Supplementary Material

Specific adsorption of heavy metals in soils: individual and competitive experiments.

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Table S1

Langmuir parameters β (mg kg^{-1}), K_L (L mg^{-1}) and R^2 after adsorption and desorption model data adjustment.

		ADSORPTION			DESORPTION-RETENTION		
		β	K_L	R^2	β	K_L	R^2
Cu	S1	1516.37 ± 90.88	0.21 ± 0.04	0.94	1714.35 ± 57.18	1.09 ± 0.10	0.99
	S2	1513.47 ± 80.19	0.33 ± 0.06	0.94	1839.10 ± 44.07	1.00 ± 0.06	0.99
	S3	1231.75 ± 105.9	0.05 ± 0.01	0.92	1332.38 ± 95.14	0.49 ± 0.09	0.96
	S4	1329.95 ± 96.24	0.07 ± 0.02	0.94	1326.36 ± 62.17	0.86 ± 0.11	0.97
	S5	1428.68 ± 97.50	0.13 ± 0.03	0.93	1433.01 ± 102.7	0.74 ± 0.16	0.94
	S6	9458.5 ± 2745.8	0.34 ± 0.12	0.98			
	S7						
	S8	1655.71 ± 108.6	0.12 ± 0.02	0.94	1596.48 ± 94.13	0.74 ± 0.13	0.95
	S9	1624.03 ± 90.92	0.25 ± 0.05	0.94	1673.58 ± 97.15	1.20 ± 0.21	0.95
	S10	1533.06 ± 90.99	0.33 ± 0.07	0.93	1674.90 ± 88.73	1.32 ± 0.21	0.96
Zn	S1	753.52 ± 16.73	0.06 ± 0.00	0.99	354.41 ± 91.78	0.03 ± 0.02	0.82
	S2	904.26 ± 19.47	0.07 ± 0.01	0.99	823.00 ± 257.8	0.01 ± 0.01	0.94
	S3	466.13 ± 28.67	0.04 ± 0.01	0.94	302.43 ± 98.97	0.05 ± 0.03	0.74
	S4	500.28 ± 20.94	0.05 ± 0.01	0.97			
	S5	583.60 ± 23.55	0.08 ± 0.01	0.97	422.98 ± 139.2	0.03 ± 0.02	0.81
	S6	2177.69 ± 48.68	0.59 ± 0.04	0.99	2048.05 ± 54.82	1.19 ± 0.08	0.99
	S7	2257.88 ± 62.14	2.46 ± 0.18	0.99	2851.01 ± 195.2	3.00 ± 0.43	0.97
	S8	632.39 ± 28.34	0.04 ± 0.00	0.98	473.98 ± 35.37	0.25 ± 0.05	0.94
	S9	595.50 ± 24.96	0.04 ± 0.01	0.97	335.34 ± 68.59	0.05 ± 0.02	0.84
	S10	713.59 ± 19.73	0.06 ± 0.01	0.99	473.72 ± 89.34	0.05 ± 0.02	0.87
Ni	S1	1133.77 ± 71.87	0.04 ± 0.01	0.96	1224.59 ± 65.74	0.19 ± 0.02	0.99
	S2	1080.50 ± 58.88	0.06 ± 0.01	0.96	1180.81 ± 70.00	0.26 ± 0.03	0.98
	S3	578.81 ± 32.14	0.02 ± 0.00	0.97	608.74 ± 41.26	0.16 ± 0.02	0.98
	S4	674.31 ± 32.74	0.04 ± 0.01	0.97	767.44 ± 45.47	0.20 ± 0.03	0.98
	S5	761.46 ± 35.85	0.04 ± 0.01	0.97	846.67 ± 45.25	0.15 ± 0.02	0.99
	S6	2308.82 ± 61.21	0.29 ± 0.02	0.99	2686.54 ± 57.37	0.69 ± 0.03	1.00
	S7	2615.12 ± 96.31	0.60 ± 0.05	0.99	2597.76 ± 196.5	2.65 ± 0.44	0.95
	S8	866.14 ± 60.43	0.02 ± 0.00	0.96	736.64 ± 41.89	0.17 ± 0.02	0.98
	S9	1107.65 ± 104.9	0.02 ± 0.00	0.95	820.83 ± 56.62	0.16 ± 0.03	0.97
	S10	740.59 ± 62.36	0.05 ± 0.01	0.91	647.69 ± 53.80	0.31 ± 0.07	0.92
Pb	S1	2404.63 ± 87.58	1.60 ± 0.14	0.98			
	S2	4390.74 ± 410.0	0.89 ± 0.13	0.98			
	S3	1919.10 ± 102.3	0.54 ± 0.09	0.95	2056.14 ± 99.66	1.68 ± 0.22	0.97
	S4	1810.05 ± 89.77	1.41 ± 0.24	0.95	2442.65 ± 133.2	2.33 ± 0.28	0.97
	S5	1990.99 ± 72.81	4.07 ± 0.47	0.97	2152.52 ± 143.2	8.61 ± 1.64	0.93
	S6				3255.03 ± 402.8	6.80 ± 1.56	0.93
	S7						
	S8	2118.70 ± 120.8	1.39 ± 0.23	0.94	2237.04 ± 66.77	5.37 ± 0.42	0.99
	S9	2166.79 ± 113.5	1.37 ± 0.20	0.95	2207.69 ± 107.6	6.15 ± 0.82	0.97
	S10	2293.43 ± 188.9	2.63 ± 0.57	0.88	2232.84 ± 118.2	12.85 ± 1.85	0.96
Cr	S1	753.40 ± 38.61	0.16 ± 0.04	0.93	753.41 ± 33.91	3.19 ± 0.46	0.94
	S2	758.18 ± 56.26	0.06 ± 0.01	0.92	647.85 ± 32.55	2.25 ± 0.41	0.93
	S3	574.40 ± 21.86	0.03 ± 0.00	0.98	444.42 ± 30.69	0.16 ± 0.03	0.96
	S4	448.96 ± 19.59	0.03 ± 0.00	0.98	327.88 ± 13.64	1.01 ± 0.16	0.96
	S5	858.56 ± 35.28	0.04 ± 0.00	0.98	745.97 ± 33.69	0.13 ± 0.01	0.99
	S6	2257.96 ± 198.8	0.01 ± 0.00	0.99	1422.67 ± 86.52	0.08 ± 0.01	0.99
	S7				2556.95 ± 877.3	0.02 ± 0.01	0.97
	S8	944.39 ± 66.69	0.03 ± 0.00	0.96	632.40 ± 39.24	0.27 ± 0.05	0.95
	S9	897.99 ± 63.75	0.02 ± 0.00	0.96	612.57 ± 33.34	0.17 ± 0.02	0.97
	S10	1041.21 ± 58.37	0.04 ± 0.01	0.97	746.23 ± 36.25	0.27 ± 0.04	0.97

Table S2

Competitive desorption results. Parameters derived from Freundlich model fitted with competitive desorption data.

	metal 1			metal 2		
	Competitive DESORPTION Freundlich metal 1 (metal 2)			Competitive DESORPTION Freundlich metal 2 (metal 1)		
	$K_{F\text{-}m1(m2)}$	n	R^2	$K_{F\text{-}m2(m1)}$	n	R^2
	Cu(Zn)			Zn(Cu)		
S1	656.75 ± 25.38	0.47 ± 0.03	0.96			
S6	3702.76 ± 212.55	1.00 ± 0.05	0.96	933.78 ± 23.83	0.46 ± 0.02	0.98
S7	9760.2 ± 1210.2	1.19 ± 0.07	0.95	2066.41 ± 125.54	0.62 ± 0.05	0.89
	Cu(Ni)			Ni(Cu)		
S1	637.84 ± 21.73	0.48 ± 0.02	0.97			
S6	3713.80 ± 186.52	1.06 ± 0.05	0.97	650.84 ± 36.66	0.56 ± 0.04	0.93
S7	25007.2 ± 4592.2	1.65 ± 0.11	0.95	1205.64 ± 56.92	0.59 ± 0.04	0.91
	Cu(Pb)			Pb(Cu)		
S1	604.66 ± 27.26	0.42 ± 0.03	0.94	1332.71 ± 27.08	0.40 ± 0.02	0.98
S6	20393.7 ± 2261.3	2.00 ± 0.08	0.99	16136.9 ± 5642.6	1.37 ± 0.19	0.82
S7	30390.7 ± 6772.9	1.63 ± 0.12	0.94			
	Cu(Cr)			Cr(Cu)		
S1	993.83 ± 38.24	0.54 ± 0.03	0.94	668.53 ± 48.87	0.40 ± 0.04	0.81
S6	3396.00 ± 94.28	1.17 ± 0.03	0.99	116.43 ± 7.60	0.87 ± 0.03	0.99
S7	5904.49 ± 352.04	1.17 ± 0.05	0.98	41.39 ± 4.59	1.05 ± 0.04	0.99
	Zn(Ni)			Ni(Zn)		
S1	120.43 ± 06.37	0.44 ± 0.03	0.96	184.26 ± 12.85	0.33 ± 0.04	0.88
S6	1027.37 ± 19.19	0.45 ± 0.02	0.99	845.20 ± 28.34	0.44 ± 0.03	0.97
S7	2236.81 ± 79.57	0.58 ± 0.03	0.97	1255.21 ± 21.82	0.52 ± 0.02	0.99
	Zn(Pb)			Pb(Zn)		
S1	154.68 ± 10.41	0.43 ± 0.03	0.94	2611.25 ± 95.88	0.78 ± 0.03	0.98
S6	1509.43 ± 22.56	0.67 ± 0.02	0.99	10658.3 ± 3582.7	1.24 ± 0.20	0.83
S7	3058.48 ± 334.11	0.75 ± 0.08	0.83			
	Zn(Cr)			Cr(Zn)		
S1	224.34 ± 14.98	0.60 ± 0.04	0.96	541.30 ± 27.43	0.31 ± 0.03	0.89
S6	1592.84 ± 23.59	0.70 ± 0.02	0.99	163.71 ± 9.57	0.81 ± 0.03	0.99
S7	4259.87 ± 337.28	0.97 ± 0.06	0.94	50.90 ± 3.23	0.96 ± 0.02	0.99
	Ni(Pb)			Pb(Ni)		
S1	192.69 ± 23.16	0.40 ± 0.06	0.78	2440.12 ± 105.02	0.69 ± 0.04	0.96
S6	937.61 ± 37.03	0.72 ± 0.04	0.95	20508.0 ± 10934.6	1.16 ± 0.22	0.82
S7	1584.06 ± 36.46	0.74 ± 0.03	0.80	13663.3 ± 3469.6	0.93 ± 0.62	0.88
	Ni(Cr)			Cr(Ni)		
S1	264.36 ± 13.66	0.56 ± 0.03	0.98	600.31 ± 28.52	0.34 ± 0.03	0.91
S6	975.04 ± 13.04	0.67 ± 0.02	1.00	153.8 ± 11.55	0.81 ± 0.03	0.98
S7	1461.73 ± 45.33	0.63 ± 0.05	0.96	32.75 ± 2.92	1.06 ± 0.03	0.99
	Pb(Cr)			Cr(Pb)		
S1				445.73 ± 17.51	0.59 ± 0.03	0.98
S6				188.70 ± 9.74	0.79 ± 0.03	0.99
S7				53.85 ± 4.05	1.03 ± 0.03	0.99

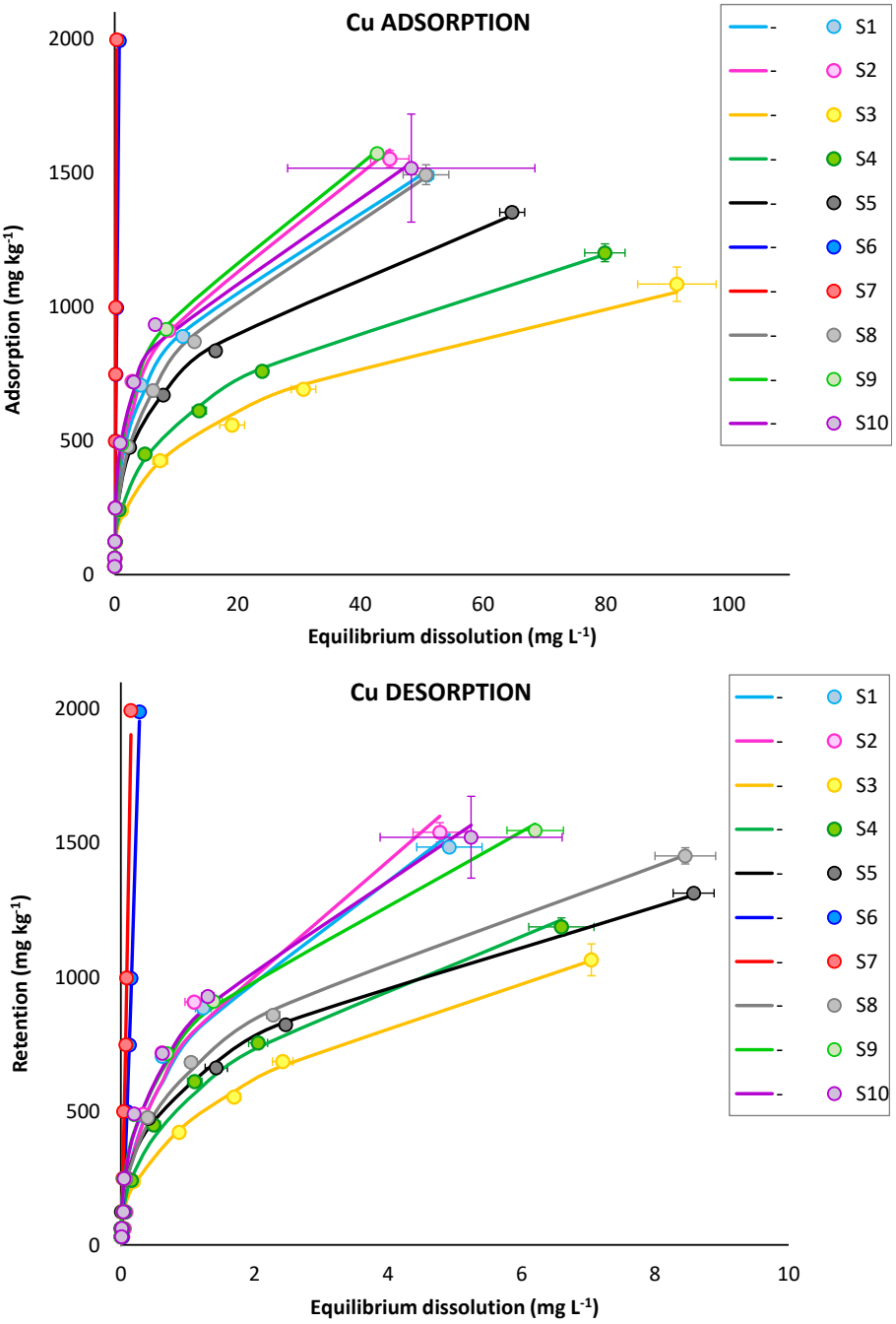


Fig. S1. Single adsorption and desorption curves of Cu by soil samples.

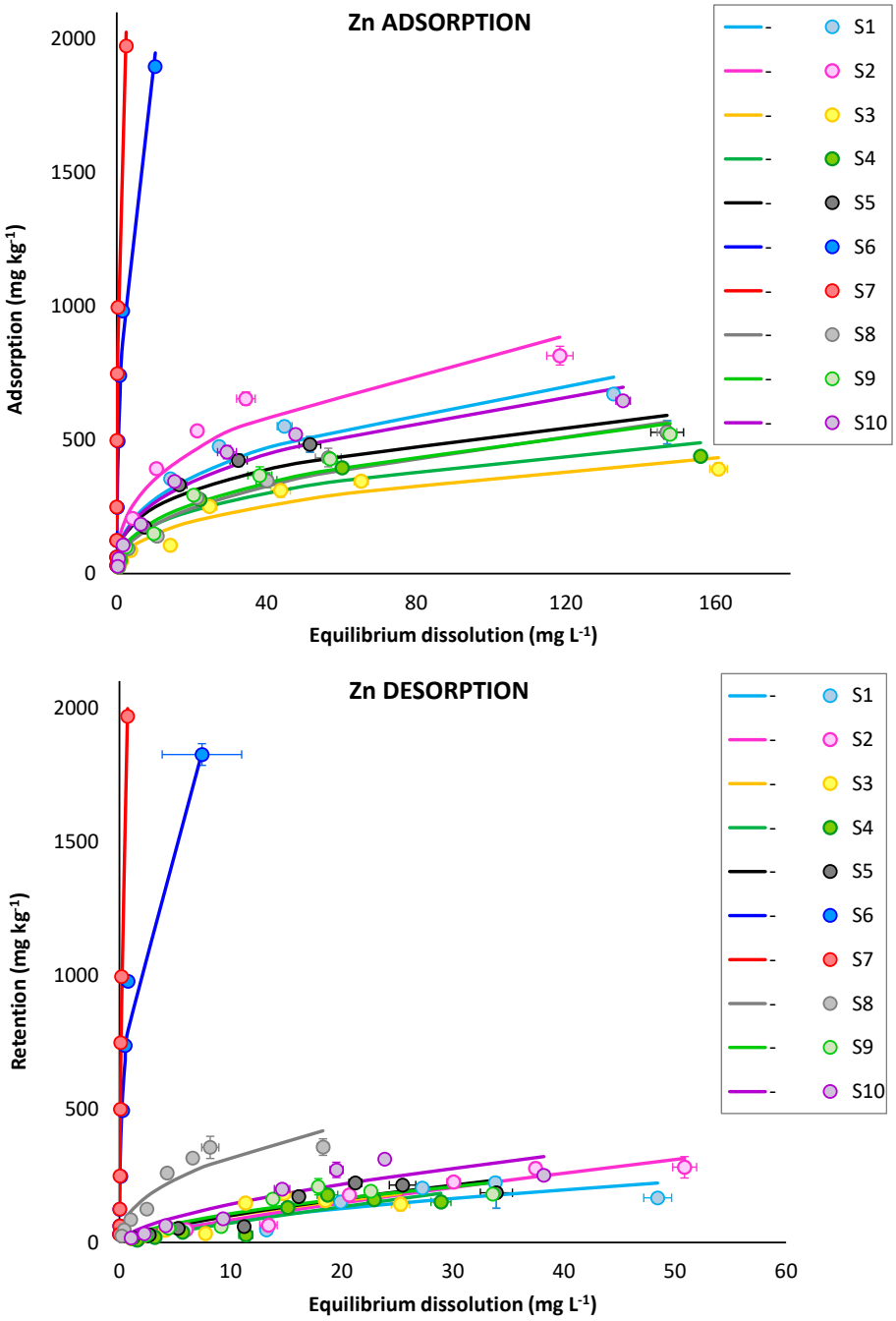
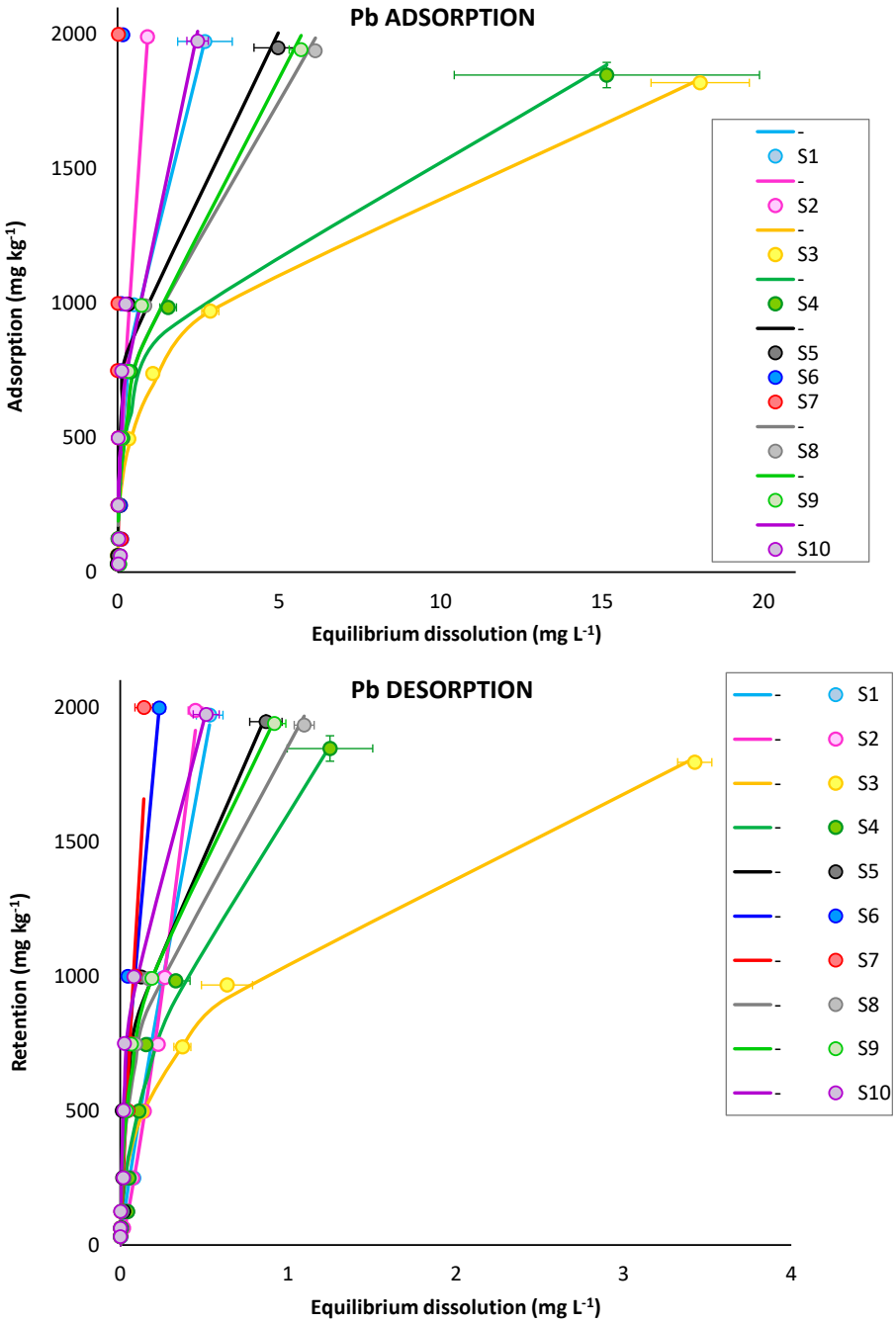
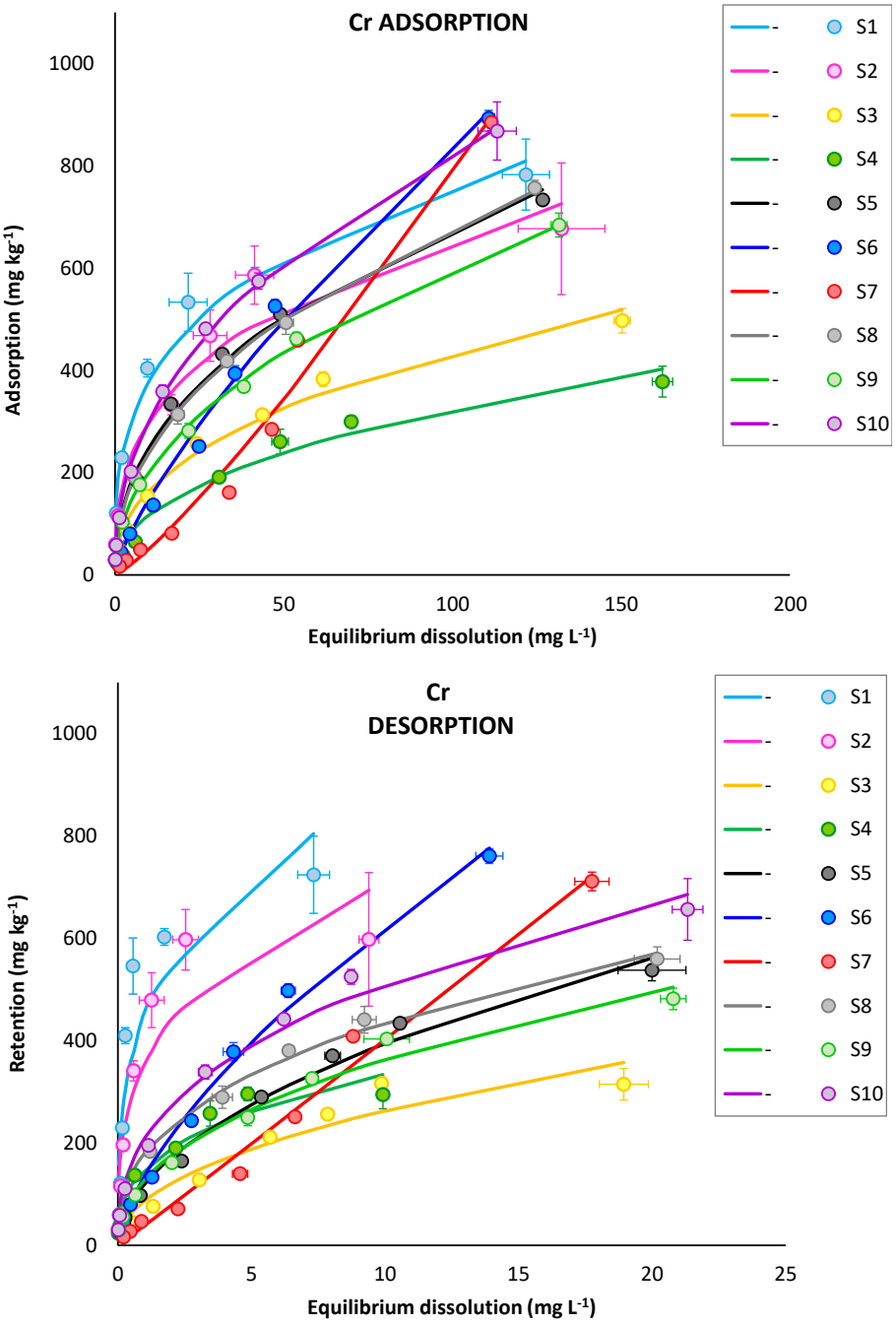


Fig. S2. Single adsorption and desorption curves of Zn by soil samples.

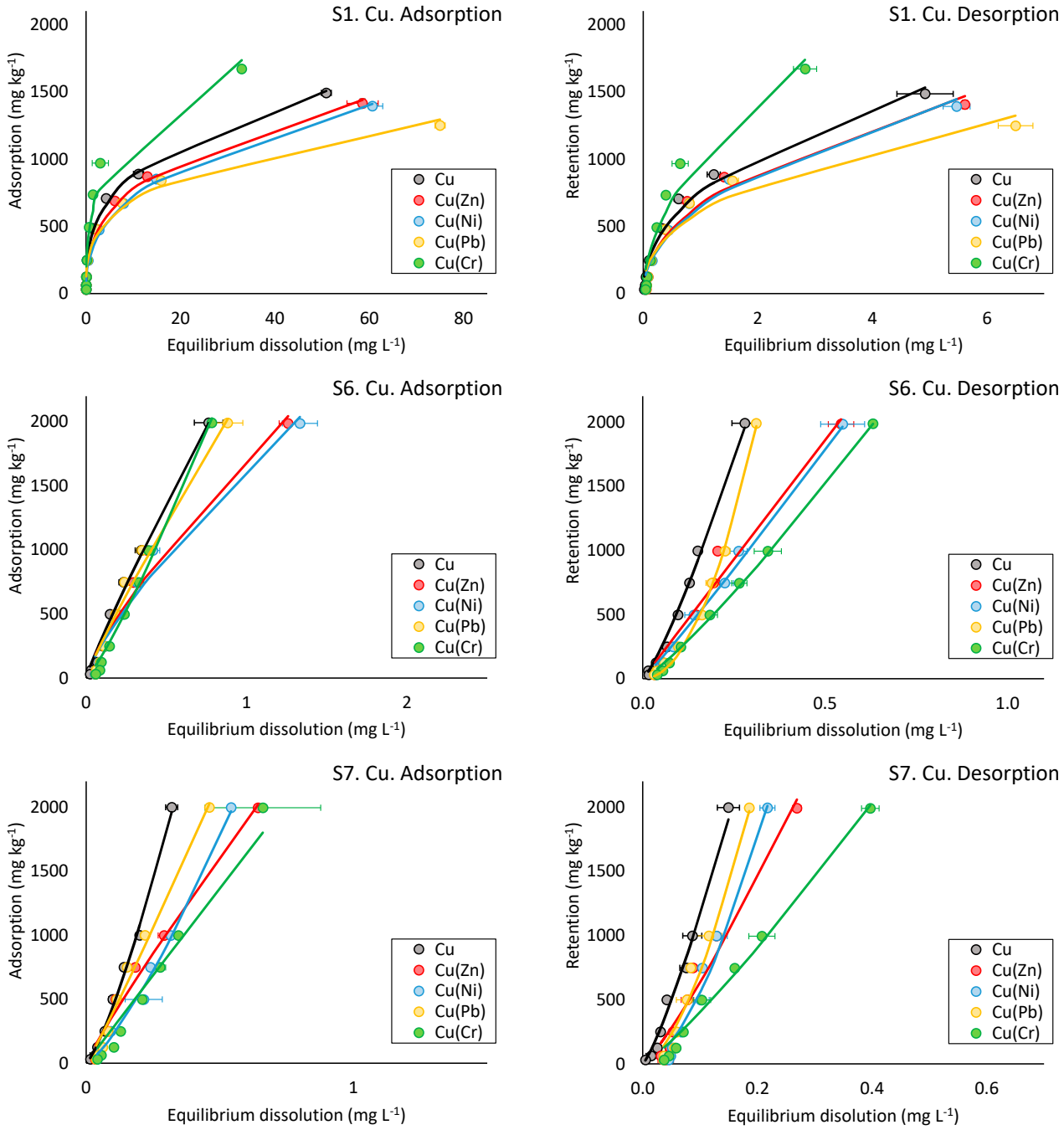


11 **Fig. S3**. Single adsorption and desorption curves of Pb by soil samples.



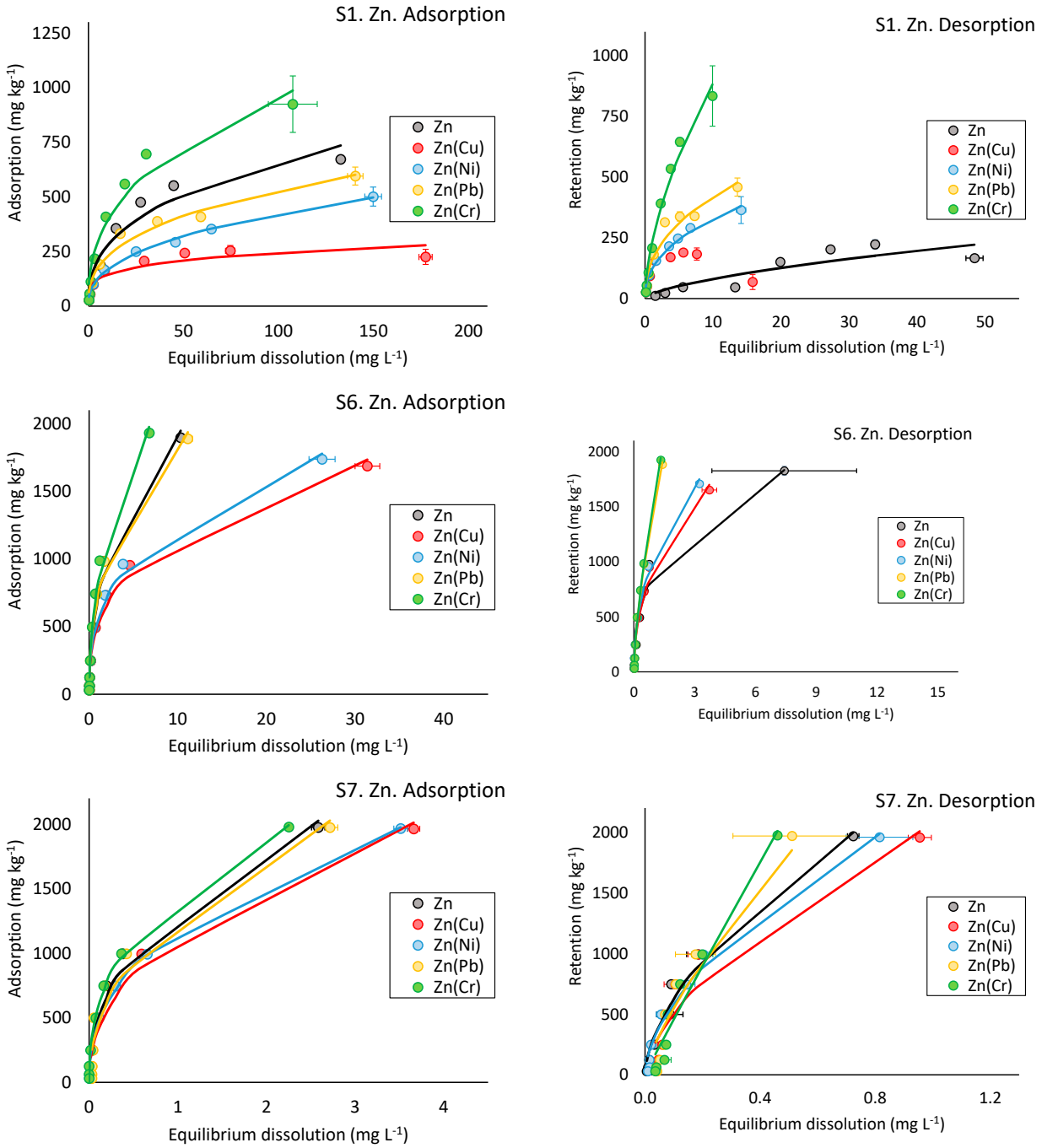
12 **Fig. S4**. Single adsorption and desorption curves of Zn by soil samples

13



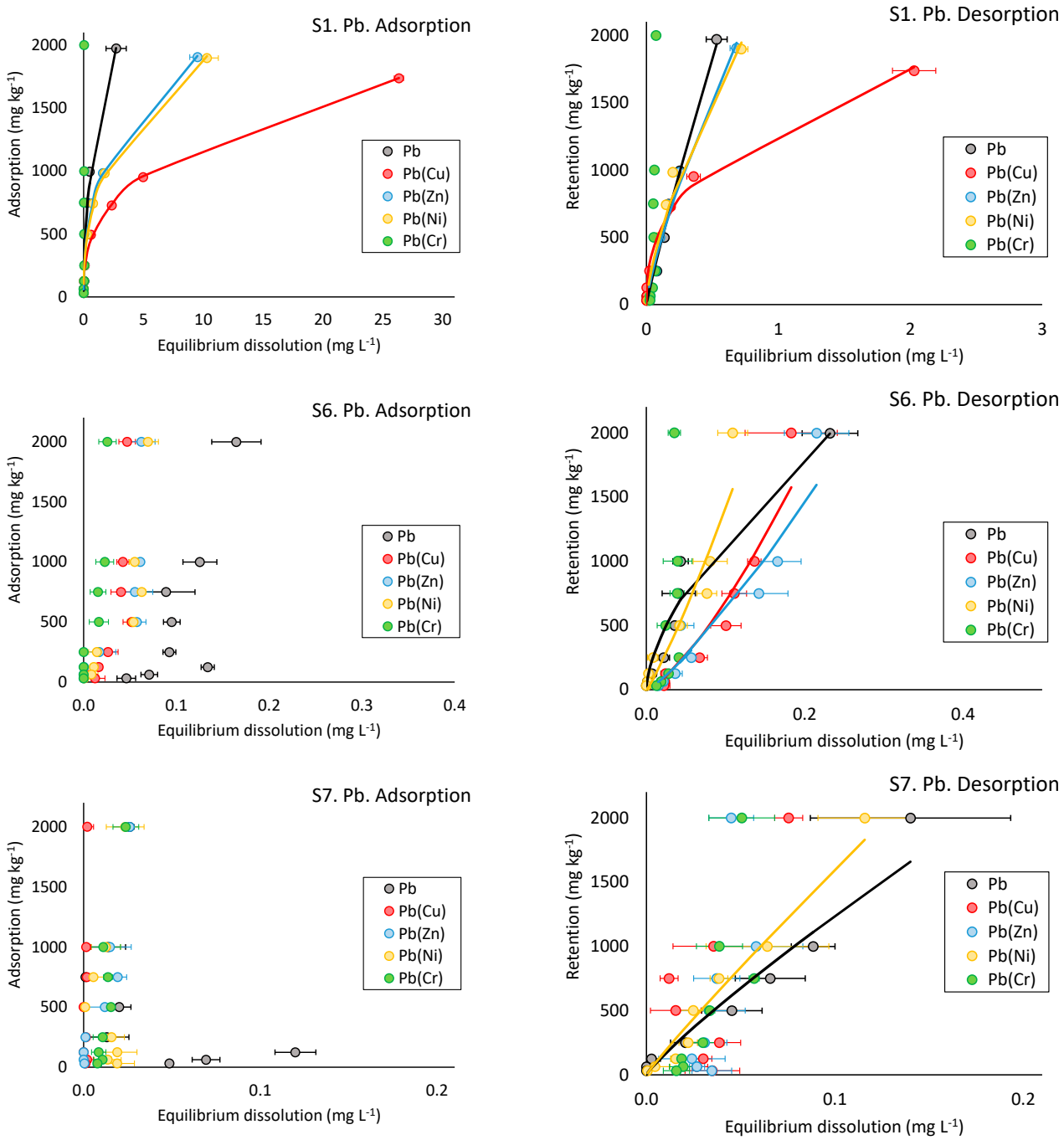
14 **Fig. S5**. Competitive (coloured) and single (black) adsorption and desorption curves of Cu by soil S1, S6

15 and S7 samples.



16 **Fig. S6**. Competitive (coloured) and single (black) adsorption and desorption curves of Zn by soil S1, S6

17 and S7 samples.



18 **Fig. S7**. Competitive (coloured) and single (black) adsorption and desorption curves of Pb by soil S1, S6

19 and S7 samples.