

Supplementary materials

Short- and Long-Term Biochar Cadmium and Lead Immobilization Mechanisms

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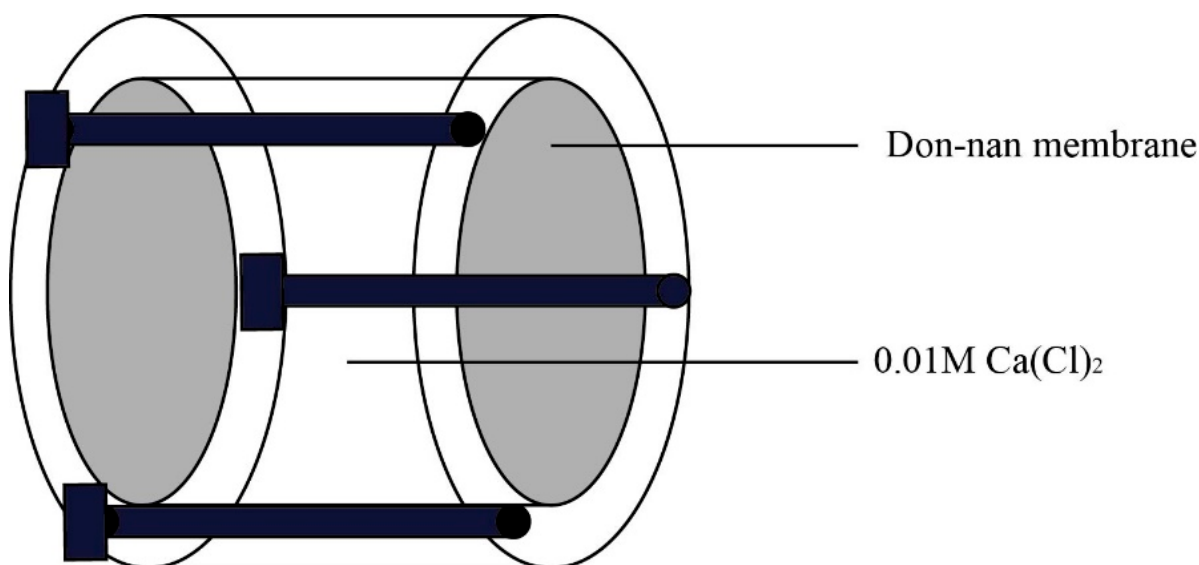
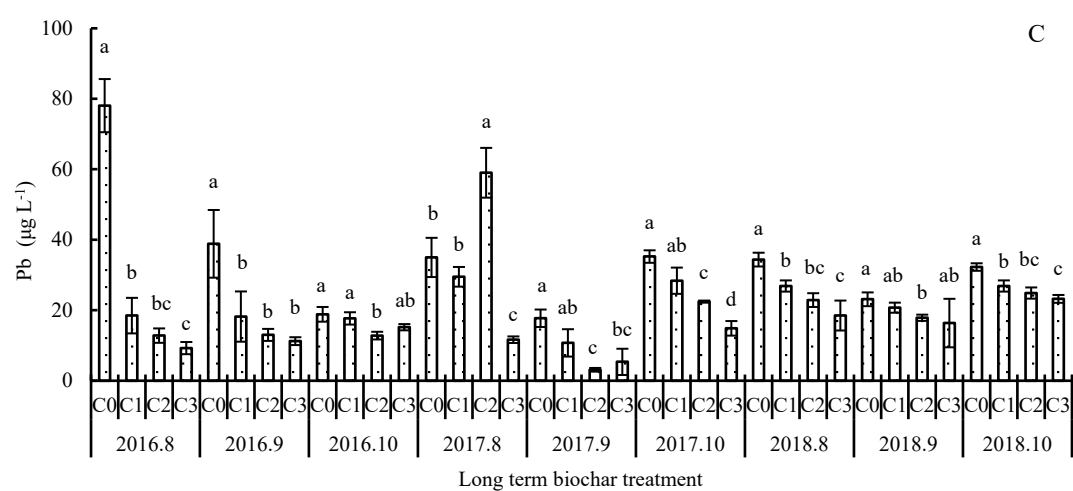
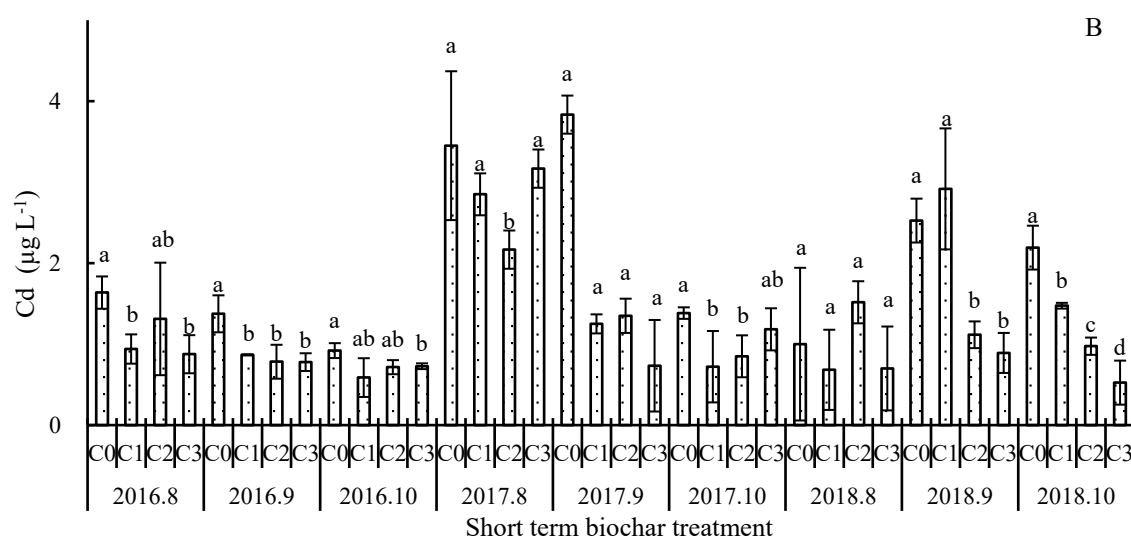
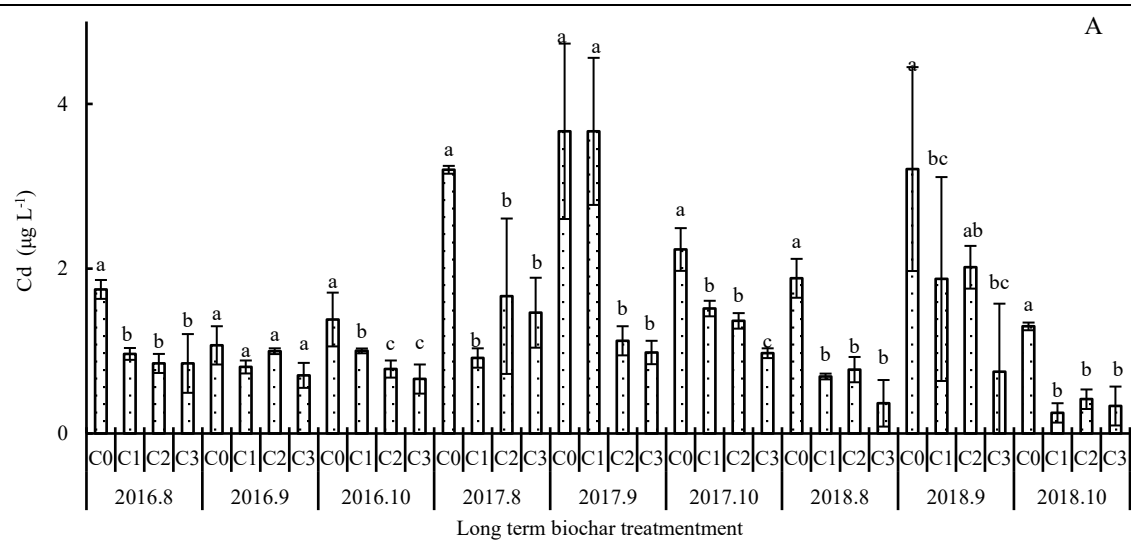


Figure 1. The schematic diagram for the acceptor cell.



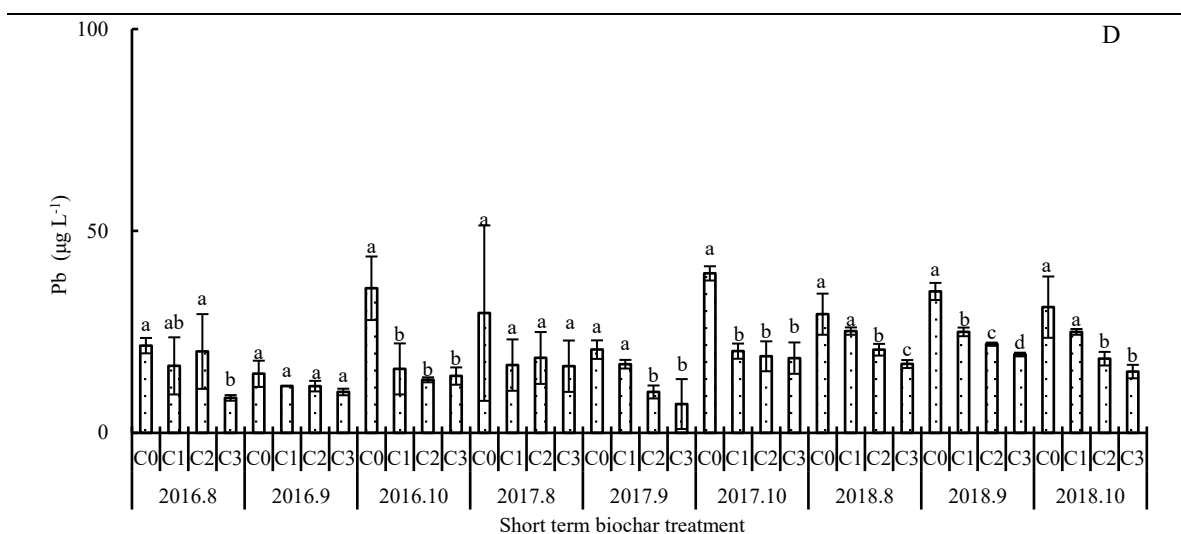


Figure 2. The effect of long- and short-term, increasing biochar application rates [0(C0), 10 (C1), 20 (C2) and 40 (C3) t ha⁻¹] on water-soluble Cd and Pb with in-situ different time (A: Cd long-term; B: Cd short-term; C: Pb long-term; D: Pb short-term). The different lower-case letters above the error bars indicate significant differences between the treatments in one year ($p < 0.05$, LSD post-hoc test). The error bars represent one standard deviation of the mean ($n = 3$).

Table 1. Basic paddy soil (0 to 15 cm depth) and biochar (g kg⁻¹) properties.

	pH (H ₂ O)	Organic C	Total N	Total P	Total K	CEC	Total Cd (mg kg ⁻¹)	Total Pb (mg kg ⁻¹)
Soil	6.07	20.7	3.19	0.82	11.4	18.0	22.6	621
Biochar	10.4	467	5.90	14.4	11.5	21.7	0.03	12.9

CEC: cation exchange capacity (cmol kg⁻¹).

Table 2. Bioconcentration (BCF) and translocation (TF) factors associated with biochar amend soil (biochar rates = 0(C0), 10 (C1), 20 (C2) and 40 (C3) t ha⁻¹).

Year	Factors	Metals	Long term				Short term			
			C0	C1	C2	C3	C0	C1	C2	C3
2017	BCF	Cd	1.12	1.11	1.01	0.96	1.78	1.28	1.10	0.97
		Pb	0.06	0.05	0.05	0.04	0.14	0.14	0.11	0.08
	TF	Cd	0.30	0.31	0.30	0.35	0.51	0.40	0.47	0.53
		Pb	0.08	0.06	0.08	0.07	0.19	0.20	0.16	0.14
2018	BCF	Cd	0.69	0.51	0.31	0.16	0.36	0.33	0.32	0.22
		Pb	0.10	0.09	0.07	0.07	0.12	0.11	0.09	0.08
	TF	Cd	0.20	0.22	0.20	0.09	0.12	0.09	0.10	0.11
		Pb	0.10	0.11	0.09	0.11	0.12	0.11	0.09	0.12

Bioconcentration factor (BCF) = above ground Cd or Pb concentration/soil Cd or Pb concentration;
Translocation factor (TF) = above ground plant Cd or Pb concentration/root Cd or Pb concentration.