

Humus-assisted cleaning of heavy metal contaminated soils

Ole K. Borggaard (1) and Signe B. Rasmussen (2)

(1) University of Copenhagen, Plant and Environmental Sciences, Frederiksberg C, Denmark (okb@plen.ku.dk), (2)
University of Copenhagen, Plant and Environmental Sciences, Frederiksberg C, Denmark

Contamination of soils with non-degradable heavy metals (HMs) because of human activities is globally a serious problem threatening human health and ecosystem functioning. To avoid negative effects, HMs must be removed either on-site by plant uptake (phytoremediation) or off-site by extraction (soil washing). In both strategies, HM solubility must be augmented by means of a strong ligand (complexant). Often polycarboxylates such as EDTA and NTA are used but these ligands are toxic, synthetic (non-natural) and may promote HM leaching. Instead naturally occurring soluble humic substances (HS) were tested as means for cleaning HM contaminated soils; HS samples from beech and spruce litter, compost percolate and processed cow slurry were tested. Various long-term HM contaminated soils were extracted with solutions of EDTA, NTA or HS at different pH by single-step and multiple-step extraction mode. The results showed that each of the three complexant types increased HM solubility but the pH-dependent HM extraction efficiency decreased in the order: EDTA \approx NTA > HS. However, the naturally occurring HS seems suitable for cleaning As, Cd, Cu and Zn contaminated soils both in relation to phytoremediation of moderately contaminated soils and washing of strongly contaminated soils. On the other hand, HS was found unsuited as cleaning agent for Pb polluted calcareous soils. If future field experiments confirm these laboratory results, we have a new cheap and environmentally friendly method for solving a great pollution problem, i.e. cleaning of heavy metal contaminated soils. In addition, humic substances possess additional benefits such as improving soil structure and stimulating microbial activity.