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Leachate Categorization and Surface Groundwater Contamination at Municipal Solid Waste Landfill of Ahmedabad, Gujarat, India

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Abstract: ***As a developing country the protection of groundwater resources is extremely important in India. Landfills are a major source of water pollution. The filling for the disposal site in Ahmedabad, occurs at a distance of about 50 meters from Ahmedabad plant water intake. In addition, there are several holes are near the tip, which is used for drinking and domestic use. A survey of the composition of landfill leachate and groundwater contamination Ahmedabad performed Landfill, located on gyaspur village. Leachate championship to nine points of the landfill. Groundwater samples were collected using snekkeeffekt five positions. Also, to find out the seasonal variation of water quality in water wells nearby, got four water samples in both wet and dry seasons. Leachate and groundwater were physically and chemically characterized. The measured parameters were pH, sulphate, nitrate, nitrites, heavy metals (Pb, Zn, Ni, Cr, Co, Fe, Mn, and Cu). The results showed that the landfill leachate was probably the methanogenic phase on the basis of the alkaline pH is recorded. These results also show that the significant number of well was contaminated with respect to the concentration of the chemical-physical parameters of the World Health Organization standards for drinking water. Therefore, this landfill is a threat to the environment, and the government should make the landfill to prevent further contamination of groundwater and soil.***

Keywords: Leachate, Ground water, contamination, Categorization, Municipal solid waste

1. Introduction

India as a developing country with limited land and rapid growth rate of the population, possible pollution problems underground by the disposal of liquid and solid waste should be a high priority. And 'it produced from landfill Leachate containing a large amount of toxic substances that can contaminate groundwater. It may cause harmful effects on public health if the concentrations in water rose above the WHO standard. Leachate streaming along the river through the rice fields located bellows the disposal site. There is a bad smell around the place of waste products. Solid waste is made up of very heterogeneous mass of waste from urban areas and the more homogeneous accumulation of agricultural, industrial and mining waste. Several disposal methods are available, and many who are prominent open dumping, composting, incineration and sanitary landfills etc. But the lack of land for landfill sites and technologies to other treatment options are often dumps resorted to in India. However, it creates many environmental problems as well as heath.

The primary mechanism by the primary mechanism through which the groundwater pollution of the landfill, through the generation of leachate and its infiltration of the bellows of the water table. When landfill leachate mixes with groundwater, it forms a plume that spreads in the direction of the water flowing. There are different types of emissions from landfill gas emissions of volatile organic compounds, airborne particles and landfill leachate. Among these, landfill leachate is a major environmental problem in case of open waste dumps as landfill leachate is heavily contaminated with different types of pollutants. The composition of landfill leachate varies from time to time and one place to another because of differences in the composition of the waste, rain, moisture, climate, change, rather than hydrology, waste compaction, leachate interaction with the environment, etc.

Leachate containing large amounts of organic matter (biodegradable and non-biodegradable), inorganic contaminants, heavy metals, etc. The sources of pollution are industrial products such as pesticides, paints, batteries, metals dumped. Contaminants in municipal landfill leachate can be classified into four categories dissolved organic matter, inorganic compounds, heavy metals xenobiotic organic substances.

The primary mechanism of the lakes and rivers of the world is heavily polluted today, and there is limited land available for solid waste dumping raw. The increased production and accumulation of waste has serious environmental, economic and social in both the developed and developing. But there is less likelihood of groundwater pollution from solid waste is dumped in open areas. The solid waste from households, institutions, industries, etc. as important elements, trace elements, heavy metals and other chemicals it may be concentrated in these sites. Because of leaching of these substances, groundwater can be polluted up to grade non-acceptable. Landfills are sources of pollution of groundwater and soil pollution due to leachate and its trek through the waste. Leachate consists of high concentrations of natural chemicals that can contaminate groundwater and soil. Water is one of the essential materials necessary to sustain life and have long been suspected to be the sources of many of the diseases of the human being. It 'was just a little' more than a hundred years ago that evidence of disease transmission through water was established.

In the present study the effect of leachate seepage on groundwater quality was estimated by an unlined landfill in Ahmedabad, India. The various physical and chemical parameters including heavy metals and nutrients were analyzed in samples of leachate and groundwater for understanding the potential for groundwater pollution. It was also examined the effect of the landfill away from underground springs.

2. Materials and Methods

Water Quality Analysis

Can be caused by a landfill into groundwater ground water system samples from holes 5 to study the potential impact of leachate seepage to the groundwater in the area was water samples collected by Augur 5 points. Also known as detecting according to the quality of the water in the wells of the water, the water in the meantime, an example of both wet and dry.

Spectrophotometer was used to measure the concentration of the method of the nitrate, nitrite, sulphate, phosphate samples of the application of the appropriate wavelength. Heavy metals Cd, Zn, As, Cr, Fe , Mn, Co, Ni , Cu, Pb of the samples was measured using atomic absorption spectrophotometer (AAS) . Use flame AAS atomic absorption spectrometry method of calculation.

Table 1: Description of the sampling site

Sample no	*Location*	*Depth to water table (m bgl)*
A1	Close to the Landfill (25m), Downstream,450m elevation	40
A2	55m from the landfill, Downstream, 447m elevation	58
A3	100m from the landfill 442.5m elevation, downstream	48
A4	150m from the landfill,440m elevation, Downstream	46
A5	Close to the river, Down stream,270m from the landfill	52

Leachate Analysis

Leachate sample was collected from multiple locations (L1 - L9). All the suspended material was filtered using 0.1µm filter. Heavy metals, the physical parameters, and are examples of nutrients in the leachate is dissolved in it talked about earlier.

3. Results and Discussion

Characteristic of Leachate

Leachate pH depends not only those present, but also with regard to which a partial pressure of CO2 that the intention of in a landfill leachate in contact with acids. This is the age of the landfill, leachate rain, and the composition of the most important factors is the type of waste issues. The average pH of the leachate in the sample is about 7.9; it can be concluded that the leachate is alkaline.

An indicator of dissolved inorganic species and the abundance of electrical conductivity is applied to the total ion concentration. Leachate from a range of electric conductivity shows values. When the high value obtained L9 22.mS/cm minimum value is obtained when the value of L1 8.9mS / cm. EC, however value for leachate that is not within the standard range of 0.7 to 4 Scm-1 treated wastewater discharges required by local standards. While the average value of conductivity (13.36 mS / cm) leachate effluent samples was to conclude that there was a high amount of mineral salt.

Table 2: Insitu and Nutrients parameters of the leachate

Sample no	pH	Conductivity mS/cm)	NO_3^- In ppm	PO_4^{-3} In ppm	SO_4^{-2} In ppm
L1	7.83	8.9	6.3	26.3	2
L2	8.12	19	9.9	26.7	21
L3	7.9	10.9	26.9	19.6	17
L4	8.13	15.9	8.3	25.5	1
L5	8.2	13.8	10.6	31.8	3
L6	7.97	16.8	33.2	20.1	1
L7	7.84	9.8	6.9	18.1	2
L8	7.44	2.95	1.2	2.39	12
L9	8.41	22.2	2.1	244.0	180

Leachate concentration of sulphate in various shows. The highest value obtained L9 treatment plants with the value of 180 mg/l. The treatment plant receives large amounts of human excrement and other biological waste that may be the reason for the high value of the sulphate concentration. In other leachate samples sulphate concentration varied in the range of between 1-17 mg / l. Leachate Nitrate concentration in the range from 1.2 to 33.2 mg / l. (Table 2). The average value of nitrate in the leachate was 14.5 mg / l. Nitrate leachate due primarily by biological sources, human and animal excrement aspect of something big percentage of the total nitrogen load. The nitrogen concentration of the compound indicates that the presence of extensive anaerobic bacterial activities. Oxidised nitrate to nitrite is reduced to nitrite, which can be quickly and otherwise enjoy the food, sow, nor gather in NH3. So leachate concentrations higher than nitrate nitrite. Leachate shows varying concentrations of phosphate. When they get to a high value L5 31.8 mg / l, where one is the least expensive is phosphate with L8 21.2mg / l.

The concentrations of heavy metals in the leachate samples collected from the landfill have mercy Ahmedabad Table 3. The distribution of Fe Leachate for different shows. High Fe content of 9.2mg / l leachate sample is measured by L4; where as the lower content of 1.18 mg / l measured by the L5. An L4 leachate sample indicates the highest level of Fe and Fe also scrap dumped in a landfill. Dark brown colour oxidation of ferrous to ferric leachate and the formation of ferric hydroxide complexes with Colloids and fulvic / humic substances.

Wastewater shows the distribution of Mn of between 0.27 to 2.91 mg / l and an average value of about 0.35 mg / l. nine leachate concentration of Zn in the site are varied between 0.10 to 9.9 mg / l. The presence of Zn in the leachate shows that the landfill receives waste from batteries and fluorescent lamps. The lowest concentration of a heavy metal to heavy metal Pb commemorated with a price range between 0.001-0.031mg / l. The presence of Pb concentrations in the

leachate test does not indicate the disposition of Pb batteries, chemicals for processing photograph, Pb-based paints and pipes landfill. The distribution of Cu in leachates showed different value. With the highest concentration of 13 mg / l measure sample L4 in which lower content of 0.08 mg / l measure L1. The high concentration of Zn, Cu, Fe and Mn reported in L4. On the other hand, most of these results are not the subject is within the standard of the wastewater can be cleaned for the issue of seeds, which are acceptable levels determined by international standards. Cr (0-0.31mg / L) Ni (0.07 to 0.76) Co (0.01-0.23mg / L), and in the leachate examples. A number of wastes dumped at the site Ahmedabad is likely to indicate the origin of Zn, Cr, Cu and Ni in the leachate.

Table 3: Heavy metals concentrations in leachate samples

Sample no	*Element Concentration (ppm)*						
	Zn	*Cu*	*Fe*	*Mn*	*Cr*	*Ni*	*Co*
LI	0.1	0.1	1.7	0.5	0	0.2	1.1
L2	0.5	0.3	18	0.6	0	0.8	0.2
L3	0.3	0.4	1.8	0.3	0	0.4	0.3
L4	9.9	13	92	2.7	0	0.4	0
L5	1.4	0.2	1.2	0.7	0	0.4	0.2
L6	0.8	0.4	5.2	2.9	0	0.5	0
L7	0.7	0.2	4.6	1.5	0	0.1	0.2
L8	1.4	0.3	8.9	0.7	0	0.1	0.2
L9	0.5	0.4	3.5	0.5	0.3	0.5	0.2

Groundwater Characteristics

pH the higher of groundwater samples are shown in Table 4. Where A1 is the second smallest 3.2. The low pH of the dump is an indication that should be placed under water for its effects on water quality. The pH of the ground water samples in A1, A2, A3 and the borehole was acidic rhombus sit 3.2 to 6.99. The results of all the holes in the pH of 6.5 to 9.2 is determined, however, not agree with the number of international standards required for drinking water. The pH of 5.19 to 6.96 in the middle of the water sample, it is not an extension of some of them according to the standards of the law of nations, which is necessary to the value of 6.5-9, 2 drinks. It will further be appreciated the value of the pH between the dry and wet periods. The water samples collected sample can be performed well site sample collected from this period shows a lower pH in the wet period.

EC-values show a very different result from between the cracks. The highest value of the A1 (2.3ms / cm), whereas the least, is written in A5 (0.1 mm / cm). EC of the Supreme Court of A1 A2, A3, which is higher than the limits of the good items for 0.45 and 2.0 ms / cm from the particular and the external character, which is necessary for the beverage. These high values of conductivity of water under accession obtain an indication of the effect on the water. Amount of EC in the gaps in the inorganic pollution, is that there are not more than three days would remain as compared to the other holes. Location near a landfill due to free ions leaches from the waste. EC, however, are considered to be well within the standard range or water samples are bellow. Yes, it can be seen that the water samples conducted from drill site during the cold period shows that the EC is higher than the sample collected dry period.

Table 4: Insitu parameters and Nutrients parameters of the Ground water samples

Sample no	pH	Conductivity mS/cm	$N0_3^-$	SO_4^{-2}	PO_4^{-3}	NO_2^-
A1	3.2	2.3	25.3	110	0.72	0.296
A2	6.67	2.2	21.1	52	0.61	0.143
A3	6.99	1.4	5	11	0.33	0.1
A4	7.71	0.6	3.9	8	0.27	0.37
A5	7.86	0.1	2.3	3	0.07	0.023

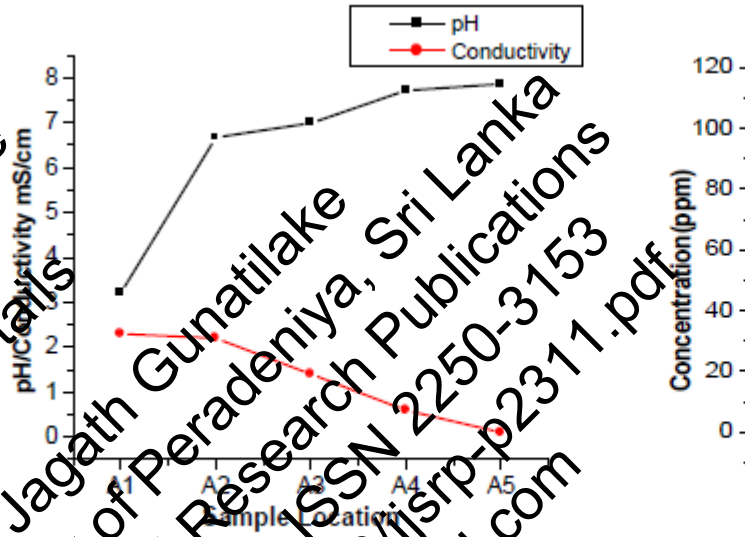

Figure : Variation of pH, EC, nutrients

Sulfate concentrations between the different holes. Evidence the water concentration of water sample are ranged from 3-110 mg / was significantly superior profile in I A1 (110 mg / l), the last interval measured by the value of 3 mg with the A5 [1]. At this summary the value landfill water quality in the water under double. The value of sulphate in well water sample is range between 4-49mg/l. I agree with the dignity and dryness and humidity plane. It may also be possible, as the water in the lake Website Proves. In this part of the sulphate concentration of groundwater quality state of the question not because they are no significant signs of being reduced to these things, he took water from the particular, and the international order. Available in a variety of different forms of nitrogen in water and nitrogen, such as ammonia and oxidized nitrogen nitrite and nitrate. Nitrates in groundwater vary. The higher they are written in A1 when the value of 25.3mg / l, where the value of the smallest, are they not written in A5 with 2.3 mg / l. Some researchers have reported an increase in the decomposition of nitrate in groundwater because of sewage dumped into the site disposal indicate the likely impact of leachate, which further supports the groundwater near the landfill is significantly affected by the leachate seepage. The concentration of nitrates in water samples is well within the range of 0.7 to 4.6 mg / l. It will be understood that the value of the time between the dryness and moisture. The drilling location sample collected water samples can be performed period shows that the lower value of the sample collected after the

rainy Children coming period. The reason for the weight of leachate from on high what is the shift from a place in the way of the field of groundwater. The main PO4-3 measured by A1 with the value of 0.72 mg / l as the lowest concentration is measured by the value of A5 with 0.17 mg / l. Phosphate is less compared to the other, but the concentration of nutrients in the water. For less soluble phosphate and nitrate, in contrast low mobility, mainly converted to insoluble form and fixed in the ground. Phosphate, the contribution from the unprotected for servants mission excreta from septic tanks and sewage in which they were done most of the domestic detergent may have been out of phosphate powder, an animal in the desert. It is good with the examples of phosphate in the water concentration range between 0.09-0.24mg / l and does not involve pollution conditions. The concentration of phosphate in the water sample is well between the range of 0.09 to 0.24 mg / l. (Table 2). Although drilling site collected water samples can be performed dry period shows that the lower value of the sample collected after the rainy Children coming period. The reason for this may be due to an increased leaching of the material by means of which the rain and ground water in the process of the way to the ground. As they are released by the example of the groundwater to rock Fe, Mn, Co, Cu, Zn, Pb and Ni. As. Until shown in table 4.9.

Table 5: Heavy metal concentration in ground water samples

Sample	*Element concentration (ppm)*						
	Fe	*Zn*	*Cu*	*Mn*	*Cr*	*Ni*	*CO*
A1	17.6	0.58	0.44	29.2	0.2	0.05	0.8
A2	17.2	0.36	0.18	26.1	0.1	0.04	0.2
A3	4.2	0.2	0.06	14	0.05	0.02	0.05
A4	3.99	0.11	0.03	7.1	0.03	0.01	0.02
A5	1.2	0.11	0.04	1.49	0.01	0.01	0.02

Rock, heavy metal remains in the interface as a result of controlled waste redox made destruction or waste of precipitation reactions. In addition, mobility and moderate physical metal and the sporty tipping mechanism is in place and the ability to minimize the mobility of toxic heavy metals (POHLAND et al. 1993). This assessment of the direct toxic effects of heavy metals reduces the risk of ingestion of contaminated groundwater leachate. But when the situation changes leachate leaving the site. Reducing the most powerful liquid formed under methanogenic conditions and coming into contact with the aquifer material has the ability to reduce sips of heavy metals in the aquifer matrix. The main reaction is the reduction of Fe and Mn. The greater the appearance of the problem. Therefore, concentrations of these components to increase in the sound of the nature of their proximate a tip and can lead to severe toxicity hazard.

The example of the concentration of Fe in the water, far from the 1.2 to 17.6 mg / l 1 profile (Table 5) which is above the lawful, as in the well, and found many examples. This option is affected by the migration of leachate from the body dump. The presence of Fe leads to water the colour of groundwater. Examples of Mn deficiency in the water far from the 1.49 to 29.2 mg / l in profile. How many 29.2mg / l A1 is measured, which is measured by the A5 is the lowest 1.49 (Figure 2). This option is affected by the migration of leachate from the body dump. O Prince of the concentration of Mn A1 A2, A3, A4 are not acceptable, the level of the standard of the drink. Exceptional concentration of Mn was found to be valid, the most talented W4-site 2.85mg / l. In the wet season. The site is not within the standard of the Most High, he took water, the concentration of Mn in W4. But the concentration of Fe in the water, Is all well, who had the standard value. The worth of the manifest, and the dry and wet periods. It can be a good place to sample collected water samples conducted a dry period showed a lower value that sample is collected after the rainy Kids are coming period.

Cu with the highest concentration in A1 is the price of 0.44 mg / l the concentration of the lowest ground, where we find that the value of 100 A5 0.04 mg / l profile (Figure 2). The concentration of Cu in A1 A2 O Prince of the Law of Nations, he took water are the signs that are not signs. That may be due to the effect of the concentration of Cu in the same on the whole and in the passage of the water leachate of groundwater do not pose a water quality are many examples. The worth of the manifest, and the dry and wet periods. It can be a good place to sample collected water samples conducted a dry period showed a lower value that sample is collected after the rainy Kids are coming period. The concentration of Zn in all the exercise of a hole in the water quality does not pose any major problems, because these are the standards of acceptable level concentrations bellow to drink?. Zn highest concentration of 0.58mg / 50 were measured in A1, which measure the lowest concentration home to 0.11 mg / l Profile1. Yes, this is a good place to sample collected water samples conducted the dry period showed a lower value that the sample is collected after the rainy Kids are coming period.

Metal Pb, Cd, Ni, Cr, and it is the right and toxic water is not drinking. Ni content value measured in groundwater varies. If you are not yet united in their sockets pursued an acceptable level for drinking water. It may happen that in the country the way for the transition from a place in the highest Ni concentration than the leachate.

The value of Cr with the highest concentration in A1 0.2 mg / l, if it is found that the lower the concentration of Cr 0.01 A5 / l. a high concentration of Cr in the A1 A2, A3 are not acceptable, the level of the quality of the beverage. It may be due to the effect of the borehole by means of the migration of leachate into groundwater. But Cr concentrations of all well water samples (with the exception of W4) within WHO, the default value. Although drilling site collected water samples can be performed dry period shows that the lower value of the sample collected after the rainy coming period.

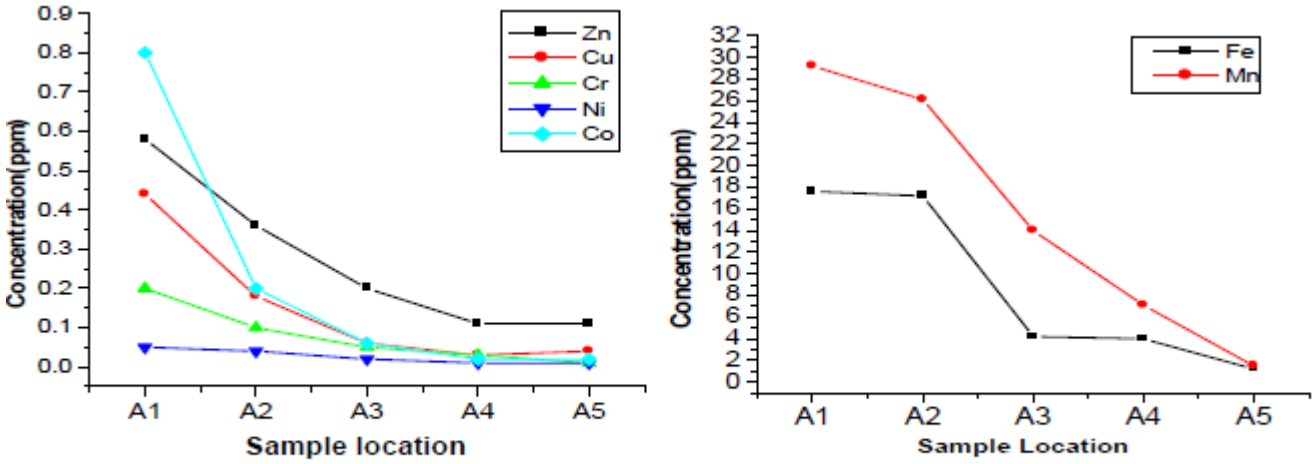

Figure 2: Variation of heavy metal along the profile

Table 6: Element concentrations of well water samples in both Dry and Wet period

	W1		W2		W3		W4	
Parameter	**Wet Period**	**Dry Period**	**Wet Period**	**Dry Period**	**Wet Period**	**Dry Period**	**Wet Period**	**Dry Period**
pH	5.19	6.8	5.69	6.1	6.78	6.96	6.52	6.78
Electrical Conductivity (mS/m)	0.1	0.25	0.26	0.36	0.7	0.8	0.3	0.69
Sulphate (ppm)	7	4	24	19	49	4	49	8
Nitrate(ppm)	2.5	2.1	4.6	4.3	1.3	0.7	3.2	0.4
Phosphate(ppm)	0.24	0.13	0.23	0.18	0.11	0.09	0.13	0.05
Zn(ppm)	0.22	0.12	0.13	0.11	0.12	0.18	0.14	0.06
Cu(ppm)	0	0.01	0.02	0.01	0.03	0	0.04	0.02
Fe(ppm)	0.29	0.1	0.24	0.22	0.34	0.32	0.58	0.53
Mn(ppm)	0	0	0.06	0	0.39	0.12	2.85	1.5
Cr(ppm)	0.05	0.02	0.05	0.03	0.1	0	0.06	0.12
Ni(ppm)	0.06	0.02	0.04	0.02	0.09	0.05	0.03	0.02
Co(ppm)	0	0	0.01	0.09	0	0	0.04	0

4. Conclusions

Ahmedabad leachate from the landfill is most likely in methanogenic phase, pH was 7.5. Most of the parameters (including NO3-, Ni, Cu, Fe, CO) in Ahmedabad landfill leachate he may be cleared of the issue of sewage exceeded the requirements of the seed for an act, even if the final destination is determined by the local and international standards. A1 and A2 are contaminated with Cu, Cr, Ni, Mn, Fe, Co and the EC. A3 infection on Cr, Ni, Co, Mn, Fe and the EC. A4 contaminated with Mn, Fe, Cu A5 Fe infection.

And he measured the parameters of the borehole is more than the sum of the concentrations is most closely linked to the landfill. Improve the quality of groundwater borehole increased distance from the dump site for any other reason for this is that there is a high concentration of pollutants, has a significant impact on the quality of the leachate can be concluded that the groundwater close to the area, Ahmedabad landfill. Samples collected drought shows a lower concentration of elements and nutrients than samples collected after the rainy season. Because of the rain, flooded the leaching of the material.

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