Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.29563

Heavy Metal Contamination in the Dhaka River Systems, Bangladesh: Industrial Impact and Implications for Water Quality Management

LI JIN[1], MOHAMMED ABED HOSSAIN[2], SHAMMI SHAWAL[2], GIANBATTISTA BUSSI[3], PAUL G WHITEHEAD[4] AND CORDELIA RAMPLEY[5]

[1]State University of New York at Cortland
[2]Institute of Water and Flood Management (IWFM), Bangladesh University of Engineering and Technology
[3]Water Resource Associates
[4]University of Oxford
[5]Oxford Molecular Biosensors, Centre for Innovation and Enterprise

Industrial pollution has severely contaminated river systems worldwide, especially in developing cities with dense industrial activity. Heavy metals from untreated industrial effluents often enter rivers, posing serious health risks, particularly for vulnerable populations lacking access to safe drinking water.

This study examines heavy metal contamination in the river systems of Greater Dhaka, Bangladesh. Nearly 1,500 water samples were collected from 58 locations across the Turag, Buriganga, Tongi Khal, Balu, Dhaleswari, and Shitalakhya Rivers between 2017 and 2021 with field measurement and laboratory analysis of water quality parameters including metals. The Integrated Catchment Model (INCA) was applied and calibrated to simulate metal concentrations including Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Lead (Pb), Manganese (Mn), Mercury (Hg), and Zinc (Zn).

Across all sampling sites, dissolved oxygen (DO) levels were low, particularly during the dry season (November-March), when they fell below 1 mg/L. Total dissolved solids (TDS) were twice as high in the dry season compared to the wet season (April-October) due to reduced flow and less dilution. The pH ranged mostly between 7 and 8, with peaks in February and the lowest levels in June. Regarding metal concentrations, Cd, Cu, Hg, Pb and Zn were elevated during the wet season, which may suggest the likely role of monsoon-driven sediment load and sediment resuspension from polluted riverbeds. Compared to WHO drinking water standards, As was the most concerning, exceeding limits in 50% of samples, followed by Mn, Cd, Cr, Pb and Hg. Spatially, 80% of sampling sites in major river systems exceeded WHO limits for As and Mn, 50% for Cd and Cr, and fewer than 5% for Pb and Hg. Our findings provide valuable insights into the extent of heavy metal pollution in Dhaka's river systems and indicate a strong link between elevated metal concentrations and industrial activities. The calibrated INCA model has proven valuable in assessing the impact of industrial waste and the potential effectiveness of proposed sewage treatment plants on river water quality. These findings highlight the urgent need for enhanced wastewater treatment strategies to mitigate both environmental and public health risks.