Heavy metals in Pétrola Lake protected area (Central Spain)

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Heavy metal pollution may lead to serious ecological consequences in aquatic ecosystems, including the disruption of microbe-mediated biogeochemical cycles. Sediments are the main reservoir of heavy metals in aquatic environments and can therefore be employed as indicators for heavy metal pollution levels and its sources. Several indexes haven been developed to assess the environmental risk of heavy metals in sediments, including the geoaccumulation index (Igeo), the potential ecological risk index (PERI), and the exchangeable fraction based risk assessment code (RAC).

Among aquatic ecosystems, saline lakes are highly vulnerable to heavy metal pollution. These ecosystems usually function as sinks for agricultural, industrial, and urban wastes. Moreover, they are mainly located in closed hydrological systems in arid and semi-arid regions. This type of environment, combined with low precipitation and high evaporation rates typical of arid climates, accumulates pollutants. This study assesses heavy metal pollution in the Pétrola Lake protected area (central Spain). The lake was classified as a heavily modified waterbody because of the inputs of pollutants from agricultural sources and urban wastewater. A total of 102 sediment samples from 14 different control points (including wastewater and agricultural areas) were used to analyze Cd, Cu, Hg, Pb, Zn, and organic matter content. Moreover, a sequential extraction procedure was performed to fractionate Cu, Pb, and Zn in sediments.

For most metals under investigation, background levels were reported. Nevertheless, Pb concentrations in sediment samples from Pétrola Lake, as well as in wastewaters area from Pétrola village, were considerably higher than background values. According to risk assessment indices, those sediments must be considered 'moderately polluted'. Lead was mainly bound to organic matter in those sediments (34.6% and 28.1%, respectively). Therefore, Pb accumulation in the lake may have an anthropogenic source, being directly derived from wastewater spills. Despite low contents of the rest of studied metals (Cd, Cu, Hg, and Zn), they showed higher concentrations in agricultural soils than in lake sediments. These findings provide first comprehensive assessment of heavy metal contents in Pétrola Lake protected area.