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Ecotoxicological evaluation of areas polluted by mining activities

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Determination of the contaminant content is not enough to evaluate the toxic effects or to characterise contaminated sites, because such a measure does not reflect the ecotoxicological danger in the environment and does not provide information on the effects of the chemical compounds. To estimate the risk of contaminants, chemical methods need to be complemented with biological methods. Therefore, ecotoxicological testing may be a useful approach for assessing the toxicity as a complement to chemical analysis. The aim of this study was to develop a battery of bioassays for the ecotoxicological screening of areas polluted by mining activities. Particularly, the toxicity of water samples, sediments and their pore-water extracts was evaluated by using three assays: bacteria, plants and ostracods. Moreover, the possible relationship between observed toxicity and results of chemical analysis was studied.

The studied area, Sierra Minera, is close to the mining region of La Unión (Murcia, SE Spain) and was for many centuries subjected to mining activities. The sampling points have been selected according to their proximity to the contamination source, establishing three types of samples: samples located in areas next to the contamination source (primary contamination), samples located in the dispersion routes (secondary contamination) and samples located in areas minimally affected by the contaminants. 50 sediment and water samples were collected. Water samples were collected at the same site as the sediment after a rain episode. In our study three methods of environmental toxicological tests were compared: the standardized toxicological test based on inhibition of luminescence employing Microtox®, a phytotoxicity test, using the monocotyl *Sorghum saccharatum* (Sorgho) and the dicotyls *Lepidium sativum* (Garden cress) and *Sinapis alba* (mustard) and a chronic toxicity test with the ostracod *Heterocypris incongruens*. The sampling points, obtained by GPS, were integrated to create a database in which the coordinates were included. With the orthophotos and the Digital Terrain Model (DTM), an hydrography restitution was carried out to study possible relationship between toxicity values and hydrographic net.

Of the bioassays employed, the ostracod test was the most responsive to the toxicants. Moreover, the *Vibrio fischeri* luminescence inhibition assay showed less sensitivity to the toxicants than phytotoxicity assay. The assays carried out in plants and ostracods showed greater sensitivity to Cd followed by As and, lastly Pb, while the Microtox® assay showed greater sensitivity to As, followed by Pb and, lastly, Cd.