A Case Study on Soil Quality Analysis around Dumping Yard

Suraj D. Bhosle[1], Sanju R. Phulpagar[2] and Abhijeet Keskar[3]

[1,2,3]Research scholar, Sardar Vallabhbhai National Institute of Technology, Surat, Gujarat, India

Email: bhosalesurajd@gmail.com, sanjup1213@gmail.com and keskarabhijeet@gmail.com

Abstract. The groundwater is one of the most important water resources. The danger of pollution in groundwater has become one of the environmental factors of greatest concern in latest years, particularly in developing countries. The society is continually enhancing the amount of municipal and industrial waste generated. Growth in solid waste has increased due to the drastic population growth in India in recent years. Due to fast urbanization, solid waste generation has deepened and influences the quality of groundwater. In addition, human operations and lifestyle modifications have risen in solid waste resulting in contamination of the soil and polluting soil and groundwater. Aurangabad City is Maharashtra State's increasing industrial centre. There are several manufacturing centres around the town that dispose their solid waste to neighboring areas. 300 MT of solid waste per day is produced in Aurangabad city, resulting in increased public health danger and environmental damage. Therefore, in the current study, Naregaon dumping yard located in Aurangabad city of Maharashtra is selected. Results of the study showed that, owing to leachate formation around the dumping yards, the quality of groundwater decreases. The study also showed that the contamination of the soil is nearer to the storage yard and reduces as distance increases.

Keywords: Soil Quility, Dumping Ground, Naregaon, Irrigation

1 Introduction

Water is very important for every living organism [2]. The groundwater is one of the most Crucial water resources. In recent years the risk of pollution in groundwater has become one of the most concerns environmental factor, especially in the developing countries [7]. The amount of municipal and industrial waste generated by the society is continuously enhancing. Due to drastically increasing population in recent years in India, growth of solid waste has increased [5]. As a result of rapid urbanization, the generation of solid waste has intensified and it has influence on the groundwater quality [3]. People in the nearby vicinity, mostly depend upon groundwater for domestic and drinking purposes. The pollution of soil arises because of the leaching of wastes

from landfills that produce induce heavy metal such as lead, mercury, copper etc. [6]. The contamination of soil and groundwater is the most serious environmental risk linked to unsanitary land filling of solid waste [6]. Soil is an interface for infiltration, surface runoff and precipitation event. Likewise soil is a very crucial media to interflow of leachate/water into the ground reservoirs [1].

Porosity is directly proportional to the contamination of groundwater as well as leachate will spread in underground soil strata that will effect on surrounding agricultural soil and land. The Physio-chemical parameters of soil are crucial for site suitability, plant growth and soil management [1]. Aurangabad city is a growing industrial hub in Maharashtra state [8]. Various industrial centers are located in regions of Paithan MIDC area, Chikalthana, Shendra, Waluj and Pandharpur that disposes their solid waste to nearby sites. This solid waste disposal generates a concern as it causes land pollution when deposited openly, water pollution when stored in low lands and air pollution when burned. [8]. Due to rapid urbanization and enhancement in population, growth of solid waste and environmental pollution has increased. [8]. In Aurangabad city 300 MT per day solid waste is generated which lead to increase in public health risk and damages environment [8]. Therefore, in the current study, Naregaon dumping yard located in Aurangabad city of Maharashtra is selected. [4] Have analyzed the soil quality and chemical characteristics and concentration of heavy metals in Konabari area of Bangladesh for the period of six months (i.e. July to December 2011) by considering five different points at a distance of 10m apart from each other at depth of 15m and 30m respectively. The outcome of the study showed that waste material produce a drastic impact on soil quality and heavy metal varies in order as, iron (Fe) > zinc (Zn) > lead (Pb) > copper (Cu) > cadmium (Cd). The metal contained were found more in the industrial effluent site and lesser in solid waste dumping site. Raman et al. (2008) have collected samples from solid waste dumping site in Chennai to find out the impact of a solid waste landfill site on groundwater. The physical and chemical parameters of soil and water such as hardness, temperature, pH, electrical conductivity, total suspended solids, alkalinity, total dissolved solids, calcium, magnesium, chloride, sulphate, phosphate, nitrate and the metals like potassium, sodium, copper, manganese, lead, cadmium, chromium, palladium, nickel, organic carbon, organic matter, moisture contain, leaches, pH antimony were studied using various analytical techniques. Its direct impact on groundwater and soil quality parameter was observed, which was exceeding the limits as stated by Indian Standards and concluded that contamination of water and sand in nearby vicinity is due to dumping of solid waste. [1] Studied physio-chemical parameters and textural analysis of soil around periphery of Davanagere Urban city. The study indicates that the soil has neutral pH and moderate permeability. The main objective of the current study is to understand how the soil contamination variation occurs with respect to distance from the boundary of the Naregaon dumping yard located in Aurangabad city of Maharashtra.

2 Study area

Aurangabad, the largest city of Maharashtra state, is located on a hilly upland terrain in the Deccan traps as shown in figure 1. It is located at latitudes 19°53′35″N and longitude 75°23′55″E. Aurangabad is the 6th most populous city in Maharashtra with a population of 1,175,116 (https://en.wikipedia.org/wiki/Aurangabad). On an average, 1000 metric ton/day of waste is dumped at the Naregaon dumping yard. The average rainfall of Aurangabad city is 714.6 mm (2011).

Fig. 1. Study area Naregaon in Aurangabad District of Maharashtra (Not to the scale)

3 Methodology

The present study is carried out, by collecting soil samples from the 9 locations around the municipal dumping ground of Nareagon located in Aurangabad city of

Maharashtra. The locations of sample collection sites are positioned on the basis of latitude and longitude. The latitude and longitude of nine sample sites and their distance from the boundary of dumping yard are shown in table 1. The Preliminary survey on the quality soil samples was conducted in 2018, for the reason that the ground water and soil got polluted due to solid waste dumping, nearer to the location.

Table 1. Details of sampling site location

Well	Latitude	Longitude	Distance from Boundary of MSW Dumping Ground (m)
Site 1 (S1)	19° 53' 50.78"	75° 23' 17.99"	1400
Site 2 (S2)	19° 53' 32.1"	75° 23' 26.09"	800
Site 3 (S3)	19° 53' 25.98"	75° 23' 27.31"	750
Site 4 (S4)	19° 53' 12.19"	75° 23' 57.95"	700
Site 5 (S5)	19° 53' 26.66"	75° 23' 51.29"	330
Site 6 (S6)	19° 53' 36.13"	75° 23' 50.82"	380
Site 7 (S7)	19° 53' 49.09"	75° 23' 50.6"	420
Site 8 (S8)	19° 53' 49.49"	75° 23' 51.86"	450
Site 9 (S9)	19° 53' 45.85"	75° 23' 45.67"	310

3.1 Soil samples

The collection of soil sample was done by standard method (Core cutter method) that is used to collect the soil samples. The core cutter containing the soil, is dug out from the ground. The dolly is removed and the excess soil is trimmed off. The soil samples were then taken to the laboratory for testing. The method adopted for Physio-chemical analysis of the soil sample is shown in table 2. The station-wise distributions of analytical parameters such as soil textural characteristics and Physio-chemical parameters are shown in table 3 and table 4 respectively.

Table 2. The Method adopted for Physio-chemical analysis of soil

Sr. No.	Soil Characteristics	Symbol	Unit	Test Method
1	pH	pH	-	pH Analyzer
2	Electrical Conductivity	EC	dS/m	EC Analyzer
3	Moisture content	MC	%	Oven dry method
4	Organic matter	OM	%	Titration Method

4 Results and Discussion

4.1 Soil Characteristics

Soil acts as a media to interflow of leachate into ground water (GW). If the soil have high porosity, the interflow is more and GW contamination is more and furthermore the leachate will spread; that affects the soil quality. Each of these soil conditions has distinct characteristics that can be observed in the field (Naregaon dumping ground). Experimental results obtained on the characteristics of soil samples are shown in Table 3.

4.2 Soil Textural Characteristics

The textural characteristics of soil samples collected around the Naregaon dumping ground are shown in table 3. From the study it was observed that the soil quality varied in different locations.

Table 3. Textural Characteristics of soil

Well	Clay (%)	Silt (%)	Sand (%)
Site 1 (S1)	29	35	36
Site 2 (S2)	28	38	34
Site 3 (S3)	28	42	30
Site 4 (S4)	29	38	33
Site 5 (S5)	28	35	37
Site 6 (S6)	30	36	34
Site 7 (S7)	29	41	30
Site 8 (S8)	28	43	29
Site 9 (S9)	30	33	37

The results of textural analysis indicate that leachate can percolate deeper and has a high risk of ground water contamination for soils having the larger portion of sand content. The uncontaminated soil is relatively uniform and contaminated soil has more fines than the uncontaminated soil. The high percentage of fine content for contaminated soil quality is from emanating the decomposed municipal solid waste above the soil. During bacterial degradation or decomposition of municipal solid waste large amount of fines are produced.

4.3 Physiochemical Parameters

The Physico-chemical parameters of soil such as pH, Electric conductivity (EC), organic matter (OM) and moisture content (MC) are analyzed in the MSW dumping yard of Naregaon located in Aurangabad city of Maharashtra and are shown in table 4.

Table 4. Physico-chemical properties of soil samples around Naregaon dumping ground

Well	pH	EC (dS/m)	Organic Matter (OM) (%)	Moisture content (MC) (%)
Site 1 (S1)	7.5	0.19	0.54	10
Site 2 (S2)	7.6	0.44	0.58	12
Site 3 (S3)	7.4	0.49	0.56	11
Site 4 (S4)	7.3	0.51	0.34	15
Site 5 (S5)	6.9	0.65	0.43	12
Site 6 (S6)	7.1	0.70	0.18	16
Site 7 (S7)	6.8	0.81	0.13	17
Site 8 (S8)	6.9	1.16	0.23	14
Site 9 (S9)	7.6	1.23	0.17	19

pH. It decides the amount of hydrogen present in the soil and ranges from zero to fourteen (0-14). The low pH value of the samples indicates sour soil and high pH value shows salty soil. The pH value of collected soil samples from nine locations were ranged from 6.8 to 7.6 as shown in table 4. The soil pH should be within the limits of 6 to 8.5. The leachate is acidic in nature and will reduce the soil pH [Pooja et al.]. Results of the study showed that, the soil pH of all samples is less than 8.5 and are within the limits.

Electrical Conductivity (EC). The amount of soluble salts in the soil sample is expressed in terms of EC and it is measured by a conductivity meter. The high salt content in the soil samples leads to plasmolysis and exosmosises and leads to inhibition of water, that condition of soil is unfavourable for crop growth [Pooja et al.]. The limitation of EC is 2 dS/m. Result of the study showed that, the EC of all the collected soil samples ranges from 0.19 to 1.23 dS/m as shown in table 4.

Organic Matter (OM). Organic matter (OM) of the soil includes animal and plant waste with the rate of decomposition [Pooja et al.]. Its limitation is less than 0.5%. Result of the study showed that, OM that ranges from 0.13 to 0.58 % for all the soil samples as well as microbial activity is also less due to less holding capacity of water.

Moisture Content (MC). The MC of soil is the percentage (%) of water content available in the soil. The MC is the ratio of mass of free water in the collected soil samples to the mass of dry soil sample [Pooja et al.]. The MC of soil should be less than 20%. Results of the study showed that, MC varies from 10 % to 19 % of the samples collected from all the nine locations around the dumping yard (Table 4) and are within the limits. If the MC is greater than 20%, increase in the leachate formation and the gas production takes place which further contaminates the ground water.

Conclusion

As India is developing country and Indian economy depends on agricultural yield, if suitable quality of ground water is not available in the ground, it will directly impact on agricultural growth. The quality of ground water is decresing due to leachate formation around the dumping yards. The study has shown that the soil contamination is more near the dumping yard and decreases with increase in distance. This conclude that agricultural production around the study area is unfavourable due to the presence of dumping yard. Hence selection of dumping yard is of major importance for agricultural productivity.

References

1. Bhagwat, T. N. Soil Suitability for Solid Waste Dumping: Implication for Groundwater Protection. Earth Sciences: An International Journal (ESIJ) (Vol. 1).(2018)
2. Chavan, B. L., & Zambare, N. S. -Ground Water Quality Assessment Near Municipal Solid Waste Dumping Site, Solapur, Maharashtra, India, 2, 73–78. (2014).
3. Eshanthini P, & Padminitk. Impact of Leachate on Ground Water Quality near Kodungaiyur Dumping Site, Chennai, Tamil Nadu, India.(2016)
4. Islam, M. S., Tusher, T. R., Mustafa, M., & Mahmud, S. Effects of Solid Waste and Industrial Effluents on Water Quality of Turag River at Konabari Industrial Area, Gazipur, Bangladesh. J. Environ. Sci. & Natural Resources, 5(2), 213–218. (2012).
5. Prasanna, K., & Annadurai, R. Study on Ground Water Quality in and Around Perungudi Solid Waste Dumping Site in Chennai, 9(2).(2016)
6. Raman, N., & Narayanan, D. S. Impact of Solid Waste Effect on Ground Water and Soil Quality Nearer To Pallavaram Solid Waste Landfill Site in Chennai. RIC Rasayan Journal Chemical (Vol. 1). (2008).
7. Shenbagarani, S. Analysis of Groundwater Quality near The Solid Waste Dumping Site. IOSR Journal of Environmental Science (Vol. 4). (2012).
8. Tejankar, A., & Pathrikar, R. K. Analysis & Recycling Of Municipal Solid Waste: A Case Study of Aurangabad City, Maharashtra, India. International Journal of Scientific Research in Engineering (Vol. 2). (2017).