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EGC-01 General contributions to environmental geochemistry - Part 2

Heavy metals in soils of Angren-Almalik mining industrial area: Distribution, forms, bioavailability, and their impacts on nematode and microbial biomass

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The knowledge of chemical mobility of heavy metals in soils is fundamental to understanding their toxicity, bioavailability, and geochemical behavior. The soil samples, which are heavily impacted by aerial emissions from the coal burning and metal-processing industry of the Angren-Almalyk mining industrial area, were the main subject of our intensive investigation. Accumulation and persistence of heavy metals in surface soil layers, their bioavailability and potential toxicity were the main reasons for conducted research. In first part of our studies two different methods, i.e. mineralogical means and sequential extractions, were employed to analyze the total contents, existing states, and chemical forms of heavy metals in soil. The obtained data demonstrate that the Angren Power Plant (APP) and Almalyk Mining Metallurgical Combine (AMMC) are major sources for Pb, Zn, Cu, Cd, and As enrichment in soils of study area. Highest contents above mentioned metals were determined in the upper soil layer (0-10 cm) near the sources of pollution. The concentrations and forms of Cr, Ni, and Co in contrast suggest that the concentrations of these metals in soil were derived from the lithogenic background. Microprobe observations have shown that the studied heavy metals (Cu, Zn, Pb, Cd and As) are associated with two major forms in the contaminated soils. Metals bound to fine grains of sulphide ore minerals, occasionally covered with weathering rims of secondary ore minerals (sulphates or carbonates) can be related to contamination by mining activities. Spherical metallyferrous particles can be found in smelter-impacted areas. Therefore, we can divide enrichments of all studied heavy metals into two groups: 1) anthropogenic (airborne) source: Pb, Zn, Cu, Cd and As U; 2) lithogenic (geochemical) source: Cr, Ni and Co. The influences of heavy metals (Cu, Pb, Zn, Cd and AS) on soil microbial and nematode population characteristics along the pollution gradient in Angren-Almalyk industrial area was investigated in detail. Data obtained during these studies has shown intensive effect of mining industry to soil ecosystem. Results on the influences of heavy metals (Cu, Pb, Zn, Cd and As) on soil microbial and nematode characteristics in Angren-Almalyk mining industrial area along the two deposition transects illustrate their negative response to heavy metal pollution. Studies on the relationship between soil biota and pollution levels have raised the question regarding the importance of natural soil abiotic properties, stressing the importance of background data of environmental conditions, and elucidating the importance of further studies on this subject. Obtained data on nematode population and community structure, ecological indices and other indicators including microbial biomass, metabolic quotient in soils of Angren-Almalyk mining industrial area show bright future of these techniques as tools for environmental biomonitoring and bioremediation measures.

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