

Impact of Stormwater Runoff on the Water Quality of Lakes in a Metropolitan Region in India

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Extended Abstract

Pollutants originate in stormwater runoff from natural and anthropogenic activities in the urban watershed. In metropolitan areas, runoff is a significant contributor to non-point source pollution [1]. Emerging contaminants are synthetic substances not commonly monitored in developing countries and have become an environmental concern due to their potential adverse effects on human health and ecosystems [2]. This research aims to characterize the runoff in the Powai region of Mumbai, India and identify the potential sources of pollutants entering the Powai lake. The focus of the current work is on heavy metals and emerging contaminants. Runoff samples were collected from five different outfall locations in the region (SL1, SL2, SL3, SL4, and SL5) for ten storm events between the 2022 and 2023 monsoon seasons. The analysis of runoff samples revealed elevated concentrations of aluminum, lead, iron, nickel, manganese and chromium. In addition, trace levels of copper and zinc were detected for both the monsoon season. Vehicular sources were identified as probable sources of iron, lead, nickel, and aluminum. Construction activity and leaching from building materials were identified as likely sources of chromium.

Phthalates, pesticides, personal care products and pharmaceuticals were the four classes of emerging contaminants detected in the runoff across the five locations. The following phthalate compounds, typically originating from microplastics: Di(2-ethylhexyl) phthalate (DEHP), Decyl hexyl phthalate, Diisooctyl phthalate, Octyl decyl phthalate, Bis(3,5,5-trimethylhexyl) phthalate, Bis(2-ethylhexyl) isophthalate, Bis(2-ethylhexyl) phthalate, Dibutyl phthalate, Diethyl phthalate, Dimethyl phthalate and Dioctyl phthalate (DOP) were the most abundant phthalate esters. The study estimates PVC pipes, vinyl flooring, medical devices, and consumer-use plastics as the potential sources of phthalates. Diuron and Isoxaben, commonly used as herbicides, were prevalent across the sampling locations. The outfall locations SL1 and SL4, which convey runoff from varied catchments, indicated the presence of carbendazim, a fungicide that can migrate from urban green spaces. Zearalenone, a mycotoxin produced by certain fungi of the *Fusarium* genus, was detected for the 2022 monsoon seasons. Diflufenican, a commonly used herbicide for weed control in lawns, gardens, paints, and roof coatings, was also detected.

Pharmaceutical and Personal care products (PPCPs) such as ethyl paraben, galaxolidone, enalapril, norgestrel, caffeine, metformin, and valsartan were detected and quantified. Research is underway to identify the probable sources of these PPCPs and elaborate on their fate and transport. Preliminary findings indicate that the mixing of untreated sewage and the presence of healthcare facilities in the region could be contributing to the detected PPCPs. The depleted levels of dissolved oxygen and higher fecal coliform counts observed at the outfall locations (SL1 and SL3) further confirm the hypothesis of sewage mixture with runoff. The findings of this study could be used as a reference to assess the impact of runoff on the degrading water quality of Powai Lake.

References

- [1] L. A. Rossman and W. C. Huber, "Storm Water Management Model Reference Manual Volume III – Water Quality," *United States Environ. Prot. Agency Off. Res. Dev.*, vol. III, no. January, pp. 97–140, 2016, [Online]. Available: www2.epa.gov/water-research
- [2] L. You, V. T. Nguyen, A. Pal, H. Chen, Y. He, M. Reinhard, and K. Y. H. Gin, "Investigation of pharmaceuticals, personal care products, and endocrine disrupting chemicals in a tropical urban catchment and the influence of environmental factors," *Sci. Total Environ.*, vol. 536, pp. 955–963, 2015, doi: 10.1016/j.scitotenv.2015.06.041.