Exploring the link between Cd isotopes and speciation in plants: a case study in Solanum species

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The environmental pollution by ecotoxic heavy metals is a problem of increasing significance for ecological and human health reasons. Among these elements, cadmium (Cd) is of special concern due to its high mobility in the soil/plant system and its acute toxicity. To limit Cd contamination in plants, and to enhance food safety, it is critical to understand what controls the bioavailability of this element. Previous studies have demonstrated that Cd bioavailability in soils depends ultimately on its chemical speciation, whose investigation in plants remains extremely challenging due to traditional X-ray spectroscopy technical limitations in low-concentrated samples (~100 ppm). In this study, we explore the link between Cd speciation and Cd stable isotope composition in plants from the solanum species (*Solanum nigrum* and *S. Melongena*) to assess to what extend Cd isotopes can trace changes of in Cd speciation in plants. *S. nigrum* and *S. melongena* were grown on clayey loam soil incubated with Cd nitrate for 14 weeks, then processed for X-ray absorption analyses, Cd stable isotope composition and trace and major element determination. Our XANES and EXAFS results demonstrate that Cd behaves differently in *S. nigrum* and *S. melongena*. In both roots and leaves of *S. nigrum*, results show the major role played by thiol ligands, while Cd transport form in the shoot involves binding with carboxilic acids. Our preliminary results suggest glutathion as a potential ligand for Cd. In *S. melongena*, results show a different fate of Cd between the roots and the leaves: while Cd speciation in the roots also involves thiol ligands, carboxylic acids likely play a major role in the binding of Cd in *S. melongena* leaves. XAS results demonstrate the role of Cd binding to different organic ligands (thiols and carboxylic acids) and changes in Cd speciation in *S. nigrum* and *S. melongena* plants when exposed to high Cd content. These different behaviours are very promising for the rest of our study, as theory predicts Cd isotope fractionation between –O and –S ligands. The upcoming results on Cd stable isotope compositions of these samples will help shed light upon the mechanisms that shape the fate of Cd in *S. nigrum* and *melongena* and assess the potential of Cd isotopes as tracers of cadmium speciation changes in solanum plant species.