THE UPTAKE OF HEAVY METALS IN PLANT SPECIES ENDEMIC TO A POLLUTED STREAM NEAR AN INDUSTRIALIZED REGION OF PORTUGAL

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INTRODUCTION

The off-site migration of contaminants, when not controlled, can cause serious damage on ecossistems and affect public health. These and other reasons bring up the need for new solutions of remediation, to stop the dissemination of the contaminants in the environmental compartments.
Phytoremediation is an emergent technology that uses plants to remove, degradate or imobilize the contaminants. The selection of the plant species that should be used depends mainly on it's biomass, it's capacity to tolerate and bioacumulate the contaminants and on the location and characteristics of the contamination.
The region of Estarreja is known for its strong industrial complex, composed essentially by chemical facilities. For many years, several of these industries have discharged its solid residues in an improvised park in the surrounding area, and conducted its wastewaters into a stream nearby ("Esteiro de Estarreja"). Therefore, the levels of Pb, Zn, As and Hg, in the sediments of this stream, to a depth of 50 cm, are above the limits established by EC Directive 86/278/EC - Atkins (1999). Metals pose a specific environmental problem: they can not be destroyed, so they have to be removed and recycled.
This environmental risk cenario is aggravated by the high permeability of the soils and the intensive agriculture in the area. Nevertheless, in the banks of the stream, the vegetation remains proliferous. The purpose of this study is to identify plant species endemic to the site and to determine their ability to uptake heavy metals.
Three plant species, present in a larger amount, were collected from that area and were tested for the content of the above metals.

MATERIALS AND METHODS

The tested plants were: *Phragmites australis*, *Convolvulus* sp. and *Solanum nigrum*. The plants were collected near the former exit of wastewaters proceeding from the refered industries. The plants were washed, dried and ground. Dry plant material, including roots, shoots and leaves, was then digested with acids. The metals were determined in the resulting solutions by EA-AAS for Pb, FA-AAS for Zn, FI-HG-AAS for As and FI-CV-AAS for Hg.

RESULTS

Pb does not seem to be significantly accumulated in any of the plants. However, high levels of Zn were detected in all of them, especially on *S. nigrum,* that also had the highest level of As. The highest level of Hg was registered for *P. australis*.

Table 1. Metal concentrations (mg/kg dry plant) for different plant species (average values are shown)

Plant species	As	Hg	Zn	Pb
Phragmites australis	2.9	13	118 – 629	2.7
Convolvulus sp.	2.3	1.6	599	2.8
Solanum nigrum	5.4	9.1	1130	2.6

CONCLUSIONS

Considering the results obtained, and the distribution of the plants in the area, the one that seems to be more appropriate for further research is *Solanum nigrum*. The uptake of metals by this plant seems to be reasonably high and the extraction of seeds and plant growth in the laboratory are feasible. A deeper study of the characteristics of the plant and its dissemination along the polluted site, and the uptake of the metals in different parts of the plant will follow. This will contribute to establish the importance of such endemic species to the phytoremediation of metal polluted sites.

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