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Limestone-based technosols: a suitable way for the remediation of sediments contaminated by heavy metals.

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The aim of this work was to assess the suitability of limestone-based technosols for decreasing the toxicity of the leachates caused by rain in sites contaminated by heavy metals. For such a purpose, 64 technosols were prepared in containers of 0.75m3, filled with 4 types of sediments collected from Portman Bay and subjected to different stabilizer proportions (limestone filler), different thickness of a drainage layer and presence/absence of a topsoil cover. The technosols were then submitted to different humidity/dryness cycles simulating the usual rain conditions in the zone.

Portman bay is situated close to the mining region of La Unión. The entire area around the bay was subject to mining from the time of the Roman Empire to 1991. Since 1957, the wastes from mining operations were discharged directly into the sea in the inner part of the bay, while later on, they were also discharged to sea at a distance of the shore. These wastes mainly consisted in ore materials (galena, pyrite and sphalerite), phyllosilicates, in addition to siderite, iron oxides and sometimes alteration products such as jarosite, alunite, kaolinite and greenalite. These materials have suffered a concentration process by floatation with sea water and as a result of the discharge, the whole of the bay has filled up with wastes which also extend into the Mediterranean Sea.

The pH and the electrical conductivity (EC) was determined in obtained percolates, together with major ion content, determined by ionic chromatography. The Zn, Pb, Cd and Cu content was determined by electrothermal atomization atomic absorption spectrometry (ETAAS). The As content was measured by atomic fluorescence spectrometry. In addition, the mineralogical composition was determined in the evaporated samples by X-Ray diffraction. A battery of bioassays was applied for the ecotoxicological screening of obtained percolates . Particularly, the toxicity was evaluated by using three assays: microtox bioassay (Vibrio fischeri), embryogenesis assay in sea urchin (Paracentrotus lividus) and survival in estuarine amphipods (Gammarus aequicauda).

The obtained results suggest that selected remediation technique reduces significantly the toxicological effect of the percolate to the tested organisms. The ecotoxicological testing may be a useful approach for assessing the toxicity as a complement to chemical analysis. In addition, the use of a battery of bioassays allows diminishing problems related to false positive results.

The use of limestone filler constitutes an excellent option in sediments polluted by trace elements, because of risk for human health or ecosystems does not exist after the intervention. in addition, the designed experience allow to optimize stabilizer quantities, and may suppose a big cost-saving project in areas affected by mining activities.