Geophysical Research Abstracts
Vol. 13, EGU2011-1807-1, 2011
EGU General Assembly 2011

Phytotoxicity assay on soils and plants: elements for phytoremediation of mine soils

Mohammad Ahmad Wahsha, Claudio Bini, Silvia Fontana, and Diana Maria Zilioli

Ca' Foscari University, Department of Environmental Sciences, Venice, Italy (Tel.: + 39 412348918; Fax: + 39 412348584. E-mail: m.wahsha@stud.unive.it)

Several serious environmental hazards are due to high concentrations of heavy metals in soils. Human activities such as mining and industry may lead to elevated levels of heavy metals, increasing the potential environmental risk. Some plants have shown the ability to hold off from soils comparatively high concentrations of potentially toxic elements. In fact they manage to uptake and convert them into less toxic compounds. Phytoremediation is a technique useful for the restoration of contaminated soils. Since the '90s, in this low cost and environmental friendly technique plants have been employed for both the stabilization and the extraction of soil polluting substances. Wild and cultivated plant species have been used as (passive accumulative) bioindicators/remediators for large scale and local soil contamination. Plants growing on abandoned mine sites and naturally enriched soils (e.g. serpentine soils) are of particular interest in this perspective, since they (e.g. *Alyssum, Thymus*) are genetically tolerant to high metal concentrations.

The aims of this study were i) to determine the levels of (Cu, Zn, Mn, Ni, Cr, Fe and Pb) in an abandoned mine site in Northeast Italy and their transfer to native plant species (dandelion and willow) (*Taraxacum officinale, S. purpurea*, *S. caprea* and *S. elaeagnos*) and ii) to evaluate the phytotoxicity of heavy metals using lipid peroxidation assay on seedlings growing in the same area. Achieving these aims is the first stage towards analysing the phytoremediating ability of these plants.

Our results indicated that willow accumulated significant quantities of heavy metals in both leaves and roots, regardless of the species. Dandelion too accumulated heavy metals in leaves (up to 1636 kg^{-1}Fe), consistently with data from literature.

The effect of heavy metals is extremely toxic and causes oxidative stress to plants; it alters the biochemical processes, as it stimulates the reactive oxygen species (ROS) generation and accordingly the lipid peroxidation (LPO). The by-products of LPO, malondialdehyde (MDA) in particular, seem to be strongly correlated to the levels of heavy metals in soils. The membrane integrity was estimated in terms of MDA content by thiobarbituric acid (TBA) reaction. A maximum increase of 41.64 μM in *S. purpurea* leaves and 30.78 μM in the roots of the same species from a different site in the mine was observed, indicating a sharp cell injury. In both parts of the plant, the MDA content was found positively related with metal accumulation ($P < 0.05$). *T. Officinale* responds to the increased heavy metals contents by intensification of free radical generation. The contents of MDA were influenced by the different amount of Zn, Fe, Pb and Cu in the soil, in agreement with our data on soil pollution. Therefore, high level of MDA observed in investigated plants under metal stress might be attributed to the peroxidation of membrane lipids caused by ROS due to metal stress indicating a concentration dependent on free radical generation

The results of metal concentration in soils and plants together with the translocation coefficients and the phytotoxicity assay indicate that the selected plants appear rather highly tolerant towards environmental pollution, since their metabolic equilibrium is not altered by increased metal uptake. Therefore, the above mentioned native plant species growing on the mine area may have the potential for phytoremediation of metal contaminated soils.

Keywords: *Heavy metals, Soil phytoremediation , Lipid peroxidation, Plant toxicity.*