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Effects of Lime and N100 on the Growth and Phytoextraction Capability of a Willow Variety (S. Viminalis × S. Schwerinii × S. Dasyclados) Grown in Contaminated Soils

Authors : Mir Md. Abdus Salam, Muhammad Mohsin, Pertti Pulkkinen, Paavo Pelkonen, Ari Pappinen

Abstract : Soil and water pollution caused by extensive mining practices can adversely affect environmental components, such as humans, animals, and plants. Despite a generally positive contribution to society, mining practices have become a serious threat to biological systems. As metals do not degrade completely, they require immobilization, toxicity reduction, or removal. A greenhouse experiment was conducted to evaluate the effects of lime and N100 (11-amino-1-hydroxyundecylidene) chelate amendment on the growth and phytoextraction potential of the willow variety Klara (S. viminalis × S. schwerinii × S. dasyclados) grown in soils heavily contaminated with copper (Cu). The plants were irrigated with tap or processed water (mine wastewater). The sequential extraction technique and inductively coupled plasma-mass spectrometry (ICP-MS) tool were used to determine the extractable metals and evaluate the fraction of metals in the soil that could be potentially available for plant uptake. The results suggest that the combined effects of the contaminated soil and processed water inhibited growth parameter values. In contrast, the accumulation of Cu in the plant tissues was increased compared to the control. When the soil was supplemented with lime and N100; growth parameter and resistance capacity were significantly higher compared to unamended soil treatments, especially in the contaminated soil treatments. The combined lime- and N100-amended soil treatment produced higher growth rate of biomass, resistance capacity and phytoextraction efficiency levels relative to either the lime-amended or the N100-amended soil treatments. This study provides practical evidence of the efficient chelate-assisted phytoextraction capability of Klara and highlights its potential as a viable and inexpensive novel approach for in-situ remediation of Cu-contaminated soils and mine wastewaters. Abandoned agricultural, industrial and mining sites can also be utilized by a Salix afforestation program without conflict with the production of food crops. This kind of program may create opportunities for bioenergy production and economic development, but contamination levels should be examined before bioenergy products are used.

Keywords : copper, Klara, lime, N100, phytoextraction
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