

Evaluation of Arsenic Removal in Soils Contaminated by the Phytoremediation Technique

Authors : V. Ibijes, A. Guevara, P. Barreto

Abstract : Concentration of arsenic represents a serious threat to human health. It is a bioaccumulable toxic element and is transferred through the food chain. In Ecuador, values of 0.0423 mg/kg As are registered in potatoes of the skirts of the Tungurahua volcano. The increase of arsenic contamination in Ecuador is mainly due to mining activity, since the process of gold extraction generates toxic tailings with mercury. In the Province of Azuay, due to the mining activity, the soil reaches concentrations of 2,500 to 6,420 mg/kg As whereas in the province of Tungurahua it can be found arsenic concentrations of 6.9 to 198.7 mg/kg due to volcanic eruptions. Since the contamination by arsenic, the present investigation is directed to the remediation of the soils in the provinces of Azuay and Tungurahua by phytoremediation technique and the definition of a methodology of extraction by means of analysis of arsenic in the system soil-plant. The methodology consists in selection of two types of plants that have the best arsenic removal capacity in synthetic solutions 60 μ M As, a lower percentage of mortality and hydroponics resistance. The arsenic concentrations in each plant were obtained from taking 10 ml aliquots and the subsequent analysis of the ICP-OES (inductively coupled plasma-optical emission spectrometry) equipment. Soils were contaminated with synthetic solutions of arsenic with the capillarity method to achieve arsenic concentration of 13 and 15 mg/kg. Subsequently, two types of plants were evaluated to reduce the concentration of arsenic in soils for 7 weeks. The global variance for soil types was obtained with the InfoStat program. To measure the changes in arsenic concentration in the soil-plant system, the Rhizo and Wenzel arsenic extraction methodology was used and subsequently analyzed with the ICP-OES (optima 8000 Pekin Elmer). As a result, the selected plants were bluegrass and llanten, due to the high percentages of arsenic removal of 55% and 67% and low mortality rates of 9% and 8% respectively. In conclusion, Azuay soil with an initial concentration of 13 mg/kg As reached the concentrations of 11.49 and 11.04 mg/kg As for bluegrass and llanten respectively, and for the initial concentration of 15 mg/kg As reached 11.79 and 11.10 mg/kg As for blue grass and llanten after 7 weeks. For the Tungurahua soil with an initial concentration of 13 mg/kg As it reached the concentrations of 11.56 and 12.16 mg/kg As for the bluegrass and llanten respectively, and for the initial concentration of 15 mg/kg As reached 11.97 and 12.27 mg/kg Ace for bluegrass and llanten after 7 weeks. The best arsenic extraction methodology of soil-plant system is Wenzel.

Keywords : blue grass, llanten, phytoremediation, soil of Azuay, soil of Tungurahua, synthetic arsenic solution

Conference Title : ICSGRE 2019 : International Conference on Soil, Groundwater Remediation and Excavation

Conference Location : Berlin, Germany

Conference Dates : May 21-22, 2019