**Comparison of commonly used single extractants for availabiltiy determination of heavy metals in mine soils**

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Even in many countries the regulation of pollutants is still based on total concentration in soils, it is known that the toxic effects they cause are not always associated with this concentration since it includes all of the chemical forms that exist in there, and therefore does not provide information about the mobility, availability and toxicity of the metals. In fact, the proportion and distribution of those chemical forms are closely related to the soil properties as they strongly influence their chemical speciation.

The use of single extractions for soil evaluation allows for a more nuanced assessment of heavy metal forms and their mobility in the soil than the total soil content of metals (Meers et al. 2007). Although a good progress has been made in bioavailability methods, no universally applicable approach has been recognized (Feng et al. 2005) and to date, there is no generally accepted method of estimating the bioavailability of heavy metals in soils (Pueyo et al. 2004). There are different problems in the use of single extraction methods like the lack of uniformity in the different procedures used and the strong influence that soil properties exert in the concentration of the released pollutant. In consequence, the results obtained are not only operationally deﬁned depending on the experimental conditions used but also in the type of soils selected. This fact makes data comparison difficult and prevents the standardisation of these methods. The objective of this work was to study the influence of the main soil properties in the concentration of heavy metal released after applying different single extractions commonly used in availability of heavy metal studies.

As mine soils can provide samples with high heavy metal contents and not always are toxic (at least for the plants growing there) they were selected four soil samples from the Rubiáis mine (Lugo-Spain). The mining operations took place between 1977 and 1992 and the extracted compounds were associated with zinc sulphide (ZnS) and galena (PbS) (Arias Prieto, 1991). They were applied to the mine soil samples different single extractants selected from the literature attending to not only the most commonly used techniques for determining available contents but also to selected procedures from European countries legislation and to the first steps of well known sequential extraction procedures. The selected single extractants were 0.01M-CaCl2, 1M-MgCl2, 0.1M-NaNO3, 1M-NH4NO3, 0.11M-HOAc, 0.5M-HNO3, 0.1M-HCl, DTPA-TEA-CaCl2, EDTA-NH4OAc, 0.01M-Ca(NO3)2, 1M-Mg(NO3)2, bidistilled water (BDW) and low molecular weight organic acids (LMWOA).

The selected soils from Rubiáis mine are loamy sand soils or sand soils and their pH ranges from 7.14 to 7.54. Total carbon contents vary between 14.15 and 23.24 g kg-1 while the oxide contents (Fe, Mn and Al) do not oscillate two much among soil samples. The total contents of Cd, Pb and Zn are higher than the generic reference level for ecosystem protection stated for Galician soils (1, 80 and 200 mg kg-1, respectively). In addition, after the single extractants were applied, the released amounts of Cd, Pb and Zn are in most of the cases also higher than the mentioned levels. According to the proportion of Cd, Pb or Zn released from the total soil content it was possible to gather the extractants applied to soils. Three broad groups were formed for each of the metals. For Cd, the first one (CdGI) is composed of single extractants that released t between 0 to 3.93% of the total content. The second one (CdGII) gathers solutions that extract between 9-29%, and the third between 27 and 69% of the total Cd content. For Pb, the three groups account for 0-1%, 2-14% and 20-53% of total Pb. In the groups established for Zn the proportion released ranges from 0-1.37%, 4.7-8.9% and 10-55%. The soil with the highest total Cd contents is the one that releases the lowest proportion of “available Cd forms” (released after applying the single extractants). These proportions are always lower than 32% of the total Cd content, whatever releasing solution was applied. In the case of Pb and Zn, the soil with the lowest total contents of both metals is also the one that in general releases the lowest proportion of available Pb and Zn forms (less than 20% of the total content). Soil properties are thought to be responsible of the differences among released Cd, Pb and Zn quantities and next steps will be focussed on their influence when the different single extractants are applied.