Seasonal dynamics of leachate pollution potential at Kerawalapitiya Waste Park in Muthurajawela wetland, Sri Lanka; a Leachate Pollution Index study

S. J. S. Bandara[1,2], R. U. K. Piyadasa[1], S. Himanujahn[3], E. R. Gunawardhana[4]

[1]*Department of Environmental Technology, Faculty of Technology, University of Colombo, Sri Lanka*
[2]*Central Environmental Authority, Sri Lanka*
[3]*Department of Civil and Environmental Technology, Faculty of Technology, University of Sri Jayewardenepura, Sri Lanka*
[4]*Department of Biosystems Technology, Faculty of Technology, University of Sri Jayewardenepura, Sri Lanka*

This study investigates seasonal variations in the potential of leachate contamination at Kerawalapitiya Waste Park; the largest open waste dump located in Muthurajawela wetland. The study measured contamination potential across three seasonal periods through the Leachate Pollution Index (LPI) during a three-year monitoring period from 2022 to 2024 with 36 samples collected monthly. This study evaluated multiple physicochemical parameters including organic pollutants (BOD_5, COD), inorganic components (pH, EC, TDS), heavy metals (As, Cd, Cr, Cu, Hg, Ni, Pb, Zn, Fe, Mn), major cations and anions, and nutrient indicators (NH_4^+, NO_3^-, PO_4^{3-}) to emphasize environmental contamination threats to the nearby wetland ecosystem. The study confirmed key differences in potential of leachate pollution among seasons, based on the precipitation levels while total LPI values ranged from 10.0 during the 2023 wet season, (monthly rainfall around 1000 ml) to 37.2 during the 2024 dry season (monthly rainfall less than 300 ml) which indicated moderate to high contamination levels that surpassed environmental standards. The main pollution source consisted of organic matter which reached its maximum level of 80.0 during the 2024 intermediate season (monthly rainfall nearly 500 - 600 ml) although heavy metal contamination showed unpredictable behavior with its highest level of 43.8 during the 2024 dry season. The study revealed that 2024 signified the most hazardous year for the environment since all measured components showed in high contamination levels. The seasonal examination of the monitoring period showed irregular patterns which imply that traditional seasonal management techniques are insufficient for handling intricate relationships between climatic elements and waste composition as well as leachate generation methods. The results emphasize an immediate requirement for improved surveillance procedures along with flexible strategies of pollution management which can be adapted to time-based changes in composition of contamination. This study shows that leachate pollution potential peaks during dry seasons, underscoring the need for season-specific monitoring and treatment strategies to protect the Muthurajawela wetland.

Keywords: *Contamination, Leachate Pollution Index (LPI), Muthurajawela wetland, Seasonal variation*