Assessment of urban soil heavy metal contamination and bioremediation potential

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Continuous accumulation of heavy metal/metalloid contaminants in urban soils change the physical, chemical and biological properties of soils and can cause serious health problems. The current study was performed on urban soils to 1) identify distribution of potentially toxic elements (PTEs) and their possible contamination sources; and 2) isolate heavy metal resistance bacteria for future bioremediation in the former industrial city Salgótarján, northwest Hungary, where coal mines, coal-fired power plant, iron and steel works, machine factories and glass works contaminated the urban environment for a century. The PTE content of 36 urban soil samples were analysed by ICP-MS and their bulk compositions range at 8.5-1692 ppm for Pb, 0.10-1.59 ppm for Cd, 0.03-0.45 ppm for Hg and 3.7-73.6 ppm for As. For the source identification, ~200 grains (63-125 μm size in diameter) were analyzed by SEM-EDX separated from 4 samples with the highest PTE concentrations. Results revealed Pb-enriched alloy, slag, coal and composite grains, which carries indications of industrial treatment and processes such as weathering, burning, crystallization, cooling, quenching, etc.

The most contaminated sites were subjected also to microbiological investigations. Heavy metal/metalloid resistant bacteria were isolated, which were able to tolerate ca. 600-15000 ppm Cd, 1300-3000 ppm Pb, 600-1400 ppm Hg and 100-1000 ppm As concentrations *in vitro.* They were identified as members of genera *Bacillus*, *Brevibacterium*, *Delftia*, *Azospirillum, Pseudomonas, Aminobacter, Ochrobactrum, Arthrobacter* and the most tolerant bacterium was *Cupriavidus campinensis*. These bacteria show promise for future microbiological, both *in situ* and *ex situ* bioremediation of PTE contaminated sites.