Long-term effects of contamination from mining accidents on the contents of Zn, Cu, Pb and Cd in a floodplain soil of the river Tisza (Hungary)

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Long-term effects of metal pollution on the plant available and total Zn, Cu, Pb and Cd contents of a floodplain soil (upper Tisza river basin, Hungary) were investigated. The study area is located near the estuarine of the Szamos River (N 48° 07′ 46.5″; E 22° 19′ 39.5″), and was affected by two tailings dam failures (Baia Mare and Baia Borsa, Romania) in January and March 2000. As effects of the pollution events, water and sediment of the Lápos-Szamos-Tisza and Visó-Tisza river systems were contaminated by Cu, Zn, Pb and Cd [1,2,4,6]. The mining accidents were followed by floods; therefore the metal pollution of the floodplains were also observable [2,4]. Deposition of contaminated sediment on floodplains during flood events and the mobilization of the pollutants may increase the plant available metal content of the upper soil layer. Thus, soil samples were collected in 2011, and the total (HNO_3-H_2O_2) and easily available (AAAc-EDTA [5]) metal contents of the soils were determined. Cu, Zn contents were measured by an Optima 3300 DV ICP-OES (Perkin-Elmer). The measurement of Pb and Cd was conducted by an X7 ICP-MS (Thermo Fisher).

The total Zn, Cu, Pb and Cd contents of the upper soil layers (0-10, 10-30, 30-50 cm) were 329-440, 63-94, 108-119 and 1,8-2 mg kg^{-1}, respectively. These concentrations exceed natural background values [3]. 19-24%, 48-60%, 37-44% and 78-88% of the total Zn, Cu, Pb and Cd contents were extractable by AAAc-EDTA solution, which is considered easily available for plant. According to our results, the effects of the pollution were detectable 11 years after the pollution and its remarkable part was easily available.

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Acknowledgements

The research work was supported by the TÁMOP-4.2.2/B-10/1-2010-0024 project. The project was co-financed by the European Union and the European Social Fund.

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