

ANALYSIS OF PLANT LEAVES RELATED TO REMEDIATION STUDIES IN POST-MINING AREAS BY LABORATORY BASED MICRO-XRF SPECTROMETRY

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In the last decade, the use of plants for the stabilization (phytostabilization) and cleanup (phytoremediation) of metal contaminated environments has gained popularity among government agencies worldwide. To increase the efficiency of such technologies, it is important to learn more about the specific plant physiological process involved, including metal translocation, metal distribution in plant tissue and tolerance mechanisms. For such purposes, the use of microanalytical techniques is required [1].

The aim of the present work was to study metal accumulation and distribution in aerial parts (leaves) of *Dittrichia viscosa* specimens grown in an abandoned Pb/Zn mining area located in the south-east of Spain. This ruderal plant species spontaneously grows in the mining area and it has the capability to accumulate high concentrations of metals in its tissues (up to 1400 mg kg⁻¹ of Zn and 2000 mg kg⁻¹ of Pb) with reasonable tolerances.

A micro-XRF spectrometer designed by the Atominstytut (Vienna University of Technology) [2] was used for elemental analysis of metal pollutants in plant leaves. The system provides easy mounting and automatic sample scanning for the rapid analysis of vegetation material without previous sample pretreatment. Moreover, due to the low power (50W) Mo anode X-ray tube, the instrument exhibits very little sample heating. Therefore thermal damage to the samples and associated problems of redistribution elements when performing analysis are avoided. The incoherent Mo-K_α scatter peak was used to correct for local sample thickness. The lateral resolution obtained by using polycapillary X-ray optics (31μm for Mo-K_α and 71μm at the Cu-L edge) was thought to be small enough to study metal distribution in leaves tissues. Additional characteristics of the system include the use of a Si(Li) detector with ultra thin window and the possibility to operate under vacuum conditions, which improves the detection of light elements.

The analysis of the data revealed that leaves of *Dittrichia viscosa* grown on the mining area accumulated metals (mostly Fe, Pb and Zn) compared to control specimens. From two-dimensional elemental mapping of leaves it was found that metal distribution patterns within the leaf tissue were preferentially in “hot-spots”. Statistical analysis (Principal Component Analysis and Cluster Analysis) of data from the micro-XRF images revealed significant correlations between elements coming from the mining activities. A relationship between the elemental composition of the leaves and the sampling location could also be seen.

References:

[1] E.Marguí, A.Jurado, M.Hidalgo, G.Pardini, M.Gispert, I.Queralt. Applied Spectroscopy 63(2009)1396-1402.

[2] S.Smolek, C.Strelí, N.Zoeger, P.Wobruschek. Submitted to Review of Scientific Instruments.