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Phytoremediation of mine tailings with Atriplex halimus and organic/inorganic amendments: a five-year field case study

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Abstract

Mine tailings have adverse chemical and physical conditions, including high concentrations of metals and salts, low organic matter content, and unbalanced rates of nutrients which limit the development of vegetation. A large scale field experiment was conducted to reclaim a tailing pond by triggering the growth of native species by spontaneous colonization by tilling (TL) the tailing pond surface and using marble waste ($CaCO_3$; MW), pig slurry (PS) and their combination (MW+PS) as soil amendments. Soil physicochemical properties and water and DTPA extractable metal concentrations of bulk and rhizosphere soils were analyzed after five year from the application of the treatments. In addition, plants of *Atriplex halimus* from each treatment were collected and metals in roots, leaves and stems analyzed. Before amendments application, the studied pond showed a neutral pH, high salinity and a moderate organic carbon content. After five years, the pH value was significantly increased only in MW plot. The results showed significant increases of DTPA-extractable Zn in MW and MW+PS plots, Pb in all treatments except MW plot, Cd only in PS plot, and Cu only in MW+PS plot. *A. halimus* was the most dominant species, growing spontaneously in all plots, with lower vegetation cover in CT and MW plots, 6% and 2%