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### Phytoremediation potential of *Arundo donax* (Giant Reed) in contaminated soil by heavy metals

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Soil pollution from heavy metals poses a serious risk for environment and public health. Phytoremediation is an eco-friendly and cheaper alternative compared to chemical-physical techniques. We carried out in vitro tests where three microorganisms *Trichoderma harzianum*, *Saccharomyces cerevisiae* and *Wickerhamomyces anomalus* were exposed to eight different heavy metals (one metal at a time) in order to evaluate resistance, growth and bioaccumulation capability for each metal (Ni, Cd, Cu, V, Zn, As, Pb, Hg). Taking into account the natural characteristics of *T. harzianum*, (resistance to environmental stress, resistance to pathogenic fungi, ability to establish symbiotic relationships with superior green plants) and the good bioaccumulation capacity for V, As, Cd, Hg, Pb shown after in vitro tests, it was chosen as a microorganism to be used in greenhouse tests. Controlled exposure tests were performed in greenhouse, where *Arundo donax* and mycorrhized *Arundo donax* with *T. harzianum* were exposed for 7 months at two different doses (L1 and L2) of a heavy metal mix, so as to assess whether the symbiotic association could improve the bioaccumulation capability of the superior green plant *A. donax*. Heavy metals were determined with ICP-MS. The average bioaccumulation percentage values of *A. donax* for L1 and L2 were, respectively: Ni (31%, 26%); Cd (35%, 50%); Cu (30%, 35%); As (19%, 27%); Pb (18%, 14%); Hg (42%, 45%); V (39%, 26%); Zn (23%, 9%). The average bioaccumulation percentage values of mycorrhized *A. donax* with *T. harzianum* for L1 and L2 were, respectively: Ni (27%, 38%); Cd (44%, 42%); Cu (36%, 29%); As (17%, 23%); Pb (37%, 54%); Hg (44%, 60%); V (16%,

20%); Zn (14%, 7%). *A. donax* showed the highest BAF (bioaccumulation factor) for Cd (0.50), Cu (0.35), As (0.27) and Hg (0.45) after exposure to L2; mycorrhized *A. donax* with *T. harzianum* showed the highest BAF for Ni (0.38), Cd (0.42), Pb (0.54) and Hg (0.60) after exposure to L2. *A. donax* showed the highest TF (translocation factor) values for Cd (0.28) and Hg (0.26) after exposition at L1 and L2 respectively; *A. donax* mycorrhized with *T. harzianum* showed the highest TF values for Cd (0.70), As (0.56), V (0.24), Pb (0.18) after exposition at L2, and Zn (0.30) after exposition at L1. Our study showed a good growth capability in contaminated soils and a good bioaccumulation capability of heavy metals, both for *A. donax* and mycorrhized *A. donax* with *T. harzianum*. Furthermore, for three metals (Ni, Pb and Hg) the bioaccumulation capability was improved by the symbiosis of *T. harzianum* with *A. donax*. So, these results proved the suitability both for *A. donax* and mycorrhized *A. donax* with *T. harzianum* for phytoremediation processes.