Characteristics Study on Leachate Samples of Laloor, Thrissur

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Abstract. Leachate generation is a biggest problem faced by municipal solid waste (MSW) landfills which causes significant hazard to surface water and groundwater. Leachate contains high concentration of pollution which can cause serious problems to the society. In this study, examining the characteristics of leachate generated from a landfill site situated in Laloor, In Thrissur, Standard methods were used to monitored, analyzed and examined the water and waste water. According to the standard methods for the Parameters were monitored included dissolved oxygen (DO), chemical oxygen demand (COD), biological oxygen demand (BOD), chlorides content, alkalinity, mpn, hardness and pH. After this study results are mapped by QGIS to confirm and show the impact of the leachate issue in laloor.

Key words: Leachate, solid waste, laloor, dump waste

1. Introduction
Leachate is the liquid that drains or ‘leaches’ from a disposal area. When water seeps through a litter, it results in the decomposition process of microorganisms. This activity releases decomposition by-products and quickly makes use of accessible oxygen, creating an oxygen deprived condition.

Its properties are based on factors like the decomposition degree, composition of the litter and its age, decomposition phase, the litter moisture content, water movement's rate, procedure of waste filling and temperature. Leachate can be categorized as a waste water type because of the inconsistency in its composition and this results not only in many parameters which are specific to the site like the area's geology, climate, geography, design of landfill but also from measures taken to control the same. Impacts on health and the environment of the generated wastewaters are also based on its composition. The natural diminishing levels of leachate pollutants in aquifers plays a key role in factors like understanding the dangers of leachates seeping into the groundwater, for the explanations of samples from observing wells and also for taking the necessary steps to mitigate the problem. The degradation's first step is characterized by the organic matter's degeneration. The anaerobic degeneration phase consists of two main processes of fermentation, the acid gene phase and methanogen phase which consists of biodegradable leachates and stabilized leachates respectively.
In this study, solid waste from different places in the Thrissur Corporation was collected and deposited in Laloor. This mixed waste consists of plastic, metals, glass, rubber, domestic hazardous waste, Food and vegetable waste, etc. During rainy season, the water along with waste get logged in the living area that creates a nuisance to the people. Due to these reasons mentioned above, it makes necessary for awareness to people about water quality. So, we found out the characteristic of waste water using GIS.

**Figure 1.** Leachate

### 1.1 QGIS

QGIS (formerly Quantum GIS) is a cross-platform, free and open-source desktop geographic information system (GIS) programme for viewing, manipulating, and analysing geographical data. QGIS interfaces with a variety of different open-source geographic information systems, including Post GIS, GRASS GIS, and Map Server. A GIS is any system that can store, modify, and display digital map data. A GIS system primarily makes use of two kinds of data. There are two types: vector and raster. Vector data is the most often used kind of map data, consisting of points, lines, and polygons that are used to represent physical features or places. The less often used format is raster data, which includes satellite images and aerial photography. Often, the aim of a map is to visualise a response to a query. Maps make it easier to detect patterns and clusters than spreadsheets or databases do.

### 2. Study Area

Laloor is a place in Thrissur city, Kerala. It is located in between the Ayyanthole, Olari, and Aranattukkara; it comes under the Thrissur Municipal Corporation limit. Thrissur is built around a hillock and situated in 10° 10' and 10° 46' North latitude and 75° 55' and 77° 05' East longitude. The city is located on the National Highway 47 and is well connected to nearby cities and towns like Kochi (75 km), Kozhikode (144 km) and Palakkad. Thrissur Municipality was upgraded to a Corporation in October 2000 by joining the Panchayats of Ayyanthole, Ollukkara, Koorkkencherry, Ollur, and Vilvattom. In addition, parts of Nadathara were also merged with the Municipal Corporation and thereby increasing the total area of the Municipal Corporation from 12.65 sq. km to 101.42 sq. km. The population of the Thrissur Municipal Town steadily rose from 69,515 in 1951 to 317,526 in 2001.

#### 2.1 Land Use Pattern:

The current land use pattern as shown in Table.1, indicates that 68.60 percent of the city land is under residential use and includes houses in individual plots distributed all over the city. The Commercial area is less in comparison with residential area and consists of small establishments. Increased developments are seen in the MG road area. Industrial sector comprises mainly of service industries and small-scale industries; medium scale industries are concentrated in the city. Overall industries occupy 5.73 percent of the advanced area of the
city. Of the total area available, 10.24 percent is occupied for public and semipublic use. 62 Percent of the total 113,967 of properties assessed in the city is residential. The dominance of land used for residential purposes is expected to continue almost at the same pattern in the Future also.

![Figure 2. The burial ground and surrounding 1 km](image1)

![Figure 3. collection of news about Laloor](image2)

The plot number 362 is an exact portion of Burial ground. At first, the land area was about 44 acres. After the public encroachment, the land reduced to about 24 acres. The tremendous increase in the population also increased the generation of waste enormously. A trenching ground and the treatment plant consist about 11 acres of land and the remaining land is scattered in small areas. The north of the burial ground is sasthri line. As well as south of the burial ground is Mathayipuram colony. The west is assissibucker colony. As well as east is pulikal way.

![Figure 4. location of Laloor](image3)

![Figure 5. Present situation in Laloor](image4)

After this strike the waste dumping was completely stopped in Laloor. The vehicle from outside not enter the dumping yard. The few people around the dumping yard deposited their waste in this dumping yard. Most of the waste removed by landfill method. However enough amount waste lying on ground. Now, the main problem is leachate.

### 3. Sampling and Materials

Water samples were collected from twelve well during the season of 2018 from 1 km surroundings on the landfill site. The containers were washed and collect samples in it. Physiochemical parameters such as pH were measured in site, while samples for either parameter analysis, they were transported into the laboratory. The sampling and analysis of various physico -chemical attributes were performed. The results obtained were then
compared to the permissible limit of irrigation and drinking water quality standard (FAO, IS-10500, BIS). In this study, the water quality index was calculated by considering eight important parameters (pH, DO, BOD, TH, MPN, COD, alkalinity and Chloride).

| Table 1. Standard of leachate |
|-----------------------------|
| Physico-Chemical Parameters | Standard Value |
| Dissolved oxygen            | 5             |
| pH                          | 6.5-8.5       |
| Total hardness              | 300           |
| Ca                          | 75            |
| Mg                          | 50            |
| Cl                          | 250           |
| Biological oxygen demand    | 100           |
| Chemical oxygen demand      | 10            |

In this study, 15 samples were collected, then immediately transferred to the laboratory and stored in the cold temperature (40°C). Various physico-chemical parameters analyzed in the contaminated water samples includes, pH, dissolved oxygen, chemical oxygen demand (COD), total alkalinity (TA), biological oxygen demand (BOD), total hardness (TH), chloride, collected regions are Assissibucker colony, west of burial ground sasthirianarea, north of burial ground, pulikkal way east of burial ground, mathayapuram colony south of burial ground.

| Table 2. Sample collection details |
|-----------------------------------|
| Sample 1 V.J. Chacko from sasthri line |
| Sample 2 John from sasthri line    |
| Sample 3 Sheena from Assisi bucker |
| Sample 4 Ajitha from Assisi bucker |
| Sample 5 Vivitha from sasthri line |
| Sample 6 Omana from Pulikkal way    |
| Sample 7 Thomas from Mathayapuram colony |
| Sample 8 Alwin from Mathayapuram colony |
| Sample 9 Lalitha from Assisi bucker |
| Sample 10 Aramukhan from Assisi bucker |
| Sample 11 Jancy from Pulikkal way   |
| Sample 12 Leela from Assisi bucker |
| Sample 13 Mary from Mathayapuram colony |
| Sample 14 Alphonsa from Mathayapuram colony |
| Sample 15 Elsa from Pulikkal way    |

4. Result and Discussion

Parameters were done in laboratory, including chemical oxygen demand (COD), dissolved oxygen (DO), biological oxygen demand (BOD), presence of chlorides, alkalinity, MPN, hardness and pH shown in Table 3.

| Table 3. Parameter’s value obtained by laboratory tests |
|-------------|
| SAMPLES   | PH | HARDNESS | COD | BOD | ALKALINITY | CHLORIDE | DISOLVED OXYGEN |
| S1         | 9  | 90       | 87  | 32  | 110        | 8.9      | 7.20           |
| S2         | 6.7| 161      | 79  | 70  | 214        | 5        | 9.8            |
| S3         | 9.3| 105      | 119 | 71  | 46         | 55       | 6.8            |
| S4         | 6.8| 123      | 161 | 81  | 52         | 50       | 8              |
| S5         | 10 | 310      | 214 | 158 | 218        | 7        | 3              |
| S6         | 10 | 314      | 160 | 57.5| 26         | 35.9     | 12             |
| S7         | 9  | 290      | 300 | 58  | 70         | 17       | 5.6            |
| S8         | 9.1| 274      | 302 | 42.5| 66         | 36       | 6.3            |
| S9         | 9  | 362      | 70  | 43  | 58         | 42       | 4.2            |
| S10        | 8  | 314      | 26  | 200 | 66         | 38       | 7.3            |
PH value for drinking water ranges from 6.5 – 8.5. From graphical analysis, we found that sample 4, sample 2, sample 10, sample 14 and sample 15 are within this range. Other samples needed treatment methods for purification.

When the hardness is in the range of 0-75 then the degree of hardness is soft, if it is in the range of 75-120 then the degree of hardness is moderate, when it is in the range 120-300 then the degree is hard and when the hardness is greater than 300 the degree is very hard. From the graphical analysis, we found that sample 1, 3 are moderate, Sample 2, 4, 8 are hard and other samples are in the degree of very hard. Therefore, sample 1 and 3 used for drinking purpose after boiling because of its temporary hardness. Sample 2, 4, 8 are not useful for domestic purpose because it produces scale in water pipes.

According to WHO recommended Chemical Oxygen Demand is 10 ppm in drinking water. All samples are exceeding the limit.

Biological oxygen demand and chemical oxygen demand tests are helpful in finding the presence of biologically resistant of organic substances and also toxic level. The BOD level 1 – 2 ppm is said to be in a good range. A water having 3 – 5 ppm is considered moderately clean. Water to a BOD level of 6 – 9 ppm the water is considered somewhat contaminated. This is due to the presence of organic matter and bacterial decomposition of the waste. If the BOD level is 100 ppm or greater the water supply is considered very much contaminated with organic waste. Sample 5, 10 ,12, 11 are with a range of greater than 100 ppm, so these samples are very polluted with organic wastes.

According to Indian Standard Institution the recommended permissible value for alkalinity is 200 mg/l in drinking water. From the graphical analysis, we found that sample 2, 5 is not suitable for drinking purpose because its value 214 ,218 is greater than the limit.

The permissible limiting range for chlorides in drinking water is less than 250 mg/l. From graphical analysis, we found that all samples come within this range.

For drinking water, the allowed limit of dissolved oxygen is at least 5 mg/l. From graphical analysis, we found that sample 5 and 9 are not in the range

Membrane filters are porous, with pores of around 0.45m in diameter, which is large enough to hold microorganisms. A sample is initially fed over the membrane using a filter funnel and vacuum apparatus in this method. On the membrane surface, microorganisms present in the sample are maintained. The membrane is then moved to a specific plate that has a saturated pad with the appropriate media. During incubation, nutrients flow through the filter, facilitating organism development. Colonies of microorganisms develop on the membrane surface. After forming discrete colonies, they may be moved to a confirmation medium. The results are then calculated by using the conventional MPN standard methods. Within 24 hours the presence and absence of microorganism can be confirmed.
Figure 6. PH value of samples

Figure 7. Hardness of samples

Figure 8. COD of samples

Figure 9. BOD of samples

Figure 10. Alkalinity of samples

Figure 11. Chloride of samples
4.1 Geo-Referencing:

A geographic information system (GIS) is a framework for managing, gathering and data analysis. It analyzes spatial location and organizes layers of information into visualizations using maps and 3d scenes. Here the software used is Q-GIS 3.6 which performs advanced operations in Q-GIS. Firstly, the area including Azizibucker colony, Mathayipuram colony, Pulikkal way and Sasthri lane in Laloor derived from map and georeferenced then converted in to raster data as shown in figure.13

**Figure 12.** dissolved oxygen of samples

**Figure 13.** Geo referenced area
Figure 14. Graphical pictures of all the parameters

5. Conclusion

Leachate generation was the biggest problem in laloor, which is located in Kerala faced by municipal solid waste (MSW) landfills. Leachate contains a high contamination of pollutants which can cause serious problems to environment. This paper explains the impact of leachate peculation at the contaminated site at laloor. And on-groundwater quality was estimated from a contaminated site, water quality index mapped by using GIS. Parameters were checked by various tests which is confirms the impact of the leachate problem in the particular area. Membrane filters are recommended to analyze the waste water. As well as We can create the awareness program for the public about the Leachate problem, also can Educate the children concerning the waste management and the health hazards in schools. Thus, increasing the awareness of the matter in public.

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