ConSoil 2005 - Abstract form

Title of abstract	**THE UPTAKE OF ZINC IN PLANT SPECIES INDIGENOUS TO A PORTUGUESE POLLUTED SITE**		
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Most appropriate theme (see Call: theme A-G)	D	**ORAL presentation** (type O) **or POSTER** (type P)	O

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Topics:
Phytoremediation of zinc contaminated soils studying Phragmites australis and Rubus ulmifolius action.

Abstract

The region of Estarreja, in Portugal, 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"). The levels of Zn, among other toxic metals, in the sediments of this stream are above the limits established by the European legislation and metal soil concentrations vary considerably along the banks of the stream. Nevertheless, in the banks of the stream, the vegetation remains proliferous. This brings up the opportunity for the development of more sustainable remediation solutions, including phytoremediation, which is based on the use of plants to remove, degrade or immobilize water and soil contaminants, offering a low cost method for soil remediation. Toxic metals contamination, by their long term persistence in the environmental compartments, poses a major environmental and human health risk. Metals are a special environmental problem: they can not be destroyed, so they have to be removed and recycled, which can also be an added value to this method – in contradiction with the traditional methods that are very costly and can only affect the upper layers of the soil.

The purpose of this study was to identify the most abundant plant species indigenous to the site with high biomass, and to determine their ability to uptake zinc, while relating the potential uptake with the presence of arbuscular mycorrhizal fungi (AMF). Arbuscular mycorrhizal fungi are a group of soil microorganisms that form symbiotic associations with the plants roots in order to improve growth and reproduction. AMF capture mineral nutrients from the soil and, in "trade", draw carbohydrates from the plant. Metals can also be captured by AMF. The role of AMF in phytoremediation of heavy metals is not yet well known and the study of these rhizosphere interactions seems to be a promising patch for the optimization of metal plant uptake.

Two plant species - *Phragmites australis* (common reed) and *Rubus ulmifolius* (drewberries)-, as well as samples of adjacent soil, were collected in the spring/summer along the course of the stream (seven sampling points separated from 10 meters each – *P. australis* was collected in one of the banks and *R.*

ulmifolius was harvested from the other). Dried soils were acid digested or incubated with different extractants for the FA-AAS determination of the content of total or bioavailable zinc, respectively. Soil pH, organic matter by loss on ignition, nitrogen and phosphorous were also determined. Different parts of the plants were analyzed: roots, shoots and leaves. An adequate amount of fresh fine roots was taken for the root coloration for microscopical identification of arbuscular mycorrhizal fungi in the root systems of the collected plants. The remaining plant material was dried and acid digested for the FA-AAS determination of the zinc levels in its several parts.

Although *Phramites australis* and *Rubus* sp. have been reported in literature as arbuscular mycorrhizal fungi hosts, no AMF were observed in any of the sampled roots. As the sampling took place only in the hot seasons, the confirmation of the inexistence of AMF would only be possible with a sampling across several moments in time, accompanying the climate changes through the year.

The soil levels of zinc in the soil were variable, ranging from 138 to 993 mg Zn/kg dry weight (ppm), with consequent variation in the levels of the metal taken up by the plants. For the plants, the concentrations of zinc ranged from 38 to 78 ppm in the leaves, 33 to 59 ppm in the shoots and 41 to 129 ppm in the roots of *Phragmites australis* and from 51 to 90 ppm for leaves, from 37 to 108 ppm for shoots and from 151 to 537 ppm for shoots of *Rubus ulmifolius*. The results showed that zinc is being mainly accumulated in the roots of both plants. It was also possible to observe that *R. ulmifolius* presented higher zinc uptake rates than *P. australis*.

With this data it was possible to obtain a distribution of the zinc uptake along the stream, its relation with the soil concentrations of the metal and their availability, and in the different areas of the plant itself.

Future work includes studies relating zinc with other plants also found at a smaller scale in the stream banks, currently being grown under laboratory conditions with the association of several isolates of arbuscular mycorrhizal fungi in order to establish relations of the growth matrix metal concentrations and plant uptake and its possible assistance from AMF.

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