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Study and Assessment of Impact of Heavy Metals From Leachate On Environment.

Pavithra M P,
Assistant Professor, School of Civil Engineering,
REVA University, Bangalore, Karnataka, India

Pushpa Lumina,
Assistant Professor, School of Civil Engineering,
REVA University, Bangalore, Karnataka, India

Chandan Gowda,
Student, School of Civil Engineering,
REVA University, Bangalore, Karnataka, India

Abhishek Kolar
Student, School of Civil Engineering,
REVA University, Bangalore, Karnataka, India

Abstract

Areas near landfills have a higher probability of groundwater contamination due to the generating potential pollution source of leachate from nearby dumping site. Such contamination of groundwater leads to substantial risk of local groundwater users and to the environment. Leachate, soil, ground water and surface water sample were collected from Bellahalli landfill site, Karnataka, India. To study the possibility impact of leachate on Soil, Ground water, Surface water quality. Testing of leachate was done for the parameters including potassium, chromium, nickel, Cobalt, copper, zinc, magnesium, iron, ammonia, sodium, lead, COD, cadmium, Manganese and organic matters were determined and reported. Concentration of COD, chromium, ammonia, sodium, iron, potassium and magnesium exceeded the ISO standards of water quality for sewer water. Further testing of soil, surface water and groundwater were done for the parameters including potassium, Cobalt, magnesium, sodium, cadmium, arsenic, colour, chromium, Copper, iron, lead, manganese, odour, pH value, nickel, zinc, ammonia, COD, organic matter, chloride, TSS and TDS were determined and reported. Reports show that concentration of sodium in groundwater was slightly high according to the EPA standards of groundwater, this indicate that the Groundwater quality was less.

Concentration of TDS and sodium were slightly high compared to the standards of EPA in the surface water and concentration of copper and zinc were high in soil. Near the landfill site, the presence of contamination in sample shows the quality and thus renders the use of domestic purpose. This study requires proper management of waste in the city.

Keywords: Landfill Leachate, Heavy Metal, COD, TDS.

Introduction

Solid waste management is became a big issue in developed and developing countries. Instead of providing awareness and describing the impact of solid-waste problem caused by human activities, there is significant increase in the solid-waste generation. This could be because of increase in industrialization, population, and urbanization.
Landfill leachate is generated due to precipitation or the moisture content present in the solid waste. Ground water and Surface water contamination, Soil contamination. Groundwater and Surface

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water contamination**:** If groundwater table or surface water body lies near the landfill or under the landfill site chances of contamination is high. Concentration levels of different contaminants and presence of heavy metals might exceed and causes various problems and health disorders.

Landfill leachate is a highly polluted liquid found in the sanitary landfill. It is a liquid that leaches out from the solid waste that is dumped in a certain area. The composition of the landfill leachate depends on the age of the landfill and the type of waste it contains. It usually contains heavy metals, organic matters which can be either in dissolved or suspended from.

Leachate percolated soil contains higher concentration of different contaminants. Thus soils with higher concentration might not be useful for agriculture, construction etc.

Objectives

The objectives of the experiment are:

- To find the initial concentration of heavy metals in leachate.
- To find out the concentration of heavy metals present in soil.
- To find out the concentration of heavy metals present in groundwater.
- To find out the concentration of heavy metals present in surface water from surrounding area.
- To study impact of heavy metals to the environment and human.

Methods

The leachate is collected from the nearest solid waste landfill site, Bellahalli dumping yard. The collected leachate is stored at a particular temperature (-4˚c) for further use. The initial concentration of the leachate is tested to know its composition.

Place of study: Bellahalli landfill site**.**

Fig 1. Bellahalli landfill site

Step 1: To find the initial concentration of heavy metals in leachate. Leachate sample collected was tested to check the levels of below parameters present. Heavy metals parameters tested were Ammonia, Cadmium, Chromium, Cobalt, COD, and Copper, Iron, Lead, Magnesium, Manganese, Nickel, Organic matter, Potassium, Sodium, Zinc.

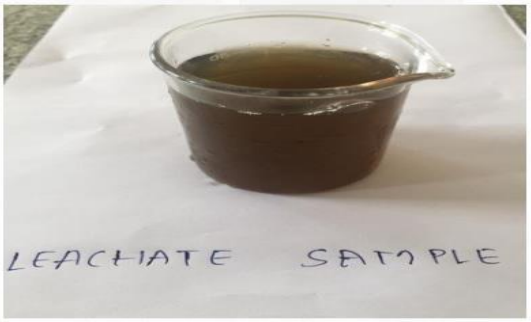

Fig 2. Leachate sample collected from landfill

Step 2: The concentration of heavy metal in soil, ground water and surface water. The above mentioned parameters were tested.

Fig 3. Soil sample collected from landfill site.

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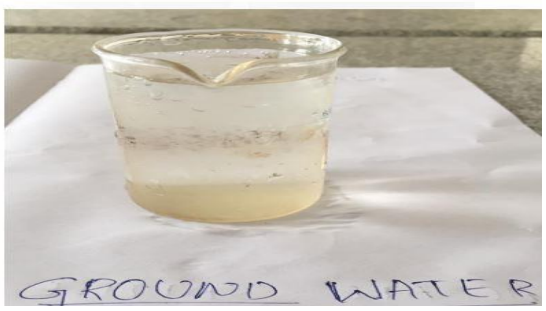

Fig 4. Ground water sample collected from nearby landfill site.

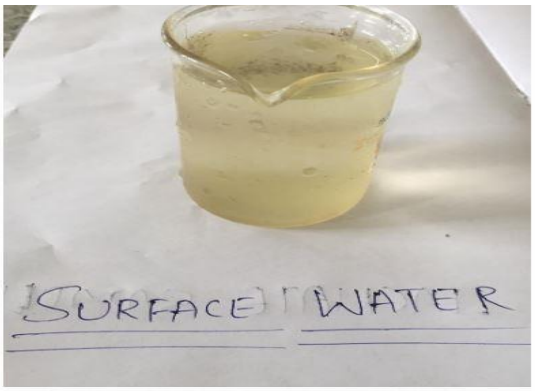

Fig 5. Surface water sample collected from nearby landfill site.

Step 3: Impacts of heavy metals.
Toxic effect of some of the heavy metal on human health:-

Table1. Heavy metal effects on human.

	industrial wastes, refining of iron ores.	skin. Liver, heart ad pancreatic problems.
Potassium	Industrial activities.	Weakness, nausea, vomiting, chest pain, kidney failure.
Chromium	Alloy steel, alloy cast iron, stainless steel and metal plating industries	Death preceded by nausea, vomiting, shock and coma ulcer on skin
Magnesium	Water hardness removal treatment, water purification treatment.	Diarrhea.

Result and Discussion

The leachate sample collected from the landfill site is tested to know its initial composition. The heavy metal components, chemical oxygen demand, organic matter and other pollutant concentration if found**.**

Table.2: Initial composition of leachate sample.

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METAL	SOURCE OF METALS	EFFECTS OF METALS
COD	Residual waste and beverage waste from industrial food processing and agricultural activities.	Stomach infection
Ammonia	Commercial fertilizers and industrial activities.	Throat and stomach related damages
Sodium	Road salt application, water treatment chemicals and ion exchange water softening unit.	Swelling of hands, arms, feet, ankle and legs. Kidney problem.
Iron	Natural deposits,	Negative impact on

Sl. No	Parameters	Unit	Results
1	Lead as Pb	mg/L	2735
2	Zinc as Zn	mg/L	0.199
3	Total Chromium as Cr	mg/L	0.107
4	Nickel as Ni	mg/L	0.125
5	Copper as Cu	mg/L	BDL
6	Cadmium as Cd	mg/L	BDL
7	Chemical Oxygen Demand	mg/L	4400.0
8	Total Ammonia	mg/L	237.25
9	Manganese as Mn	mg/L	1.41
10	Magnesium as Mg	Mg/L	320.76
11	Iron as Fe	mg/L	5.642
12	Potassium as K	mg/L	2735
13	Sodium	mg/L	2300

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Parameters exceeding the tolerance limit in leachate sample

Table3. Analyzed report of leachate sample

SL. NO	METALS EXCEEDING THE TOLERANCE LIMIT	OBTAINED VALUE FROM TESTS IN mg/L	TOLERANCE LIMITS IN mg/L
1	COD	4400	250
2	Chromium	1.107	0.1
3	Ammonia	237.25	50
4	Sodium	2300	60%
5	Iron	5.642	3
6	Potassium	2735	13-20
7	Magnesium	320.76	150

The above reports show that, the parameters

mentioned are exceeding the ISO standards

The collected ground water sample from site is tested to know the concentration.

Table4. Test report of ground water sample collected.

Sl. No	Parameters	Unit	Results
1	pH	mg/L	6.61
2	Lead (Pb)	mg/L	<0.01
3	Zinc (Zn)	mg/L	<0.5
4	Chromium (Cr)	mg/L	<0.01
5	Nickel (Ni)	mg/L	<0.01
6	Copper (Cu)	mg/L	<0.01
7	Cadmium (Cd)	mg/L	<0.001
8	Chemical Oxygen Demand	mg/L	4.0
9	Total Ammonia	mg/L	<0.1
10	Magnesium (Mg)	mg/L	19.4
11	Manganese (Mn)	mg/L	<0.1
12	Iron as Fe	mg/L	0.1
13	Sodium	mg/L	25.0
14	Potassium (K)	mg/L	2.0

Parameters exceeding the allowable value in ground water sample

Table5. Analyzed report of groundwater sample collected.

PARAMETER	OBTAINED VALUE FROM TEST IN mg/L	ALLOWABLE VALUE in mg/L
Sodium	25	20

According to EPA sodium value for ground water should not exceed 20 mg/L, if the water is used for drinking. Sodium in water may cause vomiting, muscular-twitching, nausea, rigidity, cerebral and pulmonary oedema.

The collected surface water from landfill site is tested to know the concentration.

Table6. Test reports of surface water sample collected.

Sl. No	Parameters	Unit	Results
1	pH	mg/L	6.61
2	Lead (Pb)	mg/L	<0.01
3	Zinc (Zn)	mg/L	<0.5
4	Chromium (Cr)	mg/L	<0.01
5	Nickel (Ni)	mg/L	<0.01
6	Copper (Cu)	mg/L	<0.01
7	Cadmium (Cd)	mg/L	<0.001
8	Chemical Oxygen Demand	mg/L	6.0
9	Total Ammonia	mg/L	<0.1
10	Magnesium (Mg)	mg/L	21.8
11	Manganese (Mn)	mg/L	<0.1
12	Iron as Fe	mg/L	0.1
13	Sodium	mg/L	32.0
14	Potassium (K)	mg/L	3.0

Parameters exceeding the allowable limit in surface water sample

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Table7. Analyzed report of surface water sample collected

PARAMETER	OBTAINED VALUE FROM TESTING mg/L	ALLOWABLE VALUE in mg/L
TDS	618	500
Sodium	32	30

The above mentioned parameters exceed the allowable limit according to EPA standards.

TDS in water can give water bitter, salty, brackish taste .TDS can cause water hardness, scale formation and staining.

Sodium in water may cause vomiting, muscular-twitching, nausea, rigidity, cerebral and pulmonary oedema.

The collected soil from landfill site is tested to know the concentration

Table8. Test reports of soil sample collected.

SL. NO	**PARAMETERS**	**RESULTS OBTAINED FROM TEST in mg/kg**
1.	pH value	7.57
2.	Organic matter	0.28
3.	Nitrogen	0.099
4.	Total phosphorous	0.041
5.	Potassium	0.068
6.	Copper	8.9
7.	Zinc	57
8.	Chromium	<0.01
9.	Lead	<0.01
10.	Arsenic	<0.01
11.	Cadmium	<0.01
12.	Mercury	<0.01

Parameters exceeding the allowable limit in surface water sample.

Table9.Analyzed report of soil sample collected.

SL. NO	**PARAMETER**	**OBTAINED VALUE FROM TEST in mg/kg**	**ALLOWABLE VALUE in mg/kg**
1	Copper	26.4	10
2	Zinc	235.2	60.33

From the above results, we can conclude that copper and zinc in soil exceeds the allowable limit and pH values of 7.57 determine that soil is slightly alkaline. Excess copper in soil affects largely on root growth of a plant .Inhibition of root elongation and damage of root cell membrane and the immediate response to high copper levels and can cause seed germination.

High level of zinc in soil can affect the activity in soil, likely it slow-down the breakdown of organic matters. Because as it negatively influences the activity of micro-organisms and earthworm.

Conclusion

The collected samples were tested and the results shows that some of the heavy metals exceeded the limit like COD, Cr, Ammonia, Na, Fe, K, Mg. in leachate.

Sodium is exceeded in ground water which may cause vomiting, muscular-twitching, nausea, rigidity, cerebral and pulmonary oedema. In surface water the TDS and Sodium are exceeded the TDS causes hardness of water, scale formation and staining. Sodium cause vomiting, muscular-twitching, nausea, rigidity, cerebral and pulmonary oedema.

The Zinc and Copper are exceeded in soil. High level of zinc in soil can affect the activity in soil, likely it slow-down the breakdown of organic matters. Because as it negatively influences the activity of micro-organisms and earthworm.

Excess copper in soil affects largely on root growth of a plant .Inhibition of root elongation and damage of root cell membrane and the immediate response to high copper levels and can cause seed germination.

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This condition indicates that the treatment of leachate is necessary to reduce the concentration of heavy metal

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