



A rapid screening method for the evaluation of the mobility of “heavy metals” in contaminated soils

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The environmental impact of metal contamination in soils should be not only evaluated on the basis of the total concentration of the metals, but mostly on the form in which they occur, their mobility and, consequently, bioavailability. In the last decades, many single and sequential extractions have been developed and proposed as standard methods (1). The most extensively used procedures are the one developed by Tessier et al. (2) and the revised BCR three-step sequential extraction procedure (3), but they are time consuming and, in general, applied on a limited number of samples selected among a larger set. For this reason when the contaminated site is quite wide, there is a considerable need of rapid and simple screening tools for a reliable identification of the most interesting sampling points, in terms of metal mobility, that can be successively characterised through standard leaching test or sequential extraction.

In this experimental work, a simple screening method was developed and applied on soils samples collected in two abandoned mining areas and already characterised in previous studies (4, 5). These samples have a significantly high concentration of heavy metals but different metals mobility. A buffer solution of trisodium citrate and hydroxylamine hydrochloride was used as extractant for a single-step leaching test: the experimental extraction/redox conditions, similar, unless for the pH value, to the step 2 of the BCR procedure, could provide interesting information about the mobility of toxic contaminants generally associated to the reducible fraction. At the same time, the choice of the buffer solution was strictly related to the possibility of directly determining, via titration with dithizone (6), the content of Zn, Cu, Pb and Cd, which are among the most representative contaminants in highly mineralised soils. The analysis

of bivalent ions through dithizone titration was exploited in order to further simplify and quicken the whole procedure: it measures generically the concentration of total heavy metals expressed as mol/L without distinguishing between elements; however, the results obtained with this analytical method were confirmed by ICP-OES analysis for the sum of Zn, Cu, Pb and Cd.

Moreover, the results from the leaching experiments were compared with the results from the revised BCR scheme and it was demonstrated that the studied leaching test furnishes adequate information about the mobility of trace elements in a very short time (almost 1 hour) suggesting a possible application of this screening method even for in-field tests.

References

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