

Is microbial species richness increased by aided phytostabilization of trace element contaminated soils?

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Abstract

Chemical mobility and toxicity of metal and metalloids in trace element contaminated soils (TECS) can be reduced by soil amendment with organic residues, and various industrial (by-)products rich alone or in combination. After treatments, TECS generally show reduced trace element mobility and bioavailability, and positive effects on soil biochemical activities and plant growth. We determined soil eubacterial and fungal species richness by the 16S and 18S PCR-DGGE in soils from various aided phytostabilization experiments (Table 1), to determine whether such TECS remediation practice also increases the richness of the microbial communities in restored soils.

Table 1. Changes in chemical and biological parameters depending on soils and treatments

Louis Fargue experiment, France, main contaminants: Cd, Ni	Jales gold mine, Portugal, main contaminants: As, Zn						Reppel, Belgium, main contaminants: As, Pb			Slagnäs, Sweden, main contaminants: Cu, Pb
	Amendments		Amendments				Amendments			Amendments
Endpoint	B	Z	OM	OM+B	OM+Z	OM+BZ	B	Z	BZ	OM+CFA
Metal mobility and bioavailability	Cd: + Ni: +	+	As:- Zn: -	As: - Zn:+	As:- Zn:+	As:- Zn: +	As: - Pb: +	As: - Pb: +	As: + Pb: +	Cu: + Pb: +
Plant colonization	ND	ND	+	+	+	+	+	+	+	+
Soil microbial biomass and activity	+	+	+	+	+	+	+	+	+	+
Eubacterial species richness	-	-	-	-	-	-	-	-	-	-
Fungal species richness	ND	ND	-	-	-	-	-	-	-	-

Legend: C: compost, OM = organic matter, B = beringite, CFA = coal fly ash from wood and coal combustion, Z = zerovalent Fe. ND = not determined. Symbols + and – indicate a positive effect and no or negative effects of TECS treatments, respectively.

Molecular analyses of microbial communities showed that aided phytostabilization of TECS reduced soil toxicity through metal chemisorption and allowed recovery of key soil functions and plant colonization, but did not increase eubacterial and fungal species richness, but caused shifts in the composition of the community structures. Possible causes of such lack of response are discussed.