

Supplementary Material

Biochar, slag and ferrous manganese ore affect lead, cadmium and antioxidant enzymes in water spinach (*Ipomoea aquatica*) grown in multi-metal contaminated soil

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Table S1. Basic attributes of amendments.

Attributes	Units	Biochar	Slag	Ferrous manganese ore
pH		10.1	8.87	6.91
EC	mS cm ⁻¹	5.78	4.89	1.7
CEC	cmol kg ⁻¹	45	23	8
Total Cd	mg kg ⁻¹	Nd*	Nd*	0.001
Total Pb	mg kg ⁻¹	22	9	0.034
Fe	%	4.65	3.84	11.062
Mn	%	8.76	0.28	13.119
N	%	0.9	0.6	0.003
P	%	0.8	1.4	0.975
K	%	2.29	0.07	0.003
Ca	%	0.69	0.45	0.136
Mg	%	0.23	0.12	Nd*

Nd*= not detected

Table S2. Chemical properties of soil receiving different amendments.

Treatment	pH	EC	CEC	N	P	K	Ca	Mg
		dS cm ⁻¹	cmol kg ⁻¹	-----%-----		-----cmol kg ⁻¹ -----		
Control	5.39 ± 0.046e	1.37 ± 0.025d	11.25 ± 0.250f	0.70 ± 0.045e	0.14 ± 0.050d	10.39 ± 0.110c	6.83 ± 0.315e	1.23 ± 0.197e
BC 3%	6.94 ± 0.430c	1.74 ± 0.045b	14.28 ± 0.333c	1.00 ± 0.042b	0.33 ± 0.040b	11.90 ± 0.361b	10.07 ± 0.286b	2.08 ± 0.154c
BC 6%	7.99 ± 0.116a	2.14 ± 0.133a	18.22 ± 0.220a	1.34 ± 0.045a	0.41 ± 0.025a	13.06 ± 0.513a	14.30 ± 0.367a	4.01 ± 0.154a
SL 3%	6.07 ± 0.129d	1.53 ± 0.085c	13.46 ± 0.446d	0.83 ± 0.031d	0.23 ± 0.026c	11.00 ± 0.500c	8.41 ± 0.311d	1.67 ± 0.131d
SL 6%	7.47 ± 0.081b	1.73 ± 0.042b	16.36 ± 0.351b	0.96 ± 0.026bc	0.36 ± 0.020ab	12.26 ± 0.252b	9.24 ± 0.257c	2.31 ± 0.262c
FMO 3%	5.680 ± 0.108e	1.580 ± 0.053c	12.37 ± 0.246e	0.81 ± 0.020d	0.21 ± 0.031c	10.86 ± 0.351c	7.14 ± 0.268e	1.53 ± 0.091de
FMO 6%	6.123 ± 0.117d	1.853 ± 0.064b	14.560 ± 0.489c	0.93 ± 0.025b	0.35 ± 0.042b	11.86 ± 0.351b	8.35 ± 0.300d	2.67 ± 0.201b

Table S3. Biological properties of soil receiving different amendments.

Treatments	MBC	MBP	MBN
	mg kg⁻¹		
Control	11.70 ± 0.281f	24.50 ± 0.500f	15.96 ± 0.282g
BC 3%	19.77 ± 0.289d	30.59 ± 0.524c	33.99 ± 0.450c
BC 6%	39.74 ± 0.658a	35.44 ± 0.440a	47.48 ± 0.501a
SL 3%	25.02 ± 0.470c	27.58 ± 0.522d	30.70 ± 0.785d
SL 6%	34.92 ± 0.336b	32.63 ± 0.548b	40.55 ± 0.510b
FMO 3%	14.59 ± 0.525e	25.18 ± 0.312f	18.26 ± 0.462f
FMO 6%	15.33 ± 0.397e	26.51 ± 0.840e	19.13 ± 0.231e

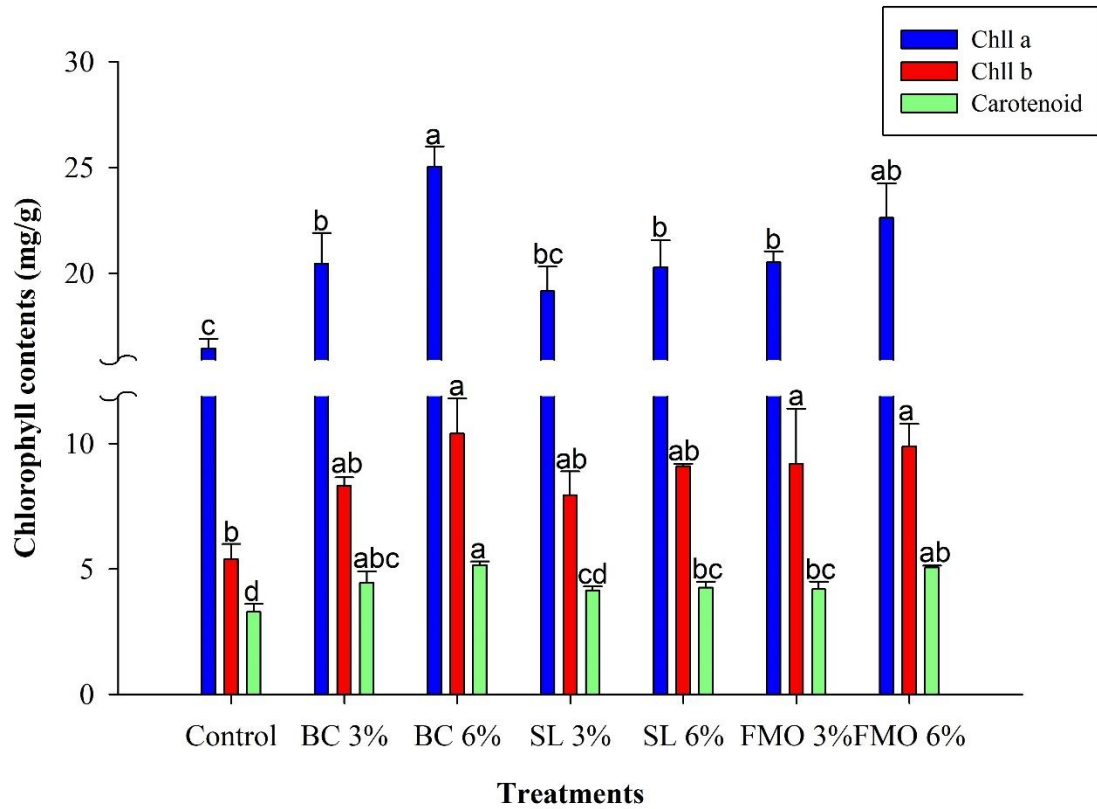


Fig. S1. Effect of amendments on plant biomass (g) and chlorophyll contents $\mu\text{g/g}$.

Treatments: control (CK), biochar (BC), slag (SL), and ferrous manganese ore

(FMO). Error bars are the SD of the means ($n=3$) and ($p < 0.05$)