

**Title:** Assessing pollution profiles along Little Akaki River receiving municipal and industrial wastewaters, Central Ethiopia: implications for environmental and public health safety

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### **Abstract**

Little Akaki River drains residential, industrial, and agricultural irrigation areas of Addis Ababa City Administration and is exposed to point and non-point sources of pollution. The purpose of this study was to identify sources, evaluate the levels of river water pollution, and its implications for environmental and public health. Pollution indices and multivariate statistical analyses were used to determine sources and levels of the river water pollution. Trace metals concentration was determined using inductive coupled plasma optical emission and spectrophotometer (ICP-OES). The average concentrations of COD, BOD, TDS,  $\text{NO}_3\text{-N}$ ,  $\text{NH}_3\text{-N}$ ,  $\text{SO}_4^{2-}$ , and  $\text{PO}_4^{3-}$  ranged from  $40.33 \pm 5.13$  to  $425 \pm 8.00$  mg/L;  $12.34 \pm 0.11$  to  $188 \pm 7.07$  mg/L;  $48.00 \pm 0.83$  to  $915.57 \pm 1.27$  mg/L;  $1.56 \pm 1.01$  to  $66.50 \pm 6.36$  mg/L;  $0.15 \pm 0.08$  to  $42.83 \pm 11.43$  mg/L;  $20.50 \pm 10.61$  to  $77.50 \pm 17.68$  mg/L; and  $0.35 \pm 0.33$  to  $37.95 \pm 0.92$  mg/L, respectively. The average concentrations of Zn ranged ( $0.048 \pm 0.037$  to  $0.318 \pm 0.158$  mg/L), Cr ( $0.012 \pm 0.007$  to  $0.203 \pm 0.199$  mg/L), Cd ( $<0.014 \pm 0.0007$  to  $0.02 \pm 0.001$  mg/L) and Pb ( $0.031 \pm 0.008$  to  $0.124 \pm 0.034$  mg/L). The comprehensive water pollution index values varied from 0.84–13.32, indicating that at all sampling sites (except for sampling site S1), the river water was heavily polluted (CPI  $>2.01$ ). Heavy metal pollution index values further demonstrated potential environmental and public health implications. The principal component analysis revealed a total of 88.99% variation in the dataset, mainly contributed by organic matter, nutrients, dissolved salts, and trace metals that originated from anthropogenic sources. Contamination of the river water has impaired its suitability for urban agriculture, aquaculture, livestock drinking, and recreational purposes. Thus, improving the river water quality is recommended to mitigate potential adverse effects and promote sustainable use of water resources.

**Keywords:** Little Akaki River, Pollution, Water pollution index, Environmental and public health safety, Sustainable use of resources

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