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Chemical speciation, vertical profile and human health risk assessment of heavy metals in soils from coal-mine brownfield, Beijing, China

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**Chemical speciation, vertical profile and human health risk  
assessment of heavy metals in soils from coal-mine brownfield,**

**Beijing, China**

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**Abstract**

The characterization of the concentration and chemical speciation of heavy metals in surface and vertical profile soils is a necessary for pollution monitoring and the potential risk assessment of the heavy metals (HMs) to animal and human health. Surface soil samples (n=14) and vertical profile soil samples (n=36) from selected sites (n=6) were collected from coal-mine brownfield in the Qingshui River Basin, in which the concentrations and chemical speciation of HMs (Cd, Cr, Cu, Mn, Ni, Pb, Zn) in surface soils and HM concentrations in vertical profile soils were determined by ICP-OES and analyzed using methods of geo-accumulation index ( $I_{geo}$ ), Tucker 3 model and health risk assessment. The chemical fractions of HMs were extracted by BCR-sequential extraction procedure. Results show that HMs in surface soils accumulate in descending order of  $Cd > Pb > Cu > Ni > Mn > Zn > Cr$ . All HMs are associated with residue fraction to different degrees. Manganese and Ni are closely

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