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Characterization of Leachate and Its Impact on Surface and Groundwater Quality of a Closed Dumpsite - A Case Study at Dhapa, Kolkata, India

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Abstract

The possible enduring environmental impact of a closed landfill on groundwater and surface water quality depends on the leachate characteristics. Post closure management of closed landfill site is needed for averting the environmental hazards. The present investigation was aimed to characterize leachate and its impact on surrounding water resources of closed dumping site at Dhapa (Kolkata, West Bengal, India).Three sampling points were identified for collection of samples fromand near the closed dumping site. All the samples were examined for pH, TDS, Cl^-, BOD_5, COD, NH_4^+-N, Zn, Cu, Cr, Cd, Hg and Pbto study the seasonal variation of significant parameters. The laboratory analysis shows prevalence of high value of TDS (8994.16±6239.2mg/L), COD (4191.66±2282.19mg/L), NH_4^+-N (1165.93±658.4mg/L), Cl^- (4356.65±1304.84mg/L) and two heavy metals viz. Pb (0.56±0.33mg/L) and Hg (0.42±0.44mg/L) in the leachate samples, which have exceeded their respective standards specified in "Municipal Solid Wastes (Management and Handling) Rules, 2000" for disposal of treated leachates. The maximum concentration of afore-said heavy metals viz. lead and mercury are found to be 0.15±0.18 mg/L and 0.16±0.28mg/Land 0.23±0.21 mg/L and 0.1±0.05 mg/L respectively for surface and ground water resources, which have exceeded their respective permissible limits recommended by Bureau of Indian Standards (BIS). The extent of contamination of local water resources necessitates appropriate treatment of leachate before getting discharged and establishes the significance of post closure management of the closed dumpsite.

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Keywords:Dumping site, Leachate, Groundwater, Surface water, Seasonal variation;

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1.0Introduction

Indecorous handling of solid waste has resulted in serious ecological, environmental and health complications (Salami et al., 2014).The interment of municipal solid waste in landfills is one of the most common disposal methodologies adopted in most of the countries. Landfill leachate is generated when excess rainwater percolates through the waste layers in a landfill. Landfill leachate may be categorized asa water-based solution of four groups of contaminants (dissolved organic matter, inorganic macro-components, heavy metals, and xenobiotic organic compounds. The most important potential environmental influences associated with landfill leachate are contamination of groundwater and surface water (Kjeldsen et al., 2002). Groundwater is a worldwide significant and valuable renewable resource for human life and economic growth. Groundwater pollution is principally due to the process of industrial development and urbanization that has gradually developed over time without any esteem for environmental significances. Only just, the impact of leachate on groundwater and other water resources has attracted a lot of care because of its devastating environmental significance. Leachate migration from landfills poses a high risk to groundwater resource if not satisfactorily managed (Patil et al., 2013).

Most of the lakes and rivers in the world are heavily polluted nowadays. There are limited lands accessible for crude solid waste dumping. The growing generation and buildup of wastes produce serious environmental, economic, and social difficulties in both developed and developing countries (Dharmarathne et al., 2013). Electronic goods, painting waste, used batteries, etc., when dumped with municipal solid wastes increase the heavy metals in dumpsites and dumping devoid of proper segregation of hazardous waste can further elevate toxic environmental effects. Environmental impact of land filling of MSW can usually result from the run-off of the noxious compounds into surface water and groundwater which ultimately lead to water pollution as a result of percolation of leachate (Ramaiah et al., 2014). The groundwater zones and surface water bodies (ponds) around the Dhapa closed dumping ground are usually affected by landfill leachate. Consequently, diseases such as hepatitis, diarrhea, vomiting, abdominal pain, dysentery etc. have been frequently occurring in majority of the people residing adjacent to Dhapa area. In the present study, considering the gravity of the situation, the effects of leachate percolation and dispersion have been studied on the surrounding groundwater and surface water courses of Dhapa closed landfill site of Kolkata.

2.0 Study Area

The Dhapa disposal site of Kolkata is located in the eastern part of India at 22.82°N and 88.20°E and 26 km from the Dumdum Airport. Kolkata is the capital of the state of West Bengal located in the eastern part of India. The climate in Kolkata is tropical and rainy.

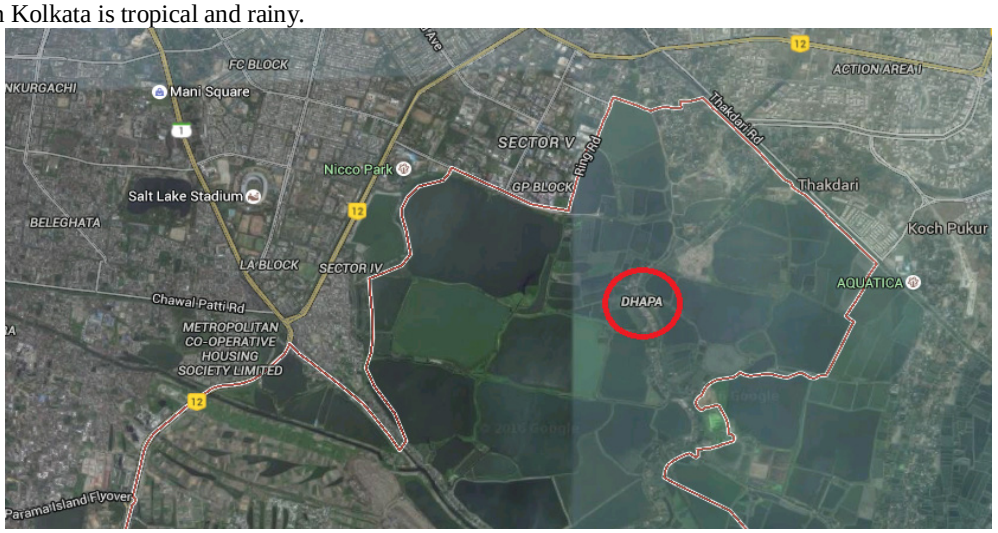

Fig. 1. View of the Study Area (Source: Google earth)