Fate of landfills on Kureepuza

Amrutha Subhash and Sruthi M

Abstract— Leachate generation is a major problem for municipal solid waste (MSW) landfills and causes significant threat to surface water and groundwater. Leachate can be defined as a liquid that passes through landfill and has extracted dissolved and suspended matter from it. Leachate results from precipitation entering the landfill from moisture that exists in the waste when it is composed. The present study associated with the fate of sanitary landfills in on water and its surrounding environment. Present study conducted at Kureepuza in Kollam district. It is a peninsula region in the city of Kollam, located on the shore of Ashtamudi Lake. Kerala's only turkey farm and a regional poultry farm are at Kureepuza. Kollam city's waste management plant also situated at Kureepuza. Today Kureepuza facing a major problem by the disposal of waste. Here a significant portion of waste from different sources is dumped on the streets or open collection points cause severe pollution in the city. Since there is no waste treatment system in the city, the entire solid waste collected is dumped at the site. In fact waste collected in past several years lay accumulated at the site. It hazard to various aquatic life in Ashtamudi Lake near the dumping site. The aim of this project is to study the effect of dumping site in Kureepuza and its surrounding area and establish some remedies for protecting the Environment.

Index Terms— Leachate, Landfills, Municipal Solid waste, Chemical Parameters, Surface water, Groundwater, Physical parameters.

1. INTRODUCTION

Kollam is a coastal district of Kerala, situated about 65km North West from the capital city of Thiruvananthapuram. The city is famous for its backwater, Ashtamudi estuary and has been an ancient spices trade centre. Kollam Municipal Corporation was constituted in October, 2001 by merging Kollam Municipality and four nearby Panchayats. Area of the corporation is 57.28km^2 with a population of 349033(as per census 2011). The residents and non-domestic waste generators deposit the waste either in designated collection points or open spaces convenient to them. The solid waste generated in the municipal corporation is dumped at Kureepuzha which is along the bank of Ashtamudi estuary. The ground level, of the site is slightly elevated (5m ASL) and undulating.

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The soil is deep laterite clay saprolitic subsoil at a depth of 2-3 m. The water is about 105m below the subsoil. There are number of wells on the sides of the site and these are being used by the neighbouring residential population. The existing 1o9ha site has been used for disposal of unsegregated solid wastes. Much of the site is covered with garbage to a height of 3-4 m and currently uncovered. During monsoon season the leachate directly percolates through the soil to the nearby lake and ground water.

1.1 Site Description

It may be stated here that the plant is situated now in Sakthikulangara village in a place known as "KUREEPUZHACHERIYIL", which is very close to "VATTAVANAKKAVU SRI DURGA TEMPLE" in the East and "THEVARU KAVU TEMPLE" on the South. Both temples were under the control of Travancore Devasom Board. Besides with in around 300 meter of the site of the plant and Dumping Yard, there is a Govt. Higher Secondary School in which more than 3000 pupils are studying (Govt HSS, Vallikeezhu, and Kollam). The Puthiyakavu Central School is

also situated with 50m of the plant. Thus one meter of the Plant is situating "ANGANAWADI, HEALTH CENTRE etc."Very close to the Plant there are about 500 residences, some of which are very close and in proximity to the Plant. Altogether there are about 10 Temples in the area frequenting by the people of the locality. There is Private Coir manufacturing unit were large number of workmen are engaged, close to the existing garbage treatment plant. Thus the Plant is established in an area where the density of population is high and large number of residences is also situated. When the Plant started functioning in December, 2010, it was found that the life for the residents of the area have become miserable as heaps of waste and garbage are always kept open in the premises and around 60 tonnes of garbage is treated every day, the practice appears to be that the garbage brought through vehicle are heaped in the premises of the plant, thereafter treated with some chemicals and kept there for about one month without putting it in the Plant. The idea appears to treat 60 tonnes of garbage every day, but since that is not commenced that garbage is heaped in the premises causing danger to environment and bad odour and all round pollution to the whole area. Flies collect in large numbers to which a very powerful chemical is used which is extremely harmful to the people particularly to the old age and children. Announcement is made by those in charge of running the plant that the children shall not be allowed to come out from houses and be indoors during the material time. Close to the Plant is situated the beautiful Ashtamudi lake, the famous "ARATTUKULAM "of Sakthi Kulangara Temple etc. The Temple Tank and Ashtamudi Lake is now wholly polluted through the flow of Impure and foul smell water from the Plant as well as the Solid Waste Dumping area, make the water un-useful for the people of the locality. The Dumped garbage and waste is pulled in to Ashtamudi Lake and now the lake will be highly polluted. The waste water is polluting the wells in the area as there is no effective scheme for water treatment. The remnants from the waste heaped in the premises including parts of dead animals and birds are spread in to the wells by birds, Crows etc frequenting the area. In addition to this there is also a danger of getting fire to the garbage & solid waste on 23.02.2005 (two days continued) and from 10.01.2009 onwards the fire was happened seven days and this year on 24.01.2011 also getting fire to the garbage. During this period the people living around 3 to 4 km areas were badly affected the smoke, foul smell etc. Due to this several peoples have been admitted to hospital also.

Fig.1. ***Kureepuza dumping site near Ashtamudi Lake***

2. LITERATURE REVIEW

Leachate is the contaminate water in landfills, which arrived at the landfill site by external precipitation and extracts dissolved or suspended materials from it [2]. Fresh water is a renewable source, yet the world's supply of clean, freshwater is steadily decreasing. Presently, only 10% of the waste water generated is treated, the rest is discharged as it is into our water bodies. Due to this, pollutants enter ground water, river and other water bodies. A study on the bacterial quality of water in selected wells in Kerala jointly conducted by Kerala Water Authority and Kerala Pollution Control Board (KWA 1991) showed that water in none of

the open wells investigated was safe for drinking. Komath et al. (2000) observed the impact of solid waste disposal on ground water quality in Kozhikode, Kerala. Results of the study confirmed that open dumping of solid wastes led to contamination of ground water sources within the vicinity of the dumping site. Sunil Kumar (2008) conducted studies on ground water pollution from dumping of municipal solid waste at Muzaffarpur, Bihar. He observed that the pollution of leachate percolation polluted the ground water to a great extent.

3. OBJECTIVES

The objectives of this study were

1. Site investigation
2. Find out the effect of landfills in Kureepuza
3. Conduct a survey with surrounding peoples
4. Collection and evaluation of leachate from landfills
5. Analyze water samples from different sources
6. Provide some methods for controlling and preventing environmental pollution

4. MATERIALS AND METHODS

Experimental Techniques - Water samples were collected at two points from the lake, one very near the dumping site and the other about 5 km away. Also, well water samples were collected from the nearby wells and surface water were collected from nearer temple.

Water sample	Direction	Distance from dumpsite
Ashtamudi	North	0m
Ashtamudi	North	5m
Groundwater	West	10m
Groundwater	East	10m
Surface water	South	15m

Table: 1. ***Details of Water Sampling Locations***

The objective was to study the physicochemical parameters like pH, Total Solids, Alkalinity, Hardness, Dissolved Oxygen, Biological Oxygen Demand (BOD), Chlorides etc.

Analysis of various chemical parameters were carried out according to the procedures and techniques outlined in standard methods for the examination of water and waste water (1995).

Samples were collected in clean five litre polythene bottles, experiments were done and results compared with standard values. Conduct a survey with surrounding peoples- about health problems- water treatment facility- availability of pure water etc.,

5. RESULTS AND DISCUSSION

5.1 Water quality analysis

pH is considered as an important ecological factor and provides important information of the hydrogen ion concentration. Generally pH of water is influenced by geology of catchment area and buffering capacity of water. The limit of pH value for drinking water is specified as 6.5-8.5. According to the present study, the ground water sample varies from 4 to 5 it shows the sample is more acidic, sample from the surface water varies from 6.65 to 8.45 it shows the water is light alkaline. Also it is favourable condition of certain type of bacteria especially mesophiles. It leads to the generation of greenhouse gases such as CO_2 and CH_4 (methonogenisis).

Alkalinity is a measure of buffering capacity of water and is important for aquatic life in marine water systems because it equilibrates the pH range that occurs naturally as a result of photosynthetic activity of aquatic plants. The desirable standard limit of alkalinity of water is 120mg/L and the values of alkalinity of the samples are within the limits.

Total hardness is the sum of temporary hardness and permanent hardness. The samples collected from the Ashtamudi show very high hardness. According to Indian standards the total hardness of domestic water can be 300 mg/L of $CaCO_3$. Dissolved oxygen is an important parameter which affects the chemical and biological aspects of the ecosystem. At levels of 4ppm or less, some fish or micro invertebrate populations will begin

to decline. At 20°C and standard pressure (sea level) the maximum amount of oxygen that can be dissolved in fresh water is 9ppm. Water sample from groundwater has low DO.

Total solids are the sum of total suspended solids and total dissolved solids. Total dissolved solids in samples collected from the estuary showed very high values when compared with the acceptable limit of 500 mg/L as per Indian Standards. Well water samples and surface water samples showed values above the tolerable limit.

parameters	Ashtamudi lake (AM)	AM lake	Ground water (GW) west	GW east	SW south
Turbidity (NTU)	5	3	1	1	2
Electrical conductivity	155µs/cm	120µs/cm	26.9µs/cm	27µs/cm	119 µ/cm
pH	6.65	7.18	4.64	5	8.45
BOD (mg/l)	60	108	66	62	40
Total hardness (mg/l)	5300	4570	20	23	32
Calcium hardness (mg/l)	730	770	7	17	29
Calcium (mg/l)	292.58	308.62	20.06	6.814	11.6
Magnesium (mg/l)	111.05	9.23	0.32	0.15	0.07
Alkalinity (mg/l)	41	66	11	9	53
Chloride (mg/l)	16000	25400	44	47	62
Total solids (mg/l)	35000	34000	2000	1000	2000
DO (mg/l)	4.2	5	3.6	4	11.2

Table: 2 ***Water quality of the present study***

A sample with a 5 day BOD between 1 and 2 mg O/L indicates very clean water-3.0 to 5.0 mg O/L indicates moderately clean water and > 5 mg O/L indicates nearby pollution source The BOD values for Ashtamudi are slightly greater than the values for samples from well water samples (collected from Kureepuzha).

When compared with well water samples parameters such as Calcium and Magnesium hardness, chloride, electrical conductivity and turbidity of Ashtamudi Lake is more.

5.2 Survey Result

Analyzing the survey results, people around 20 m from project area use public water supply for their daily use drinking water. Source of the public water supply is mainly from Sasthamkotta Lake. They also effected by some health issues by dumping site. They include lungs infection, higher rate of blood pressure, serious skin decease, diarrhea, jaundice etc. Dumped garbage and waste is pulled in to Ashtamudi Lake and now the lake will be highly polluted. The waste water is polluting the wells in the area as there is no effective scheme for water treatment. The remnants from the waste heaped in the premises including parts of dead animals and birds are spread in to the wells by birds, Crows etc frequenting the area. In addition to water pollution there is also a danger of getting fire to the garbage & solid waste on 23.02.2005 (two days continued) and from 10.01.2009 onwards the fire was happened seven days and this year on 24.01.2011 also getting fire to the garbage. During this period the people living around 3 to 4 km areas were badly affected the smoke, foul smell etc. Due to this several peoples have been admitted to hospital also.

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SL.No:	House	No: of Members	Distance from project area(m)	Source of Drinking water			Any health effect due to the proposed area	
				Well water	Public water supply	Other sources (pond, lake etc..)	Yes	No
1	A	4	2		✓		✓	
2	B	4	5		✓		✓	
3	C	6	7		✓		✓	
4	D	3	10		✓		✓	
5	E	4	15		✓		✓	
6	F	5	18		✓		✓	
7	G	4	20	✓	✓		✓	
8	H	3	23	✓				✓
9	I	5	25	✓				✓
10	J	4	28	✓				✓

Table: 3 ***Survey Results***

6. REMODIES

1. Construct proper operated and designed landfill: There are three critical elements in a secure landfill: a bottom liner, a leachate collection system, and a cover. Bottom layer may be one or more layers of clay or a synthetic flexible membrane (or a combination of these). The liner effectively creates a bathtub in the ground. If the bottom liner fails, wastes will migrate directly into the environment. There are three types of liners: clay, plastic, and composite. Normally clay is used as bottom layer. But natural clay is often fractured and cracked. A mechanism called diffusion will move organic chemicals like benzene through a three-foot thick

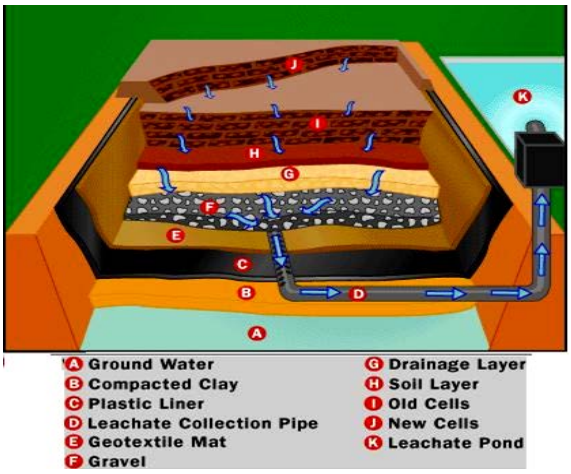

Fig.2. ***Sanitary Landfill***

clay landfill liner in approximately five years. Best landfill liners today are made of a tough plastic film called high-density polyethylene (HDPE)

2. Municipal waste reduction: Use of cleaner technology. It means that industries should use processes that make the least possible waste. This is called using Cleaner Technology. It is always best to avoid creating waste in the first place.

3. Reuse, Recovery and Recycling

7. CONCLUSION

The water quality data of the present investigation showed a negative trend in water quality parameters. The Dissolved Oxygen (DO), which represents the health of the water system, was less than 4.0 mg/l. Other parameters are high for water body. It is highly recommended to implement the actions suggested by Ashtamudi Management Plan to restore the water quality of Ashtamudi Lake [11] as well as groundwater**.** Regular awareness camp, training program for the general public to monitor the progress of the Lake restoration plan and waste generation of city

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Some chemicals can degrade clay. So the very

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