



**Figure S1.** Pearson correlation analysis of the loss of heavy metals and runoff volume; \*, \*\*, and \*\*\* respectively represents significant difference ( $P < 0.05$ ), ( $P < 0.01$ ) and ( $P < 0.001$ ).

**Table S1.** Chemical forms of soil HMs (Mn, Pb, and Zn) in different groups after phytoremediation using BCR method (mean  $\pm$  S.D.,  $n = 3$ ).

Chemical form	Group	Heavy metal (%)		
		Mn	Pb	Zn
Residual	CK	18.66 $\pm$ 0.40b	11.80 $\pm$ 0.45b	15.16 $\pm$ 0.24b
	M0	17.39 $\pm$ 0.18c	10.25 $\pm$ 0.09c	14.28 $\pm$ 0.13c
	M1	23.45 $\pm$ 0.15a	18.36 $\pm$ 0.47a	18.53 $\pm$ 0.23a
Exchangeable	CK	18.49 $\pm$ 0.21a	9.21 $\pm$ 0.34b	35.35 $\pm$ 0.11b
	M0	16.49 $\pm$ 0.22b	12.88 $\pm$ 0.62a	39.03 $\pm$ 0.31a
	M1	18.67 $\pm$ 0.31a	12.37 $\pm$ 0.39a	33.10 $\pm$ 0.20c
Reducible	CK	36.52 $\pm$ 0.27a	48.41 $\pm$ 0.64b	28.09 $\pm$ 0.73c
	M0	35.31 $\pm$ 0.33b	50.32 $\pm$ 0.06a	32.69 $\pm$ 0.60b
	M1	34.23 $\pm$ 0.28c	43.91 $\pm$ 0.50c	34.76 $\pm$ 0.29a
Oxidizable	CK	26.33 $\pm$ 0.18b	30.57 $\pm$ 0.52a	21.40 $\pm$ 0.51a
	M0	30.81 $\pm$ 0.46a	26.55 $\pm$ 0.54b	14.00 $\pm$ 0.53b
	M1	23.65 $\pm$ 0.43c	25.36 $\pm$ 0.69c	13.61 $\pm$ 0.25b

CK, manganese slag without any treatment; M0, amended manganese slag without plant; M1, amended manganese slag with *K. paniculata* trees being planted; different lowercase letters in a column represent significant difference ( $P < 0.05$ ).

**Table S2.** The relative abundance of the top 10 fungal taxa at the phylum level in different groups (mean  $\pm$  S.D.,  $n = 3$ ).

Taxonomy	Relative abundance (%)		
	CK	M0	M1
Basidiomycota	27.58 $\pm$ 0.95	87.03 $\pm$ 0.64	63.76 $\pm$ 0.69
Ascomycota	52.83 $\pm$ 0.26	12.06 $\pm$ 0.88	28.45 $\pm$ 0.22
Rozellomycota	1.15 $\pm$ 0.02	0.21 $\pm$ 0.17	3.60 $\pm$ 0.12
Mortierellomycota	0.85 $\pm$ 0.04	0.01 $\pm$ 0.02	0.68 $\pm$ 0.20
Chytridiomycota	0.00 $\pm$ 0.01	0.00 $\pm$ 0.00	0.03 $\pm$ 0.02

Glomeromycota	0.02±0.01	0.00±0.00	0.00±0.00
Zoopagomycota	0.00±0.00	0.00±0.00	0.01±0.01
Kickxellomycota	0.00±0.00	0.00±0.00	0.01±0.01
others	17.57±0.74	0.68±0.30	3.46±0.15

CK, manganese slag without any treatment; M0, amended manganese slag without plant; M1, amended manganese slag with *K. paniculata* trees being planted.

**Table S3.** The relative abundance of the top 10 fungal taxa at the genus level in different groups (mean ± S.D., *n* = 3).

Taxonomy	Relative abundance (%)		
	CK	M0	M1
<i>Clitopilus</i>	0.00±0.01	86.28±1.07	0.00±0.00
<i>Leucocoprinus</i>	8.02±2.40	0.07±0.11	53.24±0.42
<i>Coprinus</i>	0.00±0.00	0.46±0.20	6.80±0.18
<i>Acrocalymma</i>	0.36±0.36	0.00±0.01	3.46±0.14
<i>Cephalotrichum</i>	0.33±0.39	1.88±0.26	5.02±0.00
<i>Thermomyces</i>	0.46±0.24	1.55±0.14	8.43±0.84
<i>Myceliophthora</i>	0.40±0.10	2.91±0.74	2.47±0.14
<i>Tausonia</i>	0.01±0.01	0.00±0.00	0.36±0.13
<i>Idriella</i>	4.10±2.64	0.03±0.01	0.31±0.53
<i>Alternaria</i>	4.45±0.15	0.27±0.01	0.15±0.71
others	18.14±3.85	93.45±0.93	80.23±0.22

CK, manganese slag without any treatment; M0, amended manganese slag without plant; M1, amended manganese slag with *K. paniculata* trees being planted.