a	100	566	3.23	0.48	1.69	0.04	0.01	0.71
H_2O_2	15	0.75	561	3.33	0.50	1.96	0.06	0.03	0.73
H_2O_2	30	0.25	536	3.30	0.48	2.02	0.04	0.01	0.72
H_2O_2	30	6	515	3.21	0.48	1.29	0.04	0.01	0.70
H_2O_2	30	110	601	2.62	0.40	0.53	0.02	0.00	0.57
H_2O_2	30	350	576	2.24	0.32	0.66	0.02	0.01	0.45
P-value[1]	n/a	n/a	0.506	0.02	0.005	0.196	0.112	0.595	0.006

[1] P-value for a linear regression of the effect of duration of H_2O_2 exposure (only including no H_2O_2 and 30%)

Supplementary Online Table S3 Data corresponding to Fig. 5 in the main manuscript.

		Proportion of recovered NH_4^+-N (% of adsorbed)			
	pH of oxidized biochar	**First water extraction (% of adsorbed)**	**Second water extraction (% of adsorbed)**	**KCl-extracted ammonium-N (% of adsorbed)**	**Residual ^{15}N in solid biochar**
Not pH-adjusted	3.69	14.18±0.65a	6.49±0.10a	80.53±1.17a	0.34±0.01a
	4.37	19.63±0.34b	7.81±0.11ab	64.89±1.25b	0.49±0.04a
	5.97	11.70±0.29c	8.95±0.20b	64.91±1.27bc	1.49±0.03b
	7.44	5.73±0.39d	8.32±0.40b	55.05±1.96d	2.84±0.09c
	7.53	6.24±0.09d	8.27±0.14b	54.35±1.05de	2.85±0.10cd
	8.13	7.97±0.89d	8.04±0.55b	41.30±1.47f	3.83±0.06e
pH-adjusted	pH= 3.69→7.00	0.85±0.03a	0.75±0.03a	89.43±0.23a	4.73±0.18a
	pH= 4.37→7.00	1.59±0.06ab	1.62±0.06a	85.20±0.45a	3.95±0.03b
	pH= 5.97→7.00	5.04±0.22ab	5.34±0.61bc	73.87±3.18b	3.00±0.07c
	pH= 7.44→7.00	7.00±0.37b	8.47±0.52d	60.36±1.40c	2.02±0.02d
	pH= 7.53→7.00	6.75±0.45ab	6.64±0.47bd	58.99±1.07cd	2.23±0.01d
	pH= 8.13→7.00	8.50±0.03ab	10.58±0.75de	51.32±1.92de	1.89±0.09d

Different small letters indicate significant difference at $P < 0.05$ (one-way ANOVA).