
**A REVIEW ON ASSESSMENT OF SOIL AND WATER CONTAMINATION LEVEL
IN AND AROUND MUNICIPAL SOLID WASTE DUMP YARD: A CASE STUDY****Hemadri BN^{*1}, Abhay Shanbhag^{*2}, Danunjay Kumar^{*3}, Jeevan L^{*4}**^{*1,2,3,4}Student, Department Of Civil Engineering, Dayananda Sagar College Of Engineering,
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ABSTRACT

Unscientific municipal solid waste management is one of the primary sources of contamination in developing nations such as India. The survey attempted to examine the characteristics of groundwater, leachate, and soil in and around a dumping site in Bengaluru, Karnataka's capital city. Standard standards for assessing soil and water quality were followed. According to the findings, the surrounding dumpsite harms environmental indicators such as groundwater and soil quality, as demonstrated in this study. Parameters that shall be tested include temperature, pH, turbidity, nitrates, and TDS among others. The study has been conducted at Bellahalli Leachate Plant, Mitganahalli, Bengaluru. About 3100 tonnes of waste is dumped at this site every day.

Keywords: Municipal Solid Waste, Contamination, Groundwater, Soil, Leachate.

I. INTRODUCTION

There has been a massive increase in trash output in parallel with rising trends in urbanisation and population in the previous few decades and Municipal solid waste (MSW) management has become increasingly difficult in the Indian subcontinent's growing metropolitan environments.

As a result of the COVID-19 epidemic, recent times have seen exponential population increase, high population density in metropolitan areas, diversified culture, changing dietary habits, and lifestyles, as well as an astronomical spike in biological waste output.

In poor countries, open dumping of MSW is a popular disposal strategy. The dynamics of waste generation have evolved in 'transformed cities,' which have experienced fast population increase and industrial development in recent decades, resulting in direct and indirect impacts on environmental health.

Since humans rely on water for sustenance, surface water contamination is also a major source of stress for the community. Rainfall events can either dilute or enhance toxicity if the pace of transport increases the flow of contaminants to surface water. Municipal solid trash is disposed of in rivers and streams. Waste is frequently released into receiving water bodies with little or no regard.

Bengaluru is the state capital of Karnataka, which is located at Latitude 13°50' North and Longitude 77°36' East, on the southern end of the Deccan plateau, bordering two other South Indian states, Tamil Nadu and Andhra Pradesh. It is at a height of 900 meters. The Bengaluru Metropolitan Zone has an area of 2190 square kilometres and with an ever-growing population as well as the developing demands of the Information Technology (IT) sector, it is critical to find a solution to the waste management problem.

Bangalore lacks appropriate treatment strategy facilities for solid waste generated by municipalities and businesses in the surrounding area. This has resulted in the establishment of a handful of illegal and unregulated dumps in Bangalore.

II. LITERATURE REVIEW

2.1. B.P. Naveen, et al. (2013) In-depth case study on Present conditions of waste disposal, elaboration on handling of various categories of waste in (Shivajinagar, Malleshwaram, Koramangala, Indian Institute of Science campus (IISc), Hindustan Machine Tools colony (HMT), Airport Road and Chickpet. Analysis of landfill in Bangalore was done by authors considering it's landfill location, landfill capacity, and other criterion. Chemical Analysis of landfill waste in Bangalore was conducted and following parameters are estimated Nitrogen, phosphorus and Potassium content as well as carbon /Nitrogen (C/N)ratio. The authors also described Comparative study of waste production in Bangalore and other metropolitan cities was conducted. Authors have discussed potential use of solid waste for power production.

2.2. M. Sureshkumar, et al. (2016) 15 water samples from various borewells surrounding a dump yard were collected for laboratory analysis from Kanchipuram Municipality. Authors have described the following test to describe the quality of water samples collected, such as pH, Total dissolved solids, electrical conductivity, Total Alkalinity, Total Hardness, Fluoride, Sulphate, Free Ammonia, Nitrate, Chloride and Phosphate. Authors have also compared the Results obtained on water quality analysis with respect to BIS and WHO standards. Finally, authors have concluded by determining the Water Quality Index for the samples along with graphical representation of data. Further, it was also concluded that water is of very poor quality for drinking purpose. 6.7% of water under unfit for drinking water condition.

2.3. R. N. Uma, et al. (2016) Soil samples were collected over two years in various seasons, characteristics such as pH, Electrical conductivity, Moisture content, Organic matter as well as presence of Ca, Mg, Na, and K were tested. Tests used were titration, Flame photometer, pH and EC analysers. For soil suitability for irrigation, Sodium adsorption ratio, Cation Exchange Capacity and Exchangeable sodium percentage were calculated. Soil Quality index was drawn up to quantify soil quality. The authors have concluded that soil quality in and around Coimbatore region most of the soil samples are within the limits except in some places

2.4. S. Mageswari, et al. (2017) In this study the authors have made use of Geographic information system (GIS) for groundwater quality research. Data that has been acquired in this study is ASTER DEM (Digital Elevation Modelling) and Satellite imagery 12 samples at around 250m buffer distance and another 12 samples at around 500m buffer distance were collected Perungudi Dump Yard, "Quantum GIS" software was used to prepare spatial variation of various parameters such as Turbidity, Hardness, Magnesium, Ammonia, Chloride, Calcium, Dissolved Oxygen, Fluorides etc. The various parameters were assigned scores and given weightage using the weighted linear combination method.

2.5. Aishwarya R (2021) Kodungaiyur dump yard chosen for this study by the author is the major toxic dump yard in Chennai. The sampling points are transferred to GIS platform and the parameters of water quality after testing are linked to their attributes to generate various thematic maps. With the help of the Inverse Weight Diagram (IWD) interpolation technique. The leachate percolation results in the decrease of groundwater quality which in turn affects the suitability of groundwater for beneficial purposes. Conclusion In the current study, an attempt was made to evaluate the groundwater contamination mapping around the Kodungaiyur dump yard. The spatial distribution for the tested water qualities was successfully obtained and mapped using the Inverse distance weighted (IDW) interpolation technique in QGIS. These parameters adversely affect health as water is the primary source for human habitat and make the water unfit for drinking

2.6. B.P. Naveen (2021) In this study, a comprehensive review of Bangalore's waste management has been provided to elaborate on the current status. Bangalore doesn't have any logical treatment strategy facilities for solid waste produced by municipal and industries around Bangalore. In Bangalore alone, 4500 tons of waste are generated every day, including household waste as well as industrial, hospital, commercial and construction waste The recycling bio methanation process can be successfully used for biodegradable waste. It should also have a strict monitoring mechanism for the implementation of solid waste management rules. BBMP should be given authority to impose stringent penalties upon those who would defer from the rules.

2.7. Dr. Basavaraj Paruti, et al. (2019) have described Municipal solid waste (MSW) normally termed as garbage or trash is an unavoidable consequence of human activity. There are such MSW dump yard in Bangalore urban district is located on the Deccan Plateau in the south eastern part of Karnataka. To analyse the MSW waste for Various parameters and methods, the below test were carried out by the authors are applied such as Digital pH meter, Electrical Conductivity, Digital Conductivity meter, Bulk Density Core cutter method, Dry Density Core cutter method, Permeability Constant head method, Moisture Content Oven dry method, Specific Gravity Pycnometer method. The surface water sample is found to have significantly high salinity and alkalinity as reflected in their values for conductivity, TDS, alkalinity and pH

2.8. Sruti Pillai, et al. (2014) The Municipal Solid Waste disposal site for the city of Thrissur, in Kerala, India, has become an overflowing landfill because of the indiscriminate dumping of solid waste at the site. The organic matter in solid waste in developing countries is much higher than that in the waste in developed countries. Various physico-chemical parameters examined by the author in leachate sample such as, pH, electrical conductivity (EC), total dissolved solids (TDS), Total suspended solids (TSS)chemical oxygen demand (COD),

biological oxygen demand (BOD), calcium, magnesium, sodium, potassium, chloride, Sulphates and Nitrates. It is concluded from this study by the authors that the hardness of the control sample was found to be much higher than the hardness of the polluted samples. Various chemical parameters in the soil showed different trends with increasing leachate concentrations.

2.9. Seema Jilani, et al. (2019) The authors randomly collected soil samples at a depth of 0- 3 cm using a hand auger at the test site. Investigation showed that Municipal Solid Waste (MSW) in the residential area of Karachi contained a significant higher proportion of biodegradable organic waste.

2.10. Besufekad Mekonnen, et al. (2020) Tepi is a town in Southwest Ethiopia, study was conducted for 4 months. Soil was collected 10, 30, 60 meters away from the dump sites using a hand auger, river water samples (1-liter) were collected from three different sampling points. In conclusion, parameters exceeded the permissible limits of EEPA and WHO standards.

2.11. N. Victor Babu, et al. (2013) For the study, the authors collected 25 water samples adjacent to the unlined sewage drains. Chemical parameters were found to be exceeding the maximum limits. It was observed that the groundwater is being highly polluted due to improper dumping of solid waste in unlined sewage drains.

2.12. M. Choudhury, et al (2022) Silchar, the headquarters of the Cachar district of Assam was taken as the study area. Open digestion method was followed to prepare the soil extract for metal analysis. Principal component analysis (PCA) was used to identify patterns in data. Trace Elements in Groundwater were found in the soil sample.

2.13. Evangelin Ramani Sujatha, et al. (2013) The authors picked the Municipal Solid Waste Dumpsite at Ariyamangalam for this study. Grain size distribution analysis was performed by dry sieving. Water Quality Analysis for various parameters was conducted.

2.14. Sunil Srigrisetty, et al. (2017) Field Survey and Quantification of Solid Waste methodology was used by the authors for calculating the per capita waste quantification at study area. With the help of local bodies and the field survey, the amount of waste that is being generated in the Srikakulam town was quantified. The electric conductivity around the study site was found. Soil Quality index was drawn up to quantify soil quality.

2.15. Basavaraj Paruti, et al. (2019) Assessment of quality of water bodies and landfill soil surrounding S. Bingipura was conducted. Assessment of Ground water bodies: Colour, Turbidity, pH, etc. Assessment of surface water bodies and Soil Characteristics: Colour, pH, electric conductivity, etc. was found to be exceeding the limits based on WHO standards.

2.16. Patrick Akata Nwofe, (2015) Management and Disposal of Municipal Solid Wastes in Abakaliki Metropolis, Ebonyi State, Nigeria was conducted. In this study, the municipal solid waste management and disposal methods in Abakaliki Metropolis, The sources of municipal solid waste in the metropolis were obtained from the analysis of the physical observation of the composition of the wastes in each waste dump site.

2.17. Manbir Kaur, et al. (2020) Implementation analysis of municipal solid waste management in Dinanagar city of Punjab, India, for this study. In this study analyzes the implementation of solid waste management. Also, examine the factors responsible for the dysfunction of the municipal corporation of Dinanagar (MCD) city of Punjab (India). According to literature one major reason behind poor waste management is inhabitants' perception, concern, behavior, participation and awareness.

2.18. Shilpa P, et al. (2018) The study was based on both primary and secondary data. Study was carried out in Hubballi-Dharwad Municipal Corporation and Bruhat Bengaluru Mahanagara Palike. The primary data on health impacts of households was collected from 60 selected respondents residing near dumping and secondary data on method of disposal of solid waste was collected from municipal corporations.

2.19. Suleyman Sefa Bilgilioglu, et al. (2021) A GIS-based multi-criteria decision-making method for the selection of potential municipal solid waste disposal sites in Mersin, Turkey. Authors determined disposal sites using geographic information system (GIS) and the analytic hierarchy process. The authors selected evaluation criteria such as: elevation, slope, distance from lineaments, etc. The authors concluded that 80.88% was determined unsuitable for an Municipal Solid Waste Disposal site.

2.20. Yupeng Liu, et al.(2021) Developing a GIS-based model to quantify spatiotemporal pattern of home appliances and e-waste generation—A case study in Xiamen, China for this study, Geographic information system (GIS) along with material flow analysis (MFA) methods were used. Xiamen, a rapidly urbanized city in China, was used for this study, Stocks and demands of e-waste generation in 1 km × 1 km grids were mapped using this GIS-MFA model.

2.21. Imran,et al.(2020) Quantum GIS Based Descriptive and Predictive Data Analysis for Effective Planning of Waste Management for this study, Jeju Island in South Korea was considered for this study using Quantum GIS software, The results of the analysis were evaluated using Mean Absolute Error, Root Mean Square Error , and Mean Absolute Percentage Error. Authors concluded that Effective planning for the waste management needs reliable data analysis for a more detailed waste information generation

2.22. N.Raman, et al.(2008) Impact of solid waste effect on ground water and soil quality nearer to pallavaram solid waste landfill site in Chennai, The study was done Pallavaram landfill , The Preliminary survey on the quality of ground water, soil and solid waste samples was conducted.Soil sample was collected by removing surface soil up to 6 inches using hand augur and water sample was collected at three different site near the dumpsite.

2.23. Henry Olawale Sawyerr,et al.(2017) Impact of Dumpsites on the Quality of Soil and Groundwater in Satellite Towns of the Federal Capital Territory, Abuja, Nigeria, The study was conducted in federal capital territory ,Abuja ,Nigeria Soil and water samples were collected about 20m away from the dumpsites and corresponding parameters test were conducted and analysed and it was found it was exceeding maximum permissible limits.

2.24. Dinesh C, et al.(2005) Impact of solid waste on water quality of Bishnumati River and surrounding areas in Kathmandu, Nepal, The study area is located within the Kathmandu valley, Water samples were collected from six locations and included shallow wells, surface water, and leachate. A total of nineteen parameters were analyzed and conducted and they included physical, chemical, and microbiological indicator samples were free of pollution (mainly microbial contamination), the water requires treatment before using for drinking purpose.

2.25. Mr. Sagar Shinde et al.(2019) Investigation of ground water contamination around landfill site, The study was conducted on the samples collected from the Malegaon Municipal Solid Waste dump site. The open dumping ground was actually situated out of city near Chandanpuri. Methodology comprises of both ground water and Leachate sampling and analysis. The sampling was carried out at beyond the boundaries of landfill site. The analyses covered Physio-chemical parameters of water samples from a nearby well.

III. METHODOLOGY

3.1 Method of analysis

Electrical conductivity (EC), pH, water temperature (Tem), and total dissolved solids (TDS) were measured in situ using a previously calibrated EC/pH metre (WM22EP, Toadkk, Japan). The HCO₃ concentration was determined by titration with 0.02 N sulfuric acid on the day of sampling before filtration, and the final pH was 4.2-4.4 using methyl orange endpoint titration.

The major ions in water samples were treated and analysed in the laboratory of the physical and chemical analysis centre. Inductively coupled plasma optical emission spectrometry was used to analyse the cations in water samples (Perkin-Elmer Optima 5300 DV, USA). Ion chromatography was used to analyse major anions.

3.2 Water quality index

This is a measurement scale that combines the findings of numerous water quality affecting parameters into a single value to assess the status of the water quality. The WQI was determined as follows: (1) A weight was assigned to each water quality parameter (wi), representing the parameter's proportional importance to the overall quality of water for various purposes. (2) Equation was used to calculate the relative weight (wi) of each parameter. (3) For each parameter, the quality rating scale (qi) is computed. The measured concentration for each parameter is divided to standard values in this phase. Finally, the WQI was computed.

3.3 Sample collection

Initially after visually analysing the landfill site, specific points or coordinates were chosen for collecting soil sample. The pits were dug out for about 0.5m at the coordinates and the fresh soil sample was taken.For the

groundwater sample, the nearby available sources like wells, borewell etc were taken into consideration and about a litre of sample was collected at each source. The drains of leachate collection systems were used for collection leachate sample.

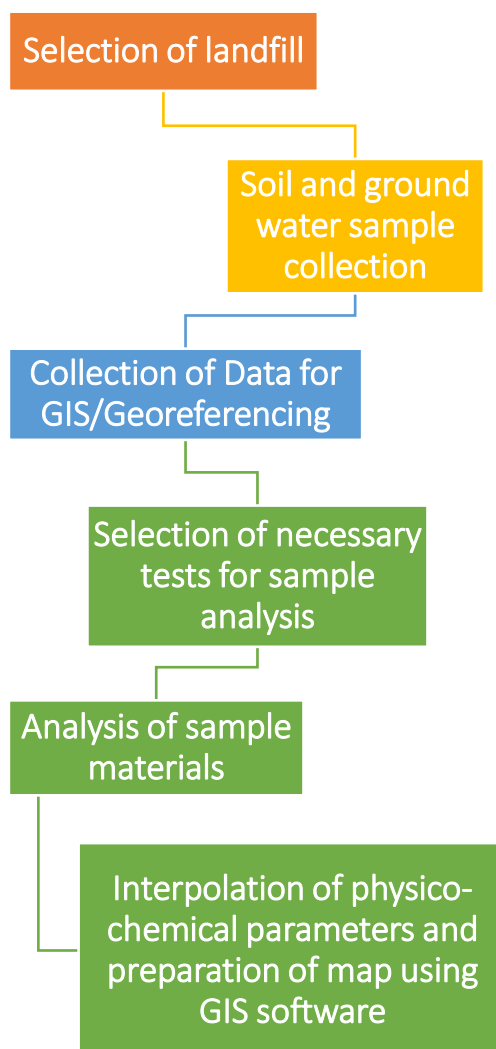


Figure a – Flowchart of methodology

IV. CONCLUSION

The city of Bengaluru requires major waste management reform. Improper disposal of municipal solid waste dumping has caused nuisance to the surrounding villages. Closed anaerobic decomposition can help reduce the odour of exposed garbage which can travel across large distances. The waste leachate must be stopped from seeping into the ground and polluting the groundwater.

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