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Heavy metals in soils from Baia Mare mining impacted area (Romania) and their bioavailability

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The fate of various metals, including chromium, nickel, copper, manganese, mercury, cadmium, and lead, and metalloids, like arsenic, antimony, and selenium, in the natural environment is of great concern, particularly in the vicinity of former mining sites, dumps, tailings piles, and impoundments, but also in urban areas and industrial centres. Most of the studies focused on the heavy metal pollution in mining areas present only the total amounts of metals in soils. The bioavailable concentration of metals in soil may be a better predictor for environmental impact of historical and current dispersion of metals. Assessment of the metal bioavailability and bioaccessibility is critical in understanding the possible effects on soil biota. The bioavailability of metals in soil and their retention in the solid phase of soil is affected by different parameters like pH, metal amount, cation-exchange capacity, content of organic matter, or soil mineralogy. The main objectives of the present study were to determine the total fraction and the bioavailable fraction of Cu, Cd, Pb and Zn from soil in a well-known mining region in Romania, and to evaluate the influence of soil pH on the metal bioavailability in soil. The heavy metal contents and their bioavailability were monitored in a total of 50 soil samples, collected during June and July 2014 from private gardens of the inhabitants from Baia-Mare area. The main mining activities developed in the area consisted of non-ferrous sulphidic ores extraction and processing, aiming to obtain concentrates of lead, copper, zinc and precious metals. After 2006, the metallurgical industry has considerably reduced its activity by closing or diminishing its production capacity. The analysed soil samples proved to have high levels of Pb (50 – 830 mg/kg), Cu (40 – 600 mg/kg), Zn (100 – 700 mg/kg) and Cd (up to 10 mg/kg). The metal abundance in the total fraction is following the sequence Zn > Pb > Cu > Cd, while the bioavailable fractions were considerably lower and their sequence was as follows: Cd > Cu > Pb > Zn. Higher proportions of mobile fractions of metals were detected in samples taken from soils with acidic pH.

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