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Different extraction procedures comparison for the evaluation of antimony mobility in soils from an abandoned Sb-mining area

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Soil particulate phases frequently have high concentrations of metals, but the total concentrations of contaminants are not always directly related to the real risk. Nevertheless, due to the relative ease of analysis, it is a common practice in many countries, to establish environmental quality criteria based solely on the total concentration of metals in the environmental matrix. The derivation of quality objectives for the soil compartment should preferably be based on the (bio)availability and mobility of metals.

The Antimony and Arsenic distribution and mobility in soils of an abandoned mining area located in Manciano (Grosseto–Italy) were studied applying single and sequential extraction procedures. The primary objective of this work is to exploit the possibility to implement a suite of extraction tests to predict human and ecological exposures to metals, particularly Sb and As, in mine-soil. The recent increase in awareness of the toxicity of arsenic and antimony, also at very low concentrations has renewed the interest in their mobility especially in environmentally stressed region (1). Quantification of extractable forms of As and Sb in contaminated soils provides the basis for monitoring bioavailability and their mobility in environment.

The determination of total content of the toxic contaminant has showed very high concentration of As and Sb; so, to get preliminary information on the potential mobility and bioavailability of two most critical elements of the area a complex procedure of sequential extraction was performed, after an appraisal of the existing procedures described in literature (1-4). The performed procedure comprises 8 extraction steps (water soluble, easily exchangeable, specifically sorbed on mineral surfaces, bound to Mn-oxides, to organic matter, to amorphous Fe-oxides, to Crystalline Fe-oxides, and to sulphides). The higher As and Sb percentage were extracted in step 7 (more than 50% of the total content), indicating that probably their mobility depends on dissolution of Crystalline Fe-oxides.

Fractionation using this sequential extraction procedure provides comprehensive information about the potential mobility of contaminants: indeed, the more elevated is the number of steps, the more we obtain information, but this is also time-consuming. Therefore, to assess the potential metal mobility it is essential to consider also other relatively more rapid and simple procedure, furnishing adequate information about the mobility of trace elements and taking into account the kinetic aspects of the metal-sediment associations. For this reason BCR extraction procedure and kinetic test were also performed. The choice of the adequate procedure will depend on the aim of the work, the type of expected information and available resources.

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