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Effectiveness of biomass ash and fish waste as amendments in mining soils determined by batch experiments

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Soil contamination by potentially toxic elements is a global environmental problem caused mainly by anthropogenic activities. A singular example is the soils of the abandoned mining districts of the Iberian Pyrite Belt (SW Iberian Peninsula), severely contaminated by past uncontrolled mining activity, resulting in a continuous source of polluted leachates (from the oxidation of sulfide minerals) that cause serious damage to surrounding ecosystems. This study aims to identify a feasible solution for the remediation of these severely contaminated mining soils. For that, the effectiveness of local wastes (biomass ash and fish waste) as soil amendments has been evaluated, with the aim of neutralising the acidity of these soils and reducing the concentration of pollutants that are mobilized following interaction with rainwater. Batch experiments were carried out using contaminated soil from the Tharsis mine (Huelva) (60% by weight) plus different proportions of waste amendments (40% by weight). Milli-Q water was added in a solid-liquid ratio of 1:10. Results showed an increase in pH with values ranging from 3 (100% mine soil) to 12 (60% mine soil and 40% biomass ash). This amendment showed a high degree of success in the elimination of contaminants (e.g., Fe, Al, Mn, Cu, Zn, Ni and Co), reaching average removal rates around 92-100%. On the other hand, the addition of a 40% fish waste amendment to the soil increased the pH of the leachate to values close to 5. Despite the slight increase in the pH of the contaminated leachate, this amendment allowed the total removal of Fe, Al and Zn, and around 78-86% removal of Mn, Co, Ni and Cu. The chemical composition of the leachates from the remediated soil were within the FAO limits for irrigation standards, except for Cu, Co and Ni in the fish waste treated soil. This study shows that the use of biomass ash and fish waste is an effective option to mitigate pollution generated from mine soils. However, a larger scale experiment is needed to evaluate the properties of these soils overtime.

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