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Evaluating The Potential Of Biochar As Landfill Liner For Leachate Prevention

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ABSTRACT

This project aims is to create a of biochar based landfill liner. Leachate, a byproduct of landfill waste, contains various hazardous substances that can pollute the surrounding environment if not managed properly. Traditional landfill liners made of synthetic materials have been effective in preventing leachate seepage, but they are costly and can have negative environmental impacts. Biochar, a type of charcoal produced from organic material (Sewage sludge in our case), has been identified as a promising alternative liner material due to its high porosity and adsorption capacity. In this project we plan on conducting laboratory experiment to test the effectiveness of biochar as a landfill liner material.

Keywords: Biochar, Landfill, Liner, Leachate

INTRODUCTION

Landfill is a integral part of SWM system, where waste is disposed of in engineered site, However the leachate generated from the decomposition of waste poses a significant risk to the environment due to its high concentration of pollutants. Biochar a carbon rich material produced from the pyrolysis of organic matter, has been shown to possess several beneficial properties for use a landfill liner. The biochar property includes high porosity, high surface area, and chemical stability.

OBJECTIVES

1. To utilize as a filtration medium.

2. To maintain stable pH.

3. To enhance Leachate retention and microbial activity.

LITERATURE REVIEW

1. P.R. Yashika et al., presents a critical review of biochar's role in circular bioeconomy and environmental remediation, focusing on production methods, characterization, stability, and applications for addressing ecological issues. It highlights the growing enthusiasm for utilizing waste biomass-derived biochar to remove contaminants and emphasizes decentralized production as a means to create jobs and manage waste. The review also addresses current knowledge gaps and future perspectives in using biochar for toxic pollutant remediation

2. Lei Zhao et al. “Sewage sludge derived biochar for environmental improvement: Advances, challenges, and solutions” reviewed the use of biochar derived from sewage sludge as a sustainable method to manage rising sludge production, finding it effective for contaminant removal in water, soil remediation, and carbon emission reduction. The authors comprehensively examined biochar's current applications, mechanisms, and capacities in these environmental improvement areas.

METHODOLOGY

Preparation of Biochar: collect sewage sludge from the sewage treatment plant and place the sewage sludge in a container and place it in the muffle furnace. Close the muffle furnace and set the temperature to 500^0c for 6hrs afterwards remove the sample and let it cool to room temperature.

Collection of Leachate: The leachate is collected fresh from MSW landfill site in the glass bottle and the collected Leachate is to be analyse the physical and chemical characteristics. The Leachate is diluted in distilled water for titration 10:1000ml.

Model setup: A mini landfill model is setup in laboratory using glass. In the model soil and biochar is putted in layers. 1st layer soil 2nd layer of biochar and 3rd layer of soil. The leachate is to be poured on top and collected at bottom of the model setup. The collected leachate needed to be analysed.

Fig: Sewage sludge turns into biochar

RESULT AND DISCUSSION

Physical and chemical characteristics of Leachate before process

Sl No	CHARACTERISTICS	LEACHATE	UNIT
1	pH	4	-
2	Colours	Black	-
3	Turbidity	260	JTU
4	Total solids	26.653	(mg/L)
5	Total suspended solids	13.803	(mg/L)
6	Total dissolved solids	13.85	(mg/L)
7	Total hardness	91.64	(mg/L)
8	Magnesium hardness	51.64	(mg/L)
9	Calcium hardness	41	(mg/L)
10	Alkalinity	13.8	(mg/L)

11	Chlorides	441.662	(mg/L)
12	COD	3487	(mg/L)

Physical and chemical characteristics of Leachate after process

Sl No	CHARACTERISTICS	LEACHATE	UNIT
1	pH	7.8	-
2	Colours	yellow	-
3	Turbidity	280	JTU
4	Total solids	15.432	(mg/L)
5	Total suspended solids	7.45	(mg/L)
6	Total dissolved solids	15.432	(mg/L)
7	Total hardness	16.8	(mg/L)
8	Magnesium hardness	6.8	(mg/L)
9	Calcium hardness	10	(mg/L)
10	Alkalinity	13.32	(mg/L)
11	Chlorides	266.86	(mg/L)
12	COD	3000	(mg/L)

1.. the pH of Leachate sample was 4 but after passing the biochar linear it nearly got neutralised that is 7.8.

2.The colour of Leachate turned yellow from black.

3. The chloride content is reduced from 441.662 to 266.86 mg/l.

4. The total hardness are also reduced significantly from 91.64 to 16.8 mg/l.

5. The suspended solids, total solids and TDS are also been reduced.

6. Calcium hardness and magnesium hardness are reduced to 10 mg/l and 6.8 mg/l.

7. COD has been reduced little bit from 3487 to 300 mg/l

8. Bio char liner can be used as filter medium.

CONCLUSION

The design and development of a biochar-based landfill liner as an alternative to conventional liners holds promise in reducing Leachate contamination. But unable to prevent leachate penetration. Ongoing research and collaboration are essential optimise the design, performance and regulatory compliance of biochar-based liners. This innovative approach contributes to sustainable waste management practised and environmental protection.

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