Plants as metal bioindicators in abandoned mining areas

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Considering the current economic growth and technological development, a continuous demand for new ore deposits and/or the re-exploitation of low-grade ore deposits and tailings is crucial. This poses two approaches: (1) the prospecting of new or the already known mineral deposits; and (2) the recovery and treatment of the tailings produced by mining activities, preferentially using environment friendly techniques.

Plants have a limited capability for the selective uptake of elements, resulting on the absorption of non-essential elements during water and nutrient uptake, particularly between those with similar chemical properties. Physico-chemical conditions and metal-support phases (mineralogy) of the rhizosphere are also key factors in the mobility and bioavailability of metals to plants. Despite the risk of toxicity when exposed to metal levels exceeding the typical thresholds, some species known as metallophytes tolerate high concentrations of metals. Moreover, a restricted number of plant species (hyperaccumulators) are also capable of uptaking considerable amounts of metals into their shoots.

Thus, the use of plants as metal bioindicators may be useful for biogeochemical prospecting, in order to assess the presence and nature of the underlying mineralization, and phytoremediation, a low-cost and eco-friendly technique for the reclamation of contaminated soils and waters.

The very particular, and in some cases, extreme environmental conditions prevailing in mining areas, are critical to understand the biogeochemical processes between the geogenic environment and plants. In addition, they also allow the development of tests that can contribute to the improvement of phyto-management strategies.

With the aim of evaluating the nature of the mineralization and investigate potential metal hyperaccumulators, soil, tailings and plant samples were collected from several mining areas in Portugal. The obtained results showed a clear correlation between metal levels in plant tissue and the substratum. We conclude that some of the collected plant species could be an effective tool for metal bioindication and biogeochemical prospecting. Furthermore, some plants have also exhibited potential for phytoremediation.