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Changes in metal bioavailability in soil and their accumulation in plants during a two years' aided phytostabilization experiment

Jacek Krzyżak, Grażyna Płaza, and Marta Pogrzeba
Institute for Ecology of Industrial Areas, Katowice, Poland (jkrzyzak@ietu.katowice.pl)

Aided phytostabilization is quite a promising method to solve the main problems of metal polluted soils. This method is based on the use of soil additives, which limit metal bioavailability and help in creation of a dense plant cover on the soil surface.
The aim of the study was to evaluate the effect of aided phytostabilization on lead, cadmium, zinc and arsenic bioavailability and their accumulation in plant tissues during a two years' pilot-scale (plot) experiment. For the study two plots were established: (i) a control plot with heavy metal contaminated soil and (ii) an experimental one, where contaminated soil was amended with lignite and lime to reduce metal bioavailability. Both plots were vegetated with grass Festuca arundinacea.
Application of lignite and lime increased pH and organic matter content in soil. After amendment application the bioavailable metal concentration significantly decreased, maintaining at the same level during the whole experiment. Cadmium and arsenic bioavailable forms were reduced by about 70 %, whereas in the case of zinc a 60 % decrease in bioavailable forms was observed. Diminishing of heavy metal accumulation in tall fescue, grown on amended soil, was also observed. It was was three-fold lower for lead, zinc and arsenic and two-fold lower for cadmium, in comparison to the control plot. Moreover, on the surface of the stabilized soil a dense plant cover was created, with total biomass production over four-fold higher than on the control plot.
The in situ aided phytostabilization approach to contaminated soil, proposed in this study, showed that it could be a sustainable option for degraded soil management.