

ANALYSIS AND TREATMENT OF LANDFILL LEACHATE BY ELECTROCOAGULATION/FLOCCULATION METHOD, BENGALURU

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ABSTRACT -Leachate is a poisonous liquid formed when waste breaks down in the landfill and water filters through that waste. The present study has been carried out to characterize and treatment of leachates in landfill of Bengaluru. Herewith are three different leachate sample stages (fresh, 6months & one year) that were collected and 14 parameters were tested out of those. The results are tabulated and compared with standard values. They are temperature, pH, turbidity, BOD, COD, total dissolved solids, copper, total hardness, iron, chlorides, chromium, zinc, lead and sulphate. From these, some parameters were likely elevated compared with the standard values. Due to these increase in certain crucial parameters, the landfill leachate will surely affects the properties of the soil, sub-surface and ground water. So these leachate must be treated well. Treatment of Leachate can be done in physical, chemical, biological and physico-chemical processes. This research focuses the characteristics of Homogeneous mixture of three Raw leachate samples and how it is treated by Electrocoagulation/Flocculation Method.

Key words: Leachate, Landfill, Samples, Parameters, Heavy metals, Leachate Treatment

1. INTRODUCTION

The generation of garbage has increased globally as a result of rising population. Large-scale environmental effects result from the rise in trash generation. Landfills ought to be in operation because of the effects on the environment. Liquid trash percolates in landfills as a result of their functioning; this substance is referred to as leachate. The complicated physical, chemical, and biological processes that result in leachate from landfills include the infiltration of precipitation, biodegradation of organic fractions, and compaction of waste. Wastewater that contains high amounts of contaminants and a variety of compositions is known as landfill leachate. To determine the properties of landfill leachate, numerous field sampling and monitoring techniques were used. Leachate from landfills contains dangerous and extremely poisonous substances that are harmful to both the environment and human populations' health. Surface water and groundwater are also impacted. Before being released into the environment, these leachates need to have the proper treatment. For operations at municipal landfills, choosing the right method of leachate treatment continues to be a significant challenge.

1.1 OBJECTIVE

- To find the characteristics of Homogeneous mixture of Raw leachate.
- To treat the Homogeneous mixture of Raw leachate by Electrocoagulation Method.

2. CHARACTERISTICS OF LECHATE

The municipal solid waste that is dumped in the landfill releases a liquid known as leachate after a few days of dumping. The characteristics of leachate are the result of the physical, chemical, and biological changes of solid waste in landfills. Totally 14 parameters were tested, and they are:

- Temperature, °C
- pH Value
- Turbidity, NTU
- BOD, mg/L
- COB, mg/L
- Total Dissolved Solids, mg/L
- Copper as Cu, mg/L
- Total Hardness as CaCO₃, mg/L
- Iron as Fe, mg/L
- Chlorides as Cl, mg/L
- Chromium as Cr, mg/L
- Zinc as Zn, mg/L
- Lead as Pb, mg/L
- Sulphates as SO₄, mg/L

3. METHODOLOGY

Three different leachate samples were collected from the landfill

- 1 year leachate water
- 6 months leachate water
- Fresh leachate water

The fresh leachate water was collected from the leachate compactor-vehicle. The 1 year of leachate water and the 6 months of leachate water were stored in lagoons, which were then pumped to the leachate tank, and the samples were collected from the leachate tank. In each 1 litre container, three different leachate samples were collected.



Fig- 1: Collection of three different Leachate samples

The collected leachate samples are subjected to various tests and comparisons to industry standards. The Homogeneous mixture of Raw Leachate has higher concentration of pollutants.

So the Leachate should be treated before it is disposed into the environment. If not treated before disposing into the environment, it affects the ground and surface water and also cause human health issues. Therefore, a suitable method should be used to treat the leachate. A Homogeneous mixture of three leachate sample is tested for 14 parameters and it is treated by Electrocoagulation/ flocculation method and compared with standard values.

3.1 PARAMETERS TESTED FOR HOMOGENEOUS MIXTURE OF LEACHATE SAMPLES

Table -1: Characteristics of Homogeneous mixture of Raw Leachate

Parameters	Homogeneous mixture of Leachate
Temperature, °C	26.4
pH Value	8.12
Turbidity, NTU	290.3
BOD, mg/L	2568
COD, mg/L	8526
Total Dissolved Solids, mg/L	9152
Copper as Cu, mg/L	<0.05
Total Hardness as CaCO ₃ , mg/L	5897
Iron as Fe, mg/L	1.6

Chlorides as Cl, mg/L	6910
Chromium as Cr, mg/L	<0.1
Zinc as Zn, mg/L	<0.5
Lead as Pb, mg/L	<0.01
Sulphates as SO ₄ , mg/L	806.1

3.2 TREATMENT METHOD

The leachate produced from landfills affects groundwater and surface water, which causes environmental issues. Also, it causes human health issues. So the leachate should be treated with a suitable treatment method. There are various physical, chemical, physicochemical, and biological treatment methods for treating the landfill leachate.

3.2.1 Electrocoagulation/Flocculation Method for Raw Leachate

One of the physicochemical approaches for treating landfill leachate is Electrocoagulation/Flocculation. The remediation of landfill leachate has received a lot of attention recently. Leachate pipes collect the waste liquid that has seeped through to the base of the landfill. And this leachate is stored in Raw Leachate tank. The leachate from the raw leachate tank is passed into the Electrocoagulation/Flocculation reactor and then passed into the lamellar settler. The Lamella Settler separates the solid components from the liquid components. The solid components are passed into the sludge drying bed, where they are composted. The liquid components are passed through a high-pressure sand filter, followed by an activated carbon filter, and then by ultrafiltration. Then the reverse osmosis process takes place, the liquid component is treated, and finally it is stored in a treated water tank.

a) Characteristics of Treated Homogeneous mixture of Leachate

Table -2: Characteristics of treated Homogeneous mixture of Leachate

Parameters	Homogeneous mixture of treated Leachate
Temperature, °C	26.7
pH Value	8.03
Turbidity, NTU	1.3

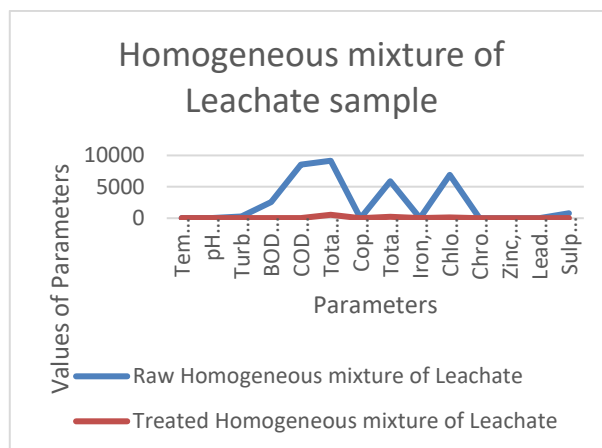
BOD, mg/L	3.0
COD, mg/L	24.0
Total Dissolved Solids, mg/L	544.0
Copper as Cu, mg/L	<0.05
Total Hardness as CaCO ₃ , mg/L	230
Iron as Fe, mg/L	0.1
Chlorides as Cl, mg/L	150.0
Chromium as Cr, mg/L	<0.1
Zinc as Zn, mg/L	<0.5
Lead as Pb, mg/L	<0.01
Sulphates as SO ₄ , mg/L	26.1

4.RESULT AND DISCUSSION

When compared to the expected values, the observed values are higher. The temperature of Homogeneous mixture of Leachate samples is nearly identical. The pH value of Homogeneous mixture of Leachate samples is nearly same. The pH of the sample is alkaline in nature. Turbidity of the Homogeneous mixture of Leachate samples are within the limit of standard value. BOD of sample is beyond the standard value but. The COD of this Homogeneous mixture of Leachate samples is beyond the limit as BOD. Copper content of this Homogeneous mixture of Leachate samples is within the limit. The total hardness of leachate water is very high. The heavy metals like iron and chromium of this Homogeneous mixture of Leachate samples is having the high value when compared to the standard value but lead and zinc are having low value when compared to the standard value. Homogeneous mixture of Leachate samples has high chloride and sulphate content when compared to standard value.

Thus the Homogeneous mixture of leachate samples is treated by Electrocoagulation/Flocculation method. After the sample is treated the values are compared with the standard values. The Temperature and pH of Homogeneous mixture of Leachate samples is identical with compared to standard values. The Turbidity, BOD, COD and Total Dissolved Solids of Homogeneous mixture of Leachate samples are within the standard values. Iron, Chlorides, Chromium, Zinc, Lead and Sulphates of Homogeneous mixture of Leachate samples.

Charts



3. CONCLUSIONS

Before being released into the environment, leachate produced by landfills needs to be treated. Finding a good treatment approach for landfill leachate is still challenging. In this study, landfill leachate is treated using the electrocoagulation/flocculation method. The COD, colour, and metals in the leachate are reduced when it is treated using the Electrocoagulation/Flocculation method. Thus, the generation of leachate, characteristics of Homogeneous mixture of three different leachate samples and its treatment using the electrocoagulation/flocculation method are explained in this paper.

ACKNOWLEDGEMENT

I sincerely thank my Research Guide Dr. A. Gandhimathi, Kumaraguru College of Technology, Coimbatore for their constant encouragement and continuous help in moulding me in my research activities.

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