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TREATMENT OF LANDFILL LEACHATE USING ALGAE

Rifana Fabin[1], Rana Rahman M[2]

[1]Mtech Environmental Engineering Student, KMCT CEW Kerala, India
[2]Assistant Professor, Dept. of Civil Engineering, KMCT CEW Kerala, India

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Abstract - *The study focuses on the treatment of landfill leachate using Algae. The algae used is chlorella vulgaris. Generation of landfill leachate become an important problem and it should be treated thoroughly. Leachate is the highly toxic waste water which is formed due to precipitation entering landfill. The amount of Nitrate, Ammonia, TDS, Chemical Oxygen Demand etc. will be very high. Leachate not only pollutes the ground water but also it generates lot of toxic gases and also it may damage the reinforcement of the nearby buildings by corroding it. The binding strength of concrete is also affected. In this study, optimum dosage and optimum time for the algae chlorella based on their removal efficiency is main focus in this project.*

Key Words: **Leachate, Chlorella**

1. INTRODUCTION

MSW after being disposed off in landfills degrade and increases release of gaseous products and liquid products, the latter is known as landfill leachate. Leachate is a liquid waste water flowing over a landfill due to precipitation (rainfall and snow), ground-water intrusion, moisture content of waste (particularly significant when sludge or liquids are disposed off), evaporation rate(daily cover during the filling period and final cover design). The leachate is formed when soluble components are dissolved or leached out by water percolation. The amount and composition of leachate generated varies over time to time. This depends on several factors such as the amount of rainfall, solubility, and moisture content of disposed waste, size of landfill, the quantity of waste contained in it, and the age of landfill sites.

Fig 1 Leachate production

1.1 Objectives

Specific objectives of this project can be outlined as follows:

- To evaluate the feasibility of Algae in the treatment of leachate.
- To determine the removal efficiency Algae in various parameters of leachate such as Chemical oxygen demand(COD), Nitrate and Ammonia nitrogen
- To find out the optimum contact time and optimum dosage of algae.

1.2 Scope of the study

Solid waste generation have been exposed to increase worldwide. Presently, the most applied methodology to dispose solid waste is landfilling. However, these landfill sites, over time releases a significant amount of leachate, which can possess serious environmental issues, including contamination of water sources. There exist many physicochemical and biological landfill leachate treatment methods with varying degrees of success. With an increasing focus on sustainability, there has been an increasing demand for developing eco-friendly, green treatment programmes for landfill leachates with viable resource recovery and minimum environmental footprints. Microalgae-based techniques can be a potential scheme for such a treatment scenario. The scale-up aspect of microalgae technology has been discussed, and the related critical factors have been evaluated.

2. METHODOLOGY

Treatment materials include Algae and is to be cultured in laboratory. Treatment of landfill leachate include raw material selection and processing, culturing and preparation, mixing and treatment, as well as quality testing.

2.1 Raw materials

Algae is used for leachate treatment. The Algae used is Chlorella vulgaris. The use of algae for the purpose of water or leachate treatment is termed as phycoremediation.

Treatment of leachate using algae is a promising method. Algae to be used is chlorella and is to be cultured in lab.

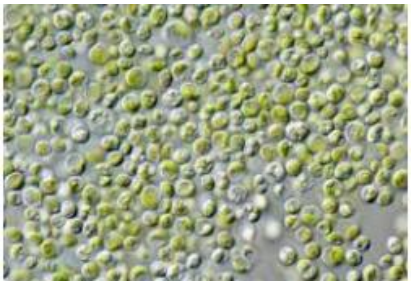

Fig -2: Chlorella vulgaris

2.2 Field experiment

2.2.1 Collection of sample

leachate samples were collected from landfill sites located at Njeliyamparambu. Njeliyanparambu is a place on the outskirts of the city of Kozhikode in Kerala, India. It is located 6km away from Kozhikode and has gained prominence for being a dumping ground for entire Kozhikode city.

Fig 3: Landfill site at Njeliyamparambu

2.2.2 Culture of Chlorella

Take a sterilized bucket and fill half to two-third of the bucket with distilled water. Add the chlorella powder into the water in the bucket with a spoon. Also add urea fertilizer as a nutrient for the growth of algae. Place the bucket on a sunny spot inside, near a windowsill is probably perfect. Also attach a thermometer to monitor the temperature of the water in the bucket if needed.

2.2.3 Preliminary Analysis of Leachate

The characteristics of leachate samples, Chemical Oxygen Demand(COD), Ammonia and Nitrate is tested before treatment inorder to compare the results after treatment.

2.2.4 Treatment process (Adsorption using Magnetic Stirrer)

1. 80ml of leachate sample is taken in a 100ml standard flask.

2. Chlorella is taken and weighed.

3. It is then added to the sample (Dosage 1000mg/L).

4. Then dissolve the Chlorella and then make up to 100ml.

5. Transfer the contents into a 250ml beaker and shake using magnetic stirrer at 150rpm for initially 5min.

6. The process is continued for different contact time (10, 15, 20 min).

7. The efficiency is evaluated and the optimum contact time is obtained.

2.2.5 Analysis of Treated Leachate

The characteristics of leachate samples including Chemical Oxygen Demand(COD), Ammonia and Nitrate is tested after treatment inorder to compare the results before treatment.

2.2.6 Results and Discussion

Finally results based on various samples, dosages, contact time are found out and compare the results of characteristics before and after treatment. And then report is prepared.

3 RESULTS AND DISCUSSION

Table -1: Values obtained after preliminary analysis of leachate

Sl no	parameter	APHA method	Unit	Obtained values	CPCB Disposible limits
1	COD	5520 B	mg/L	28220	Max 250
2	Ammonia	4500 NH_3 B	mg/L	23	Max 30
3	Nitrate	4500 NO_3 B	mg/L	875	No limit

3.1 Treatment with Chlorella (varying contact time)

Treatment with chlorella is done with varying contact time.

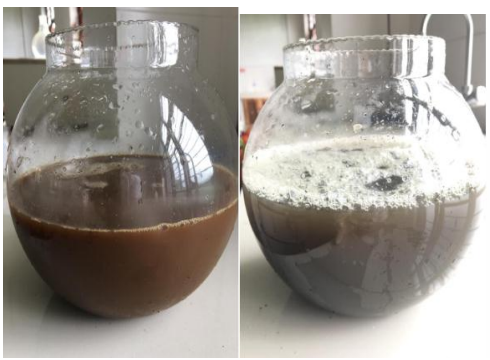

Fig 4 : Leachate before and after treatment with chlorella vulgaris

The dosage taken is 1000 mg/L and the initial contact time taken was 5 min. Contact time is then varied to 10 min, 15 min and finally to 20 min. The values obtained were noted down for each contact time.

Table -2: Values obtained after 5 minutes contact time with chlorella vulgaris

Sl no	parameter	APHA method	Unit	Obtained values	CPCB Disposible limits
1	COD	5520 B	mg/L	25660	Max 250
2	Ammonia	4500 NH_3 B	mg/L	22.2	Max 30
3	Nitrate	4500 NO_3 B	mg/L	845	No limit

Table -3: Values obtained after 10 minutes contact time with chlorella vulgaris

Sl no	parameter	APHA method	Unit	Obtained values	CPCB Disposible limits
1	COD	5520 B	mg/L	22840	Max 250
2	Ammonia	4500 NH_3 B	mg/L	21.3	Max 30
3	Nitrate	4500 NO_3 B	mg/L	810	No limit

Table -4: Values obtained after 15 minutes contact time with chlorella vulgaris

Sl no	parameter	APHA method	Unit	Obtained values	CPCB Disposible limits
1	COD	5520 B	mg/L	19762	Max 250
2	Ammonia	4500 NH_3 B	mg/L	19.3	Max 30
3	Nitrate	4500 NO_3 B	mg/L	763	No limit

Table -5: Efficiencies obtained (in %) with varying contact time (with Chlorella)

	5 min	10 min	15 min	20 min
COD	9	19.09	29.61	46.73
Ammonia	3.04	7.86	16.95	40.86
Nitrate	3.77	7.31	12.91	22.51

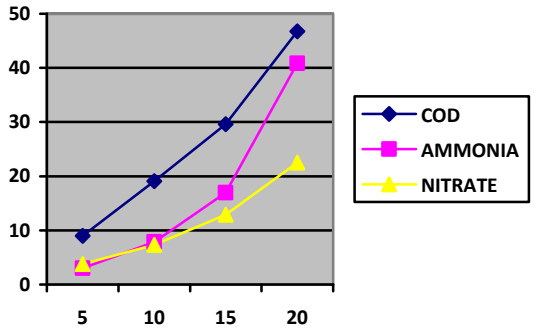

Chart -1: Removal efficiencies obtained for various parameters under varying contact time

4. CONCLUSIONS

The optimum contact time is 20 minutes and optimum dosage is 1000 mg/l.

Chlorella is found to be efficient, and also the maximum removal efficiency is attained at 20 min contact time.

Removal efficiency for COD, ammonia, nitrate are 46.73%, 40.86%, 22.51% respectively for a dosage of 1000mg/L and contact time 20 min.

Hence the use of Algae can be mentioned as a promising method for the treatment of leachate.

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