Abstract

Purpose

Coastal towns in the developing world are faced with the challenge of wastewater treatment. Most of the domestic wastewater generated in these urban areas is discharged raw into the surrounding mangrove forest. The local communities living near mangrove-fringed creeks are artisanal fishers and rely on fish as a source of protein. It is therefore important to determine the impact of sewage input on metal mobility/bioavailability in these mangrove systems.

Materials and methods

The fate of heavy metals was investigated in peri-urban mangrove systems of Kenya, Tanzania and Mozambique. Enrichment factors (EF) and pollution factors (PF) were applied to investigate the pollution status of selected metals in sewage-impacted creeks of the three countries. The spatial distribution patterns of metals in sediments and in the water column were determined. A sewage factor (SF) index was derived to determine the impact of sewage input on the water column.

Results and discussion

Data obtained from sediment analysis revealed that Cd was highly depleted (EF 0.1) at Costa do Sol in Mozambique, inferring that it is highly labile under the prevailing onsite physicochemical parameters. Comparatively, Cr was more enriched in Mozambique sediments than in Kenya and Tanzania. In Tanzania; Zn showed the highest pollution levels (PF, 3.20), with reference to Ras Dege. While in Kenya, zinc was the most polluting metal in all of the sediment segments at Tudor Creek with reference to Gazi Creek. There was a conservative mixing of sediment/particulate-hosted heavy metals at Tudor and Ras Dege. This behaviour was observed for all the metals analysed. At Mtoni, however, the conservative behaviour was only pronounced for Pb and Zn, while for all three sites in Mozambique, metals were distributed evenly across the creeks indicating sinking tendencies. Sewage discharge influenced the concentration of dissolved Cr and Pb at Fort Jesus station during both flood and ebb tide.

Conclusions

Changes in physicochemical parameters strongly influence the fate of sediment-hosted Cd as observed at Costa do Sol. The preferential association of Cd onto carbonates enhances Cd enrichment in sediments rich in carbonates. Input of domestic sewage contributes to dissolved Al loading, which is attributed to the use of alumina in fresh water treatment plants.