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CHEMICAL PROPERTIES AND TOXICITY OF SOILS CONTAMINATED BY APPLICATION OF WASTEWATER SLUDGE OF HIGH HEAVY METALS CONTENT

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Heavy metal (HM) contamination of agricultural soils and vegetation is a worldwide ecological problem. During the last decades, there has been a significant increase of industrial technologies and human activities that utilize HM ions or compounds. This remarkable industrialization has led to the continuous accumulation of HM ions in eco-environment and caused deterioration of many ecosystems and social health. Anthropogenic inputs such as agricultural activities, energy conversion and production, metallurgy and mining, microelectronics, solid and liquid waste disposal have been the major sources of HM ions accumulated in our environment. This research is aimed at assessing the total content and soluble forms of metals (zinc (Zn), lead (Pb) and cadmium (Cd)) and toxicity of soil subjected to strong human pressure associated with pollution. The study obtained total Zn between 141.93 and 4516 mg, Pb between 18.6 and 1337 and Cd concentration was between 0.34 and 41.34 mg kg⁻¹ of soil. These variations in the HM concentrations were due to the application ratio of wastewater sludge to the soil. HM concentrations varied in the soil samples as Zn > Pb > Cd after the application of wastewater sludge. The lower solubility of the HMs in 1 mol NH₄NO₃ than 1 mol HCl is connected with that, the ammonium nitrate has low extraction power, and it is used in determining the bioavailable form of HMs. Toxicity assessment of the soil samples was performed using two test seeds, wheat and alfalfa. Germination index values were varied between 35 and 72% for wheat, and between 37 and 91% for alfalfa. The general trend observed was an increase in metal toxicity measured by the biotest with increasing available metal contents in soils. Biotest is a good complement to chemical analyses in the assessment of quality of soils as well as in properly managing them.

Keywords: Soil, Heavy metals, Toxicity, alfalfa, wheat, wastewater sludge, biotest

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