

Study of Labile Cd pool in contaminated soil using Stable Isotope Analysis, Radioactive Isotope Dilution and Sequential Extraction

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Understanding polymetallic pollutions and ground-plants transfer requires measurement of metals speciation. Recent development was performed on characterization and quantification of the exchangeable metal pool [1]. The stable isotope dilution method could allow extending this characterization to elements with a wide range of complexation properties, realizing a multi-elementary spiking. In this study we try to validate the stable isotope method in the case of Cd, by realizing sequential extractions and shortlife radioisotopes dilutions. The sample studied is a soil from the Riou Mort riverbanks (Aveyron, SO France), and is strongly contaminated by heavy metals ([Cd] = 47.4 $\mu\text{g}\cdot\text{g}^{-1}$, [Zn] = 2983 $\mu\text{g}\cdot\text{g}^{-1}$, [As] = 192 $\mu\text{g}\cdot\text{g}^{-1}$, [Pb] = 851 $\mu\text{g}\cdot\text{g}^{-1}$).

Sequential extractions show that a major part of Cd $\approx 80\%$ is easily available and not included in the silicates (=residual fraction). Among the 80%, 25% of Cd is bound to organic colloids and clays phases, 10% to carbonates, 16% to Mn-Oxides, 22% to Fe-Oxides, and 7% to primary sulphides.

Stable isotope dilution was performed twice, with different amounts of ¹⁰⁶Cd added, 2% and 0.2% of total Cd in soil. These solutions were filtered at different time steps. In the first case 45% of ¹⁰⁶Cd was exchanged after 1 minute and 90% after 1 week. In the second case, these values were 20% and 75% respectively. These differences could be related to a Cd precipitation in the first experiment, due to an excess of spike. The second experiment values are coherent with those of the radioisotope ¹⁰⁹Cd experiment (16.8% after 1min. and $\approx 60\%$ after 1 week).

On the basis of the existing data about the metal exchangeable pool [2] and [3], the comparison between spiking experiment and sequential extraction suggests that the 20% of Cd exchanged within one minute in the spiking experiment was associated with colloids, clays and O.M. To explain the 75% of Cd mobilized within one week, it will be necessary to consider mobilization parameters which happen in others pools.

References

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