Abstract

Mercury is a heavy metal considered one of the ten pollutants of concern by the World Health Organization. Its persistence, mobility and toxicity make this a high risk compound for human health. The immobilization of mercury from the soil is a remediation technique that reduces its mobility and bioavailability, thus preventing its entry into the food chain. Biochar is a bioadsorbent that can be used for this purpose. In this research work, a biochar was prepared based on olive stone powder and modified with thiol for the immobilization of mercury in the soil. Both the olive stone powder and the biochar were characterized using various analysis techniques such as FTIR, XRD, SEM-EDS, among others. The chemical analysis of the biochar showed that the functionalization of the surface with thiol groups was carried out successfully. Likewise, a soil contaminated with tailings from mining tailings in the Faculty of Geological, Mining and Metallurgical Engineering at the National University of Engineering Sector A, which is mainly composed of sand, has an acidic pH and a high concentration of heavy metals, was sampled and characterized. The immobilization of mercury in the soil contaminated with the prepared biochar was evaluated with several soil incubation tests for 10 weeks and with different treatments. The treatments with olive stone powder and biochar were able to immobilize between 56 -70 % and 54 -73% respectively of the available mercury in the soil. This immobilization may be due to several immobilization mechanisms among which the formation of complexes between the functional groups on the surface of the biochar, the biomass and the mercury in the soil could predominate. Likewise, by means of an analysis of individual effects of the main factors: A (t, sem) and B (g biochar/g soil or g bone /g soil) and double synergy AB (t, sem x g biochar/g soil or t, sem x g bone /g soil), it was possible to observe that factor A (t, sem) was the most significant in immobilization (%Inm, α) using both biochar and olive stone powder in soil contaminated with mercury (Pareto diagrams)., it is observed that the test time is the only positive and significant effect in both immobilization tests performed. This analysis of effects can be 16 summarized as follows: (1) Immobilization using biochar: A >>>> AB > B and (2) Immobilization using olive stone powder: A>>>>B≥AB. Furthermore, the results confirm that the addition of biochar and olive pit powder reduced the concentration of available mercury over time. Finally, the adjustments made with the MRQIPSE, MRQIPSC and MRCNA models to the immobilization % results guarantee the chemical reaction with random nucleation or continuous reaction between the mercury present in the soil and the thiol formed by the mixture of 2.8 mL of acetic anhydride (98.5 %), 0.2 mL of sulfuric acid (95 %) and 4 mL of 2-mercaptoethanol.