

Title: Little Akaki River sediment enrichment with heavy metals, pollution load and potential ecological risks in downstream, Central Ethiopia

Authors: Deshu Mamo Mekuri, Alemnew Berhanu Kassegne and Seyoum Leta Asfaw

Abstract

Addis Ababa City's river ecosystem is under extreme pressure as a result of inappropriate practices of dumping domestic and industrial wastes; thus, threatening its ability to maintain basic ecological, social and economic functions. Little Akaki River which drains through Addis Ababa City receives inorganic and organic pollutants from various anthropogenic sources. Most of inorganic pollutants such as toxic heavy metals released into the river are eventually adsorbed and settle in the sediment. The objective of this study was to evaluate the enrichment levels, pollution load and ecological risks of selected heavy metals (Zn, Cr, Cd and Pb) using various indices. The mean concentrations of heavy metals in Little Akaki River sediment were: Zn (78.96 ± 0.021 – 235.2 ± 0.001 mg/kg); Cr (2.19 ± 0.014 – 440.8 ± 0.003 mg/kg); Cd (2.09 ± 0.001 – 4.16 ± 0.0001 mg/kg) and Pb (30.92 ± 0.018 – 596.4 ± 0.066 mg/kg). Enrichment factor values indicated that sediments were moderate to significantly enriched with Zn and Cr; moderate to very highly enriched with Pb, and very highly enriched in all sampled sites with Cd. Geo-accumulation index and contamination factor values indicated that the sediments were moderate to very highly contaminated with toxic Cd and Pb. The decreasing order of pollution load index (PLI) in downstream was: (S9) > (S4) > (S8) > (S3) > (S6) > (S10) > (S5) > (S2) > (S7) > (S1). PLI and hierarchical cluster analysis revealed that the highest pollution load occurred in the lower course of the river (S9) which may be due to metals inputs from anthropogenic sources. The ecological risk (RI = 350.62) suggested that the contaminated Little Akaki River sediment can pose considerable ecological risks of pollution. The concentrations of Zn, Cr, Cd and Pb in Little Akaki River sediment surpassed eco-toxicological guideline limits of USEPA (threshold effect concentration) and CCME (Interim Sediment Quality Guidelines). Thus, the contaminated sediments can pose adverse biological effects on sediment dwelling organisms.

Keywords: Enrichment factor, Ecological risks index, Geo-accumulation index, Pollution load

Environmental Science System 9:23, (2020), 1-14

DOI: <https://doi.org/10.1186/s40068-020-00188-z>

Download Link: <https://www.sciencedirect.com/science/article/pii/S2352152X21005223>