The phytotoxicity of Ervedosa mine soils

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Mining is one of the most relevant sources of environmental contamination worldwide. The Ervedosa mine (Bragança, Portugal), is one of the several areas impacted by this industrial activity, existing in the Portuguese territory. In this mine both underground and open pit exploration of tin and arsenic minerals was performed between 1857 and 1969, and since then any action was taken to remediate the area. The evaluation of risks of contaminated areas should be made before any reclamation action been applied to these sites, as it can gives a real indication of prior areas requiring intervention, and provide helpful information for risk managers. Hence, this study was conducted in the Ervedosa mine (Bragança, Portugal), aimed in contributing for different tiers of the ERA process obtaining ecotoxicological information with with terrestrial and aquatic plant species to obtain information about the degree of impact in both the habitat and retention soil functions. Furthermore we aimed to assess if the integration of other plant physiological endpoints, in standard protocols with terrestrial plants, can improve the ability of these assays to identifify concerning soils.

For this purpose, soil samples were collected on 16 sampling sites distributed along four transects defined in the area, and one reference site. General soil physical and chemical parameters and total metal contents were analyzed. Assays were performed for soil elutriates and the whole soil matrix with growth inhibition assays with Lemna minor and emergence and seedling growth assay with Zea mays. At the end of the Z. mays assay water content, chlorophylls (a and b) and carotenoids content, chlorophyll fluorescence (Fv/Fm and ΦPSII), membrane permeability and stress oxidative parameters (proline and MDA content) were evaluated.

In general, the soils near the exploration area, revealed high levels of Al, Mn, Fe and Cu. Elutriates of soils from sampling sites near this area were toxic to L. minor. The retention function of these soils was seriously compromised, as it was demonstrated by the low IC50 values, obtained for some elutriates. Regarding the parameters measured for

Z. mays, statistical significant differences were recorded for all of them. Nevertheless, biomass only has discriminated the soil collected near the exploration area. Chlorophyll fluorescence parameters were more sensitive to soil contamination allowing the discrimination of other soils from the reference soil. No significant differences were found for stress oxidative parameters.

Both assays have demonstrated that in a general way, the phytotoxicity was limited to the mine area, decreasing with distance both to the north and to the south. Since their measurement is rapid and technically simple, we recommend further studies to evaluate the integration of chlorophyll fluorescence parameters and pigments content in standard protocols for assays with terrestrial plant species.

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