

TRACE METALS IN MANGROVE SOILS IN THE SUBAÉ RIVER BASIN, BAHIA, BRAZIL

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Introduction

The level of lead (Pb) contamination in the urban municipality of Santo Amaro, in the State of Bahia, Brazil, is believed to be the highest in the world. As a result it is observed deleterious effects on human health, as indicated by the incidence of diseases on the population and damage to the environment including on the Subaé river basin and its estuary. In 1960 it was built in Santo Amaro a mining-metallurgy complex for lead (Pb) alloy production. This industry polluted the atmosphere, left an environmental liability of about 500,000 Mg of slag (21 % Cd and up to 3 % Pb) and also allowed tailing flow to Subaé River. This study evaluated the trace metals content in mangrove soil profiles in the basin of Subaé.

Methods

The study was carried out in mangroves located in the Subaé River basin, Bahia, Brazil, in the municipalities of Santo Amaro and São Francisco do Conde. The plant species found in the study area were: *Rhizophora mangle* (red mangrove, RM), *Laguncularia racemosa* (white mangrove, WM), and *Avicennia schaueriana* (black mangrove, MP). Five pedons, P1, P2, P3, P4 and P5 representatives of the fluvial lowland of the Subaé River in higher areas and the pedon and two pedons, P6 and P7, representatives of the lower areas, closer to the sea were described. The P2 is the closest from the former Plumbum Mining. Soil samples were collected from the horizon and layers from the profiles, samples were collected processed and subsequently extracted by the method 3050B (USEPA, 1996) and analyzed for Pb, Cd, Mn, Zn, and Fe using an atomic absorption spectrophotometer (AAS Varian AA 220 FS).

Results

Among the pedons studied, P1 had the highest contamination. The Pb concentration in all layers was above the prevention threshold established by Conama (2013). The lead concentrations in 4 Abgn horizon of P3 also exceeded the prevention threshold. The Pb concentrations in 4 Crgnj (P4) were an exception, for being below the background. In contrast, Pb concentration in 2 Abgn (P1), 111.3 mg kg⁻¹, was very close to the PEL value (112 mg kg⁻¹ Pb). The Pb concentrations registered in P1 are a matter of concern, because the pedon is located in an area frequently used by the riparian population to collect shellfish for consumption and marketing.

Cadmium values in some horizons of pedons under fluvial influence, P1 (2 Abgn), P2 (4 Abgn), P3 (4 Abgn) and P5 (3 Abgn), were equal to or higher than the prevention values established by Conama (2013). Cadmium concentrations in the two pedons under marine influence (P6 and P7) were below the prevention values. Only the Cd concentrations in 5 Abgn (P2), Crgnj (P4), and Agn (P5) were equal to or lower than the established background values (NOAA, 1999). The other layers or horizons showed Cd concentrations above the TEL limits and the Abgn layer (P2) showed a Cd concentration level that may cause adverse effects to the biota, i.e. a value above PEL. Highest Cd concentrations in pedons under fluvial influence may be associated with external waste disposal, such as contamination by waste disposed during lead mining, in the municipality of Santo Amaro, or, by urban and industrial activities, as in the Godavari Estuary, India (Ray et al., 2006).

The Zn concentrations in the pedons represent no risk for the biota, with values below the prevention values established by Conama (2013) and the TEL values established by NOAA (1999). In all P4 layers, the pedon least affected by trace metals, the concentrations were lower than the background values.

The Mn concentrations in pedons under fluvial influence ranged from 39.5 (2 Abgnj of P4) to 240.1 mg kg⁻¹ (4 Abgn of P5), which are values below the background established by NOAA (1999).

Iron concentrations ranged from 0.7 (2 Abgnj of P4) to 5.2 dag kg⁻¹ (2 Abgn of P1). In all pedons under study, either of fluvial or marine origin, Fe concentration was above the background threshold values established by NOAA (1999), except for Agn and 2 Abgn (P2) and Agn (P3) layers and all P4 layers, which were below the background concentration.

Conclusion

The trace metal concentration of Pedons formed under marine influence was lower than pedons under fluvial influence. None of the pedons formed under marine influence showed Pb concentration close to the prevention values established by Conama. All layers and horizons of pedons formed under fluvial influence contained between 1 and 3.5 times higher Pb concentrations than the TEL value. Cadmium concentrations were lower than the threshold value established as background. Manganese values in the soils from marine origin were higher than those in pedons formed under fluvial influence. All pedons in the soils under study had concentrations of, at least, one trace metal (Mn, Zn, Pb, Fe, and Cd) above the preventive threshold (TEL), except for pedon P7.

References

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