Soil-plant abstract of heavy metals in Pb-Zn mining sites from Alcudia Valley (South Spain)

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Alcudia Valley is a vast territory recently declared Natural Park, located in South of Spain. It is an area rich in mineral deposits of Zn and Pb and mining exists since the first millennium BC., having its highest ore production between mid-nineteenth century and the middle of the twentieth. This area has been selected because has more than 120 abandoned mines without remediation actions, with dumps and tailings with high contents of zinc and lead sulfides, and Cu, Ag, Cd, As, Sb in minor concentrations.
In this study we determinate the transfer rate of these metals from soils to plants represented by oak leaves (Quercus ilex), because this specie is common within the selected area. To evaluate the soil-plant transfer were studied the correlation of contents, total and extractable, in soil-leaves. Extractable fraction was done by for different methods in water, EPA 1312 sulfuric acid: nitric acid 60:40 v., Ammonium Acetate and EDTA. To establish the correlation between heavy metals from soils to plants is necessary to know the contents of these and bioavailable content in soil. Three areas (S. Quintín, Romanilla, Bombita) were selected, taking 24 samples of soils and leaves.
Analyzed leaves by XRF showed that Mn, Pb, Zn and Mo in S.Quintin and Romanilla, Mn, Pb in Bombita, exceeded the toxicity threshold. The same samples analyzed by ICP show us the toxicity threshold is exceeded Pb, Zn and Hg in S.Quintin, and Pb in Romanilla. The heavy metal content in leaves compared between two techniques analytical gives an acceptable correlation Zn - Pb with $R^2 = 95$.
Total metal contents in soils were analyzed by EDXRF (Energy Dispersion X Ray Fluorescence). We obtained RRL (Regional Reference Level), from La Bienvenida soil samples with values 20 Ni; 53 Cr; 38 Cu; 125 Zn; 128 Pb; 26 As, all in mg kg^{-1}. Taking into account the values obtained in S.Quintin Pb 10127; Zn 2861; As 183; Cd 138; Cu 331; Ni 60 and Hg 893 mg kg^{-1}, we can say that S.Quintin is a highly contaminated area; Bombita and Romanilla we would consider polluted areas where only Ni, As have values below RRL.
We found differences in uptake patterns on the three areas due to heterogeneity in soil parameters and acid drainage, especially in S.Quintín mine where only measured uptake of Sb by plant has a good linear correlation with metal content extract with Ammonium Acetate. Romanilla has more homogeneous soil condition where we found an high soil-plant correlation Ag, As, Cd, Zn using EDTA and Acetate. Bombita has a similar characteristics, with high correlations between plants contents and soil in Cd, Cu, Pb, Zn with EDTA and Acetate. Total contents of heavy metal in a soil is not enough to evaluate the Toxicity Potential, it is necessary to know the bioavailable fraction present in the soil and the extractable fraction which proved to be the decisive factor in the content of heavy metal in plant of studied areas; the correlation in metals content soil-plant is higher in extractable content metals than in total content.