

## **Construct The Liner Material To Removal Of Pollutant Form Landfill Leachate**

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

Dr. Harinath S,  
*Professor, School of Civil Engineering,  
REVA University, Bengaluru, Karnataka, India*

Ashwini K,  
*Student, School of Civil Engineering,  
REVA University, Bengaluru, Karnataka, India*

Brahamanand Reddy  
*Student, School of Civil Engineering,  
REVA University, Bengaluru, Karnataka, India*

### ***Abstract***

*Leachate have a high impact on groundwater over a period of time. A potential liner is constructed so that there is less pollutants migrating into the groundwater. However the conventional synthetic liner may be a failure due to insufficient capacity of the materials used. In this paper, low cost liner materials like bentonite and zeolite are tested for the pollutant removal efficiency. Bentonite has a self – healing properties and low permeability. It can also be used as a absorbent and used in treatment plants. Zeolite is said to have an open frame structure where it can trap the heavy metals in them. The result show that there was certain removal of pollutants by using these two low cost materials efficiently and the permeability was also reduced using these materials.*

**Keywords:** *Bentonite, zeolite, Liner Material, Landfill Leachate.*

### **Introduction**

Landfill leachate is a highly polluted liquid with organic matter, heavy metals and other impurities in them. It is toxic and can pollute the soil as well as

the ground water. Landfill leachate has an adverse effect on both quality of the groundwater and the soil composition. The risk of the contamination of the groundwater, soil and even the surface water depends upon the pollutants that are present in the leachate. If the leachate when not treated properly can directly enter the soil thus groundwater. The pathogenic microorganisms and high concentration of ammonia and other heavy metals can change the initial characteristics of the groundwater too. Leachate can also effect the aquatic life when it enters into water reservoirs and have acute or chronic impacts. Thus it can also effect the human life while depending on the underground water sources. (N.A.Muhamad Bashar, Ekrem Kalkan, etc.)[1,2]

A landfill liner is intended to be a low permeable barrier which is laid down under an sanitary landfill before dumping solid waste. It is used to prevent the further contamination of groundwater through the percolation of the leachate until the worst scenario due to failure and landfill liner. Nowadays the composite liners are used in the landfill sites. (Yucel Guney, Ummukulsum Ozel, etc) [3,4].

## Objectives

- ❖ To find out the initial characteristics of landfill leachate.
- ❖ To evaluate the efficiency of the removal of pollutants from leachate of zeolite and bentonite
- ❖ To evaluate the final characteristics of the landfill leachate
- ❖ To compare and suggest an optimum alternative material used in liner construction that can reduce the pollutants entering into the groundwater.

## Methods

Bentonite has the property of adsorbing relatively large amount of molecules. It also has the property of swelling due to which it is used as liner material as it is a useful sealant, having a self-healing property, and low permeability. It is used to line the base of landfills to prevent the contamination of leachate. Bentonite can be used in between the synthetic materials to create a geosynthetic clay liners. Bentonite was purchased from a local firm near R T Nagar, Bangalore.

Zeolite has an open cage like structure that can trap the heavy metals. It is a stable and can resist any environmental conditions without change in their properties. Zeolite has an ability to accommodate active metal species in them. Zeolite for the experiment was ordered from a dealer through Indiamart.

SET A : Zeolite

SET B : Zeolite + Bentonite

## Results and Discussion

The leachate sample is collected from the site and stored in the refrigerator for further use. the sample is given for testing the initial concentration of the heavy metals and then compared with the standards.

Table.1: Initial composition of leachate sample.

Sl. No	Parameters	Unit	Results
1	Total Chromium as Cr	mg/L	0.107
2	Chemical Oxygen Demand	mg/L	4400.0
3	Total Ammonia	mg/L	237.25
4	Manganese as Mn	mg/L	1.41
5	Iron as Fe	mg/L	5.642
6	Potassium as K	mg/L	2735
7	Sodium	mg/L	2300

Once the initial concentration of heavy metals is tested the final concentration of the heavy metals after the treatment of the leachate.

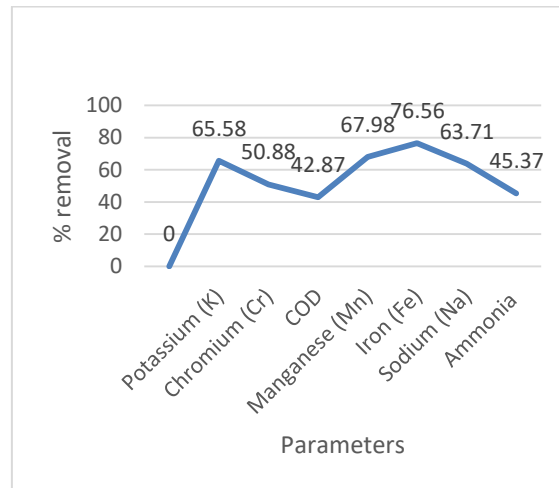
Table.2: Final concentration of the leachate.

SL. No	Parameters	Set A (mg/L)	Set B (mg/L)
1	Potassium (K)	1487.57	416.82
2	Chromium (Cr)	0.065	0.020
3	COD	2874.08	1892

4	Manganese (Mn)	154.68	18.29
5	Iron (Fe)	2.58	0.202
6	Sodium (Na)	1407.83	569.25
7	Ammonia	152.24	96.33

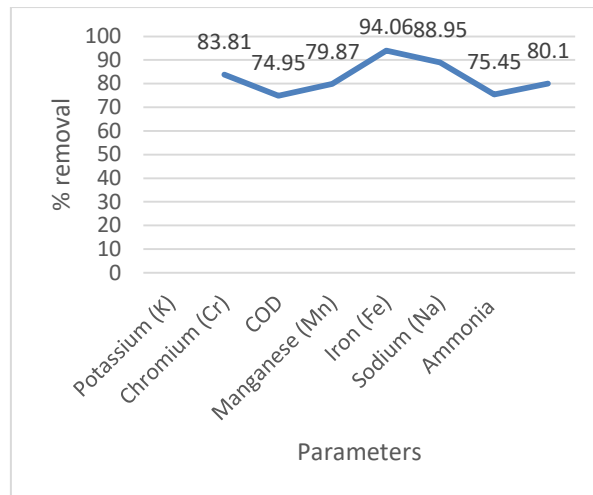
SL. No	Parameters	Zeolite	Zeolite + Bentonite
1	Potassium (K)	45.61	84.76
2	Chromium (Cr)	39.89	81.45
3	COD	34.68	57
4	Manganese (Mn)	51.78	94.3
5	Iron (Fe)	54.23	96.5
6	Sodium (Na)	38.79	75.25
7	Ammonia	35.83	59.4

Table.3 : Removal efficiency of heavy metals.



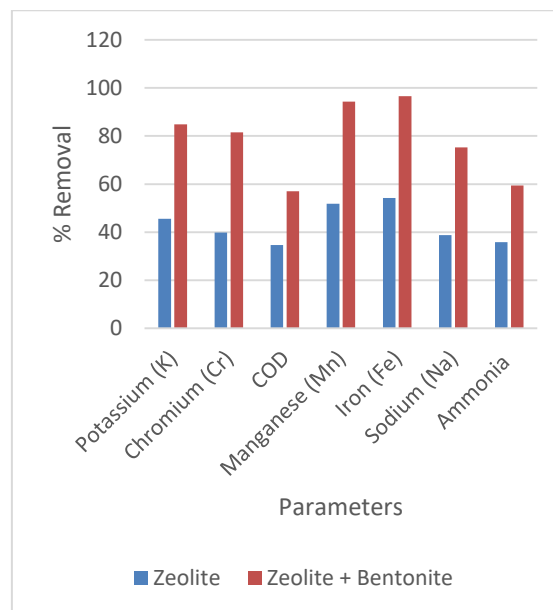
**Graph.1: Removal efficiency of zeolite.**

The above graph represents the efficiency of zeolite in removing the above parameters. It has an efficiency about 76.56% in removal of iron content from the leachate sample. A very least percentage of COD can be reduced.



**Graph.2 :The removal efficiency of Zeolite + Bentonite.**

The Graph.5 plotted shows the removal efficiency of the zeolite material with 25% of bentonite. This shows that the % removal of the selected parameters were high compared to the Set A where only zeolite was used.



**Graph.3: Comparison of removal efficiency of Zeolite and Zeolite + Bentonite liners.**

The above graph represents the comparison of the two medium. It is clearly evident that the Zeolite along with bentonite has highest removal percentage of certain parameters while compared to the individual zeolite material.

## Conclusion

Leachate have a high impact on groundwater over a period of time. A potential liner is constructed so that there is less pollutants migrating into the groundwater. However the conventional synthetic liner may be a failure due to insufficient capacity of the materials used.

The initial concentration of the leachate sample shows that treatment is required to meet the ISO standards. The removal efficiency of the selected pollutants and the parameters are tested after passing the leachate sample through seven different setup.

Zeolite can be a potential liner material. Zeolite along with 25% of bentonite can be more effective in the removal of the pollutants and heavy metals. Bentonite is a type of clay hence the percentage increase in the amount of this material can make the liner impermeable.

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