



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 10, October 2023

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

ijirset@gmail.com

www.ijirset.com

Experimental Investigation of Leachate Treatment Using Low-Cost Adsorbents

T. Sathieshkumar¹, J. Kavitha²

Assistant Professor, Gnanamani College of Technology, Pachal, Namakkal, Tamilnadu, India¹

PG Student, Gnanamani College of Technology, Pachal, Namakkal, Tamilnadu, India²

ABSTRACT: The aim of the project work is to treat the landfill leachate before disposal. The necessity for landfill leachate treatment is a requisite to reduce the environmental related to impact related to municipal solid waste land fill. If leachate is directly disposed into environment, it creates serious problems on the surrounding soil, ground water aquifers and nearby surface water. Therefore, great attention has been directed towards new techniques based on physio-chemical process, and heavy metals removal using low-cost materials as filter media with down flow reactor. Leachate generation is a major problem for municipal solid waste (MSW) landfills and causes significant threat to surface water and groundwater. Leachate can be defined as a liquid that passes through a landfill and has extracted dissolved and suspended matter from it. Leachate results from precipitation entering the landfill from moisture that exists in the waste when it is composed. Different consider while deciding for an appropriate treatment process. This paper presents the results of the analyses of leachate treatment from the solid waste land fill.

I. INTRODUCTION

Sanitary landfill is a process in the solid waste management system. It can be defined as “a method of disposing of refuse on land without creating nuisances or hazards to public health or safety, by utilizing the principles of engineering to confine the refuse to the smallest practical area, to reduce it to the smallest practical volume, and to cover it with a layer of earth at the conclusion of each day’s operation or at such more frequent intervals as may be necessary.”

Solid waste landfills may cause severe environmental impacts if leachate and gas emissions are not controlled. Leachate generated in municipal land fill contains large amounts of organic and inorganic contaminants. Leachate may also have a high concentration of metals and contain some hazardous organic chemicals. The removal of organic material based on COD, BOD and ammonium from leachate is the usual prerequisite before discharging the leachate into natural waters.

OBJECTIVE OF THE STUDY

Our main objective is to treat the landfill leachate using low-cost adsorbents.

- To utilize a natural low-cost material for treating leachate concentration. To avoid potential risks and hazards to public health and ecosystem.
- On purpose of purifying leachate liquid for final discharge to natural Water body and land disposal.
- To reduce the filtration of leachate through waste thus minimizing the migration of toxic pollutant.

II. METHODOLOGY

The method of systematically, theoretical analysis applied to a field of study is called methodology, it comprises the theoretical analysis of the body of method and principles associated with the branch of knowledge.

- Sample collection
- Sample testing
- Treatment by natural materials
- Testing after treatment
- Result & discussion

III. MATERIALS USED

The following are the adsorbents used to treat leachate,

- Sugarcane bagasse
- Laterite soil
- Brick bat

A. SUGARCANE BAGASSE

Sugarcane bagasse is a lingo cellulosic fibre residue obtained from sugar cane culm , after the culm is milled and the juice is extracted. The average composition of sugar cane is 66–75% water, 12–18% sugars, 9–14% fibres and 13–23% soluble solids. The cane basically consists of juice and fibre (Santaella, 2007). The sugar cane bagasse has the following composition (by weight): cellulose,41.8%; hemi cellulose (aspentosan), 29.0%; lignin, 21.6% Developing countries account for more than 68% of current global sugar consumption, particularly in Asia—and are expected to be the primary source of future demand growth. Brazil is the major player and the most competitive supplier in the world sugar market, with the lowest production costs both infield and factory Sugarcane bagasse presented a lower content of lignin than the other lingo cellulosic materials evaluated, and a high average content of extractives and holo cellulose.



Fig . 1 Sugarcane bagasse

B. LATERITE SOIL

Late rite is both a soil and a rock type rich in iron and aluminum and is commonly considered to have formed in hot and wet tropical areas. Nearly all laterites are of rusty-red coloration, because of high iron oxide content. They develop by intensive and prolonged weathering of the underlying parent rock. Tropical weathering (laterization) is a prolonged process of chemical weathering which produces a wide variety in the thickness, grade, chemistry and ore mineralogy of the resulting soils. Laterites are a source of aluminum ore; the ore exists largely in clay minerals and the hydroxides, gibbsite, boehmite, and diaspore, which resembles the composition of bauxite. In Northern Ireland they once provided a major source of iron and aluminum ores. Laterite ores also were the early major source of nickel.



Fig. 2 Laterite soil

C. BRICKBATS

Brick bats is defined as a cut portion of brick , generally the brick is cutted along the width and the length of brick piece is smaller then the original brick. brickwork, a bat (or, sometimes, batt) is a shorter and sometimes shaped section of a single brick to fit a specific need in the patter no bricklaying being performed he required quantity of brick bats is taken as filter media for treating landfill leachate. The following shows the image of brickbats, which removes heavy metals present in the leachate.



Fig. 3 Brickbats

IV. TESTS

- PH
- TURBIDITY
- BIOCHEMICAL OXYGEN DEMAND
- CHEMICAL OXYGEN DEMAND
- TOTAL DISSOLVED SOLIDS
- CONCENTRATION RANGES FOR COMPONENTS OF MUNICIPAL LANDFILL LEACHATE
- EFFECT OF COMPONENTS

V. TREATMENT METHOD

Landfill leachate is basically originated from infiltrated rainwater fraction in the cell of the landfill and water present in the mass grounded waste. Solid waste landfills may cause severe environmental impacts if leachate and gas emissions are not controlled. Leachate generated in municipal landfill contains large amounts of organic and inorganic contaminants. During treatment adsorbents will remove the heavy metals present in the leachate.

A. METHOD

- Land fill leachate is collected from municipal solid waste landfills NATHAM Reactor body: -Prefabricated PVC pipe material: Laterite soil, brick bats and sugarcane bagasse
- PVC pipe having 57.15 mm internal diameter and 1067 mm height is used.
- Each reactor are provided with 100mm free board at the top; distance of 957 mm is maintained between in let and outlet port which were kept Constant in all reactors.
- Flow reactors R1, R2 ,R3 are used for study purpose.
- R1-consisting of laterite soil as filter media, R2-consisting of brick bats, R3-consisting of sugarcane bagasse, combination of all filter media in layers.
- Reactors are completely filled with filter media with light compaction.

VI. TEST RESULTS

A. Ph TEST RESULTS

Before treatment	=4.6mg/l
After treatment using, Sugarcane bagasse	= 5.2
Late rite soil	= 7.8
Brick bats	= 6.3

B. TURBIDITY RESULTS

Before treatment	= 0.57 mg/l
After treatment using, sugarcane bagasse	= 2mg/l



late rite soil = 5.2.mg/l
 brick bats = 2.54mg/l

C. TOTAL DISSOLVED SOLIDS

Before treatment,
 Suspended solids = total solids – dissolved solids =2.9-1.4
 = 1.3mg/l

After treatment using,
 sugarcane bagasse = 0.6mg/l
 laterite soil = 0.4mg/l
 brickbats = 0.9mg/l

D. BOD

BOD of leachate before treatment=10,000mg/l
 After treatment using,
 sugarcane bagasse = 623mg/l
 laterite soil = 275mg/l
 brickbats = 898mg/l

E. COD

COD of leachate before treatment = 30,127mg/l
 After treatment using,
 Sugarcane bagasse = 6508mg/l
 Laterite soil =1502mg/l
 brickbats =2598mg/l

F. HEAVY METALS REMOVAL FROM LEACHATE

The Atomic Absorption Spectrophotometer (AAS) (SHIMADZUAA-7000, Japan) was used for the determination of concentration of the metal ions present in the samples by reading their absorbance and comparing it on the respective standard calibration curve. Three replicate determinations were carried out on each sample and same analytical procedure was employed for the determination of elements in digested blank solutions and for the spiked samples.

The limit of detection for the heavy metals Cd, Cu, Pb, Zn and Cr was found to be 0.003, 0.01, 0.015, 0.002 and 0.01 mg /L respectively.

G. CONCENTRATION IN LEACHATE

Heavy metals	Limit in mg/l
Cadmium(Cd)	0.01
Zinc(Zn)	5.48
Lead(Pb)	5.00
Chromium(Cr)	0.10
Copper(Cu)	0.20

Table 2 Leachate concentration

There were significant differences in the heavy metal concentrations of the leachates from the various waste dumpsites. The minimum and maximum mean concentrations of cadmium in leachates were 0.03 and 0.10 mg/L from Kojokrom and Essipong waste dumpsites, respectively. Leachates from Effiakuma and Ntankoful waste dump sites recorded the same concentrations For cadmium (0.05mg/L).The minimum and maximum mean concentrations of zinc in leachates were 0.20 and 5.48 mg/ L from Kojokrom and Essipong waste dump sites, respectively. Mean lead concentrations in the leachate samples from Kojokrom and Essipong waste dumpsites were the same. The minimum and maximum mean concentrations of chromium in leachates were 0.38 and 0.55 mg/L from Essipong and Effiakuma waste dumpsites, respectively. The minimum and maximum mean concentrations of copper in leachates were 0.17 and 0.90 mg/L from Effiakuma and Essipong waste dumpsites, respectively.



Metals	Sugarcane Bagasse (mg/l)	Laterite Soil(mg/l)	Brickbats (mg/l)
Copper	0.02	0.005	0.051
Lead	3.3	2.0	4.10
Zinc	4.0	3.4	4.2
Nickel	0.1	0.025	0.52

Table 3 Results of heavy metals after treatment

IV. RESULTS AND DISCUSSION

The leachate sample was collected from landfill site using cans. we have used sugarcane bagasse, laterite soil, brick bats as filter media for leachate treatment. The above results indicate that laterite soil removes the contaminants in the leachate when compared with other adsorbents. **After** treatment of landfill leachate using sugarcane bagasse, laterite soil, brick bats as filter media in PVC pipe, the effluent obtained from laterite soil as filter media contains less toxicity when compared with other adsorbents.

Laterite soil > Sugarcane bagasse > Brickbats.

Hence laterite soil, sugarcane bagasse are easily available, the process can be done for the treatment of landfill leachate which has been proven successfully.

V. CONCLUSION

The reactor R1 which is filled with laterite as filter media is more efficient than compare to other reactors in removal of both heavy metals and physico-chemical parameters. Sugar cane bagasse and brick bats filter medias which contains high amount of dissolved organic matter which increases the dissolved solid content and Electrical conductivity. The removal of heavy metals is observed in both laterite and other filter media. The percentage of toxic content removed by laterite soil was 83%when compared to other filter medias. sugarcane bagasse can reduce the toxic content up to 62% which is higher when compared to brick bats 43%.Thus sugarcane bagasse, laterite soil are the best one to reduce toxic content in leachate. Leachate control is a very important step to receive the long-term functionality of the drainage system, to reduce treatment costs and to render possible high tech treatment systems. Now a days more than 100 leachete treatment plants are under operation in Germany, so there are many experiences concerning the technology, costs, the effluent quality and associated problems. In some cases the treatment of leachate resulted in increasing operation problems in opposite to the treatment of other wastewaters. The selection of the adaequate treatment process should not only include the compliance with the effluent limit values and maintenance but also the production of residuals which have to be further treated or disposed.

REFERENCES

- 1) B.Inanc, B.Calh, A.Saatçi Characterization and anaerobic treatment of the sanitary landfill leachate in Istanbul Water Sci(2015).
- 2) Abbas A.A., jinsong, Rekabi W.S.Review on landfill leachate treatments. Journal of Applied Sciences Research(2009).
- 3) G.Andreottola, P.Cannas chemical and biological characteristics of landfill leachate.
- 4) Technical Instructions on Waste from Human Settlements (TASiedlungsabfall). Dritte Allgemeine Verwaltungsvorschrift zum Abfallgesetzvom 14. Mai 1996, Technische Anleitung zur Verwertung, (1996)
- 5) Anhang51: Oberirdische Ablagerungv on Abfällen, Allgemeine Rahmen Verwaltungs Mindestanforderungen an das Einleitenvon Abwasser in Gewässer, Germanregulation (1993).
- 6) Caziani,R.,Cossu,R. (1989): Landfill Hydrology and Leachate Production, from Chrisensen, Cossu, Stegmann (Eds.) Sanitary Landfilling: Process, Technology and Environmental Impact, Academic Press (1989).
- 7) Christensen, T.H., Kjeldson, P. (1989): Basic Biochemical Processes in Landfills, from: Chrisensen, Cossu, Stegmann (Eds.) Sanitary Landfilling: Process, Technology and Environmental Impact, Academic Press(1989)



INNO SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 8.423



ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

9940 572 462 6381 907 438 ijirset@gmail.com



www.ijirset.com

Scan to save the contact details