

Effects of a spontaneous revegetation of a zinc smelting slag heap on soil properties and consequence on metal leaching

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Abstract:

A natural plant cover is generally desired on heavy metals contaminated soils as it prevents runoff and wind or water erosion. However, little is known about the effects of the revegetation on soil properties and its consequence on the fate of the metals. Here, we investigate the effects of long term revegetation of a slag heap from a zinc smelting plant by Zn-hypertolerant (*Agrostis tenuis*) and Zn-hyperaccumulator (*Armeria maritima* ssp. *halleri*) plants. The mobility of Zn is investigated using acetic acid selective extraction in batch and by water leaching column test. Our data show that the predominant source for the soil CEC is the organic matter introduced by the plants (organic CEC is 13 or 20 times higher than mineral CEC). This is a consequence not only of the low alterability of the slag material and its high metal content (~53.000-66.000 mg kg⁻¹) which inhibits the soil microbial activity (C/N=41) but also of the recalcitrance of plants residues to biodegradation caused by the high Zn content in hyperaccumulator vegetation (14.800 mg kg⁻¹ DW). In response to this additional CEC, Zn has been progressively displaced from the weakly soluble soil constituents to the exchange complex (acetic acid extractable Zn fraction rises from 33% to 46% or 62%). As a result, the proportion of easily leached Zn was increased by 3.5 or 5 times. By acidifying the soil, plants further diminished its ability to retain the metal. This study suggests that revegetation of contaminated soil in which Zn was initially immobile can have negative consequences on the environment by inducing more Zn leaching.

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