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Toxic elements in the riparian soil and sediment of the Sava River

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ABSTRACT

The aim of the present study was to investigate the extent of soil pollution by As, Cd, Cr, Cu, Ni, Pb and Zn in the riparian zone of the Sava River. The study area covered over 930 km along the river, from the source to its confluence with the Danube River. Samples were taken at 12 sampling sites from different soil horizons (0-10, 10-20 and 20-30 cm). In general, element concentrations did not vary significantly between soil horizons investigated. A trend of increased element concentrations with the river flow, from the source to the mouth, was observed. Total element concentrations were mostly in the range of the average element content of European soils, with exception of Cr, Ni, Cd and Zn in some industrially exposed sites. Since the data on total element content is not an effective indicator of element toxicity and bioavailability, the partitioning of elements in the soil samples was studied using the modified BCR sequential extraction procedure. Results revealed that elements analyzed were found mainly in the residual soil fraction, incorporated into aluminosilicate lattice. Exception was Cd in samples from the Alpine and lowland regions, where about 15 to 40 % of its total content was present in the easily soluble fraction, associated with carbonates. For the assessment of the origin (natural vs. anthropogenic) of the studied elements, normalization to Al was applied. The data of the present investigation indicate that riparian soils exhibit expected pattern of contamination with selected elements, related mostly to the industrialization and urbanization of the Sava River riparian zone. In order to describe the relationship between element concentrations in soil and sediment samples from the same locations, Spearman's rank correlation coefficient was applied.