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Effect of Plant Growth Promoting Rhizobacteria on Phytoextraction of Critical Raw Materials and Potentially Toxic Elements in Soil

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There are several regions of the world where soils are contaminated with potentially toxic elements (PTE) and/or have critical raw materials (CRM) that cannot be extracted through conventional raw material extraction techniques because of their low amounts. Phytoextraction- a kind of phytoremediation- offers good option or method to sustainably remediate these contaminated soils and extract these CRM from soils. The successful phytoextraction of these elements of interest from soil is dependent on their bioavailability for plant uptake and biomass production which could be increased by inoculating soil with plant growth promoting rhizobacteria (PGPR) and the element acquisition characteristics of the plant species used for phytoextraction. This study investigated the effect of the PGPR Bacillus amyloliquefaciens - FZB42 also called Rhizovital produced as spore's formulation by ABiTEP on the phytoextraction efficiency of two selected species, Zea mays and Fagopyrum esculentum grown in potted soils under artificial lighting conditions for about 8 weeks in a laboratory. Results showed that for Fagopyrum esculentum, the inoculation of soil with Rhizovital increased the uptake of As, Cu, Pb and Co, Ni, Mg, K, P, La, Ce, Y, sum of Heavy Rare Earth Elements (HREE), sum of Light Rare Earth Elements (LREE) but significantly only for Cu and Co at alpha level 0.05 and insignificantly decreased the uptake for Ge. For Zea mays, results showed that inoculating soil with Rhizovital decreased uptake for all elements investigated and significantly so for only Co but showed an insignificant increasing effect on the uptake of Cu. For the two test species, similarity in effects of inoculation of soil with Rhizovital on uptake of elements only existed for Cu (increasing effect) and Ge (decreasing effect) suggesting that the addition of Rhizovital to soil could increase the Cu phytoextraction efficiency of Zea mays and Fagopyrum esculentum and decrease the phytoextraction efficiency of Germanium in both plants. Results from this research suggest that inoculation of soil with the PGPR Bacillus amyloliquefaciens - FZB42 could increase the phytoextraction of Copper by Zea mays and Fagopyrum esculentum respectively, thus enhancing the phytoextraction efficiency of both plants in soils contaminated by copper. Also, results suggest that inoculation of soil with Rhizovital could increase the phytoextraction efficiency of Fagopyrum esculentum for most of the PTEs and CRM investigated in this experiment and that Fagopyrum esculentum is a good candidate for PGPR assisted phytoextraction of PTE and CRM