PERFORMANCE EVALUATION OF LANDFILL LEACHATE TREATMENT USING COIR PITH AND COCONUT SHELL ACTIVATED CARBON

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ABSTRACT

The report deals with evaluation of the performance of Landfill Leachate treatment using natural adsorbents. Inorganic and organic pollutants present in the Leachate continue to pose major problems in receiving water bodies and to the environment. To overcome such problems, natural adsorbent materials are used to minimise their negative environmental impact. In order to find out the effective natural adsorbents for the treatment of landfill leachate, two locally available low cost adsorbents such as Coir Pith and Coconut shell Activated carbon were analysed by using fixed bed Vertical column adsorption Studies. The study also determine the efficiency of the adsorbent materials with time to remove contaminants from semi aerobic stabilized landfill leachate. For this study, one vertical column reactors of same dimensions such as 10.5 cm Diameter, I meter Length were fabricated providing adsorbents depth of 60 cm from the bottom and the columns were packed with pre-treated neutralized Adsorbents Coir Pith and coconut shell Activated carbon respectively. The semi aerobic landfill leachate taken for this study were analysed for its initial characteristics and noted. It was then allowed to down flow through the vertical column from the top at the flow rate of 0.5 ml/min. The treated outlet collected at the interval of 7 days from the outlet Nozzle provided at the bottom of the column and their characteristics were analysed and compared with the initial.

KEYWORDS: Natural Adsorbents, Coir Pith, Coconut shell Activated carbon, fixed bed, Vertical Column, Leachate treatment.

INTRODUCTTION

Solid waste management becomes a major problem in the world nowadays. This is because of the increase in population and the changing lifestyle of the people. Due to the accumulation of a large number of people within small areas due to urbanization, the generation of waste becomes more and more that too because of their modern lifestyle. The improper solid waste management may lead to illegal dumping of waste on nearby land or open burning which may result in out bursting of vector-borne diseases and may cause health hazards to the people and other living organisms. The effective solid waste management process requires skilled personals, necessary funding, and proper infrastructure, legislation, knowledge, and public awareness on solid waste issues. Usually, the wastes are the residue part of raw materials left over after primary use that may be generated through our daily activates. It is easy to generation is also lesser in quantity that doesn't need any special treatment process for their safe disposal since it contains the major amount of decomposable waste and only a small amount of recyclable materials. The probability of toxic wastes also less and hence the solid waste

management process becomes easier in rural areas. But in some cases, the agricultural wastes such as the residues from chemical fertilizers may cause soil infertility, water pollution and may leads to ground water contamination. Municipal Solid Waste generation including Biodegradable waste, Recyclable materials, inert waste, etc. It contains a major fraction of organic than ash and fine earth as well as paper and plastics, where glass and metals are present in the very little amount (P. Banerjee et al., 2018). The improper management of solid waste may lead to many harmful effects on the people and the environment. In order to minimize these adverse effects and to minimize the quantity of solid waste produced, a proper management plan should be needed.

Landfilling is one of the most popular and common municipal solid waste disposal techniques used in most countries around the world since it is cost-effective in practice. But it needs proper management using skilled labourers that make it difficult to execute in developing countries like India. There are some negative effects due to the landfill pollution on people as well as to the local environment especially the groundwater contamination becomes a major threat. Also, the soil becomes more polluted. When the waste started rotting or began decomposing, it will produce some harmful gases such as CO2 and Methane. On being the greenhouse gases it may contribute to global warming. It may produce some other toxic gases that will cause a serious threat to the environment and cause lung and heart diseases in humans.

Landfill leachate is a liquid which is dark in colour similar to the sewage with a strong odour often known as a heavily polluted wastewater. It is generated from the excess water percolated through the mixture of wastes containing organic and inorganic materials dumbed in the number of layers in the landfill. It is produced only when the sufficiently high moisture content is available as such in case of rainfall, surface runoff intrusion, snowfall, etc. in the landfill to make the liquid flow through the layers of the landfill wastes due to gravity. It helps the interaction of liquid with the wastes and helps in biochemical and hydrological reactions to takes place that makes the liquid change in its characteristics such as the increase in biological oxygen demand and also the chemical oxygen demand since it contains a high concentration of heavy metals like iron, lead, copper, zinc, manganese, etc., ammonia nitrogen, biodegradable and non-biodegradable organic compounds and salts.

Due to the insufficient landfill leachate treatment, Environmental pollutions, Water contamination and health problems frequently occur. The major sources of heavy metals in landfills are detergents, fluorescent tubes, pharmaceuticals, individual care goods, photographic chemicals, garden pesticides, waste oil, electronic waste, batteries, paint, electrical tools, etc. When the nearby water sources are polluted by these leachates containing heavy metals, it will lead to bioaccumulation causing health hazards.

co-treatments of landfill leachate along with wastewater.

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MATERIALS AND METHODS

Description of study area

The study of solid waste produced in the Thanjavur city is mainly consists of residential and commercial area waste products. Disposal of increasing quantities of urban solid waste is a major challenges for Thanjavur Municipal Corporation (TMC). The present method of solid waste disposal in the city has not follow the scientific way of disposal and thereby posing threat to environment and sanitation. For this study, leachate samples were collected from the active detention pond, which has a leachate age of less than 8 years.

For the presence study, Town of Thanjavur, Tamilnadu was chosen. The town Thanjavur is located at $10^{o}48'N$ $79^{o}09'E$ $10.8^{o}N$ $79.15^{o}E$. The tributaries of river Cauvery, namely, the Grand Anaicut canal (Pudhaaru), Vadavaaru rivers flow through the city. It is situated in the Cauvery delta, at a distance of 314 km (195mi) south-west of Chennai and 56 km (35 mi) east of Thiruchirapalli. The city has an elevation of 57 m (187 ft) above mean sea level. The total area of the town is 36.33 km2 (14.03 sq mt) and with14 divisions covering 51 wards. The town has an elevation of 57 meters above mean sea level. The population of the area is 2, 22,943 (Census India 2011). India raise concern over its proper disposal and treatment processes like biological treatment which involve treatment through aerobic and anaerobic bacteria, adsorption process on activated carbon, reverse osmosis and coagulation method with some modifications and their adaptability to Indian conditions.

The schematic of the apparatus and set-up used for the leachate treatment is column study. In this experiment two columns were fabricated to test the effluent that are coming out from the column. The column is of 10 cm diameter and 90 cm height. The absorbent packed up to 25 cm and 35 cm in the column and the collecting port is placed at the bottom of the column. Two packed bed were allowed to saturate by using water for two days and then the leachate is allowed to flow on the upper surfaces at 0.5 ml/min. The effluent were collected regularly from third day for testing.

Adsorbent Materials

- Coir Pith is collected from coir board industry thanjavur.
- Activated coconut carbon shell is collected from coconut industry near coimbatore.

Initial characteristics Leachate

Leachate parameter	Analysis Result	Standard Limit(CPCB)
pH	**8.21**	**6.5-9.0**
Temperature	**27^0C**	**40^0C**
Turbidity(NTU)	**199.2**	**-**
Tss(mg/L)	**1695**	**350**
COD(mg/L)	**1416**	**250**
BOD(mg/l)	**42**	**2**
Total solids(mg/l)	**6500**	**500**

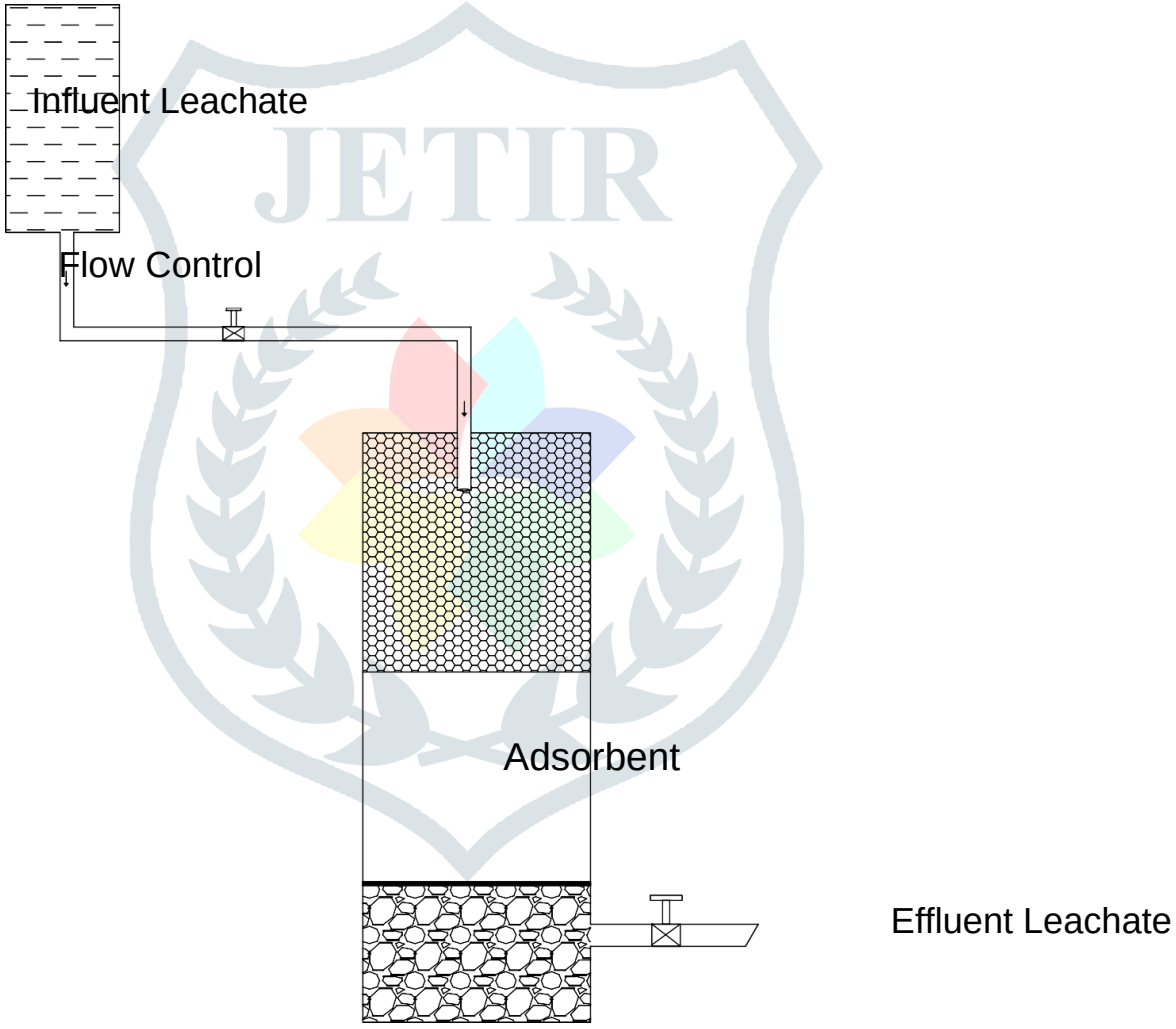


Figure 3.1 Fixed Bed Column

Results and Discussion

This study has been carried out the treatment of municipal solid waste landfill leachate waste water by using natural adsorbent. Due to the resultant leachate from waste decomposition in landfills has polluter potential hundred times greater than domestic sewage, this is considered a problem related to the depreciation of environment requiring pre-disposal treatment. In seeking to improve this situation, this project proposes the treatment of landfill leachate using natural adsorbent. The study was conducted in laboratory scale. In trials, the

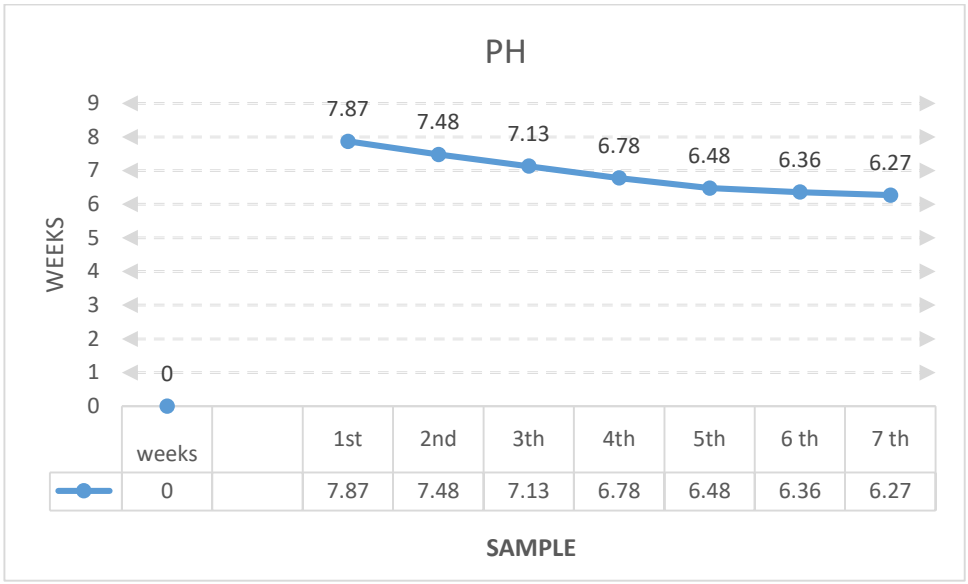
effluents were characterized as pH, Chemical Oxygen Demand (COD), Total suspended solids. The results indicate that is technically promising since that the use of certain natural fibers in the reduction of pollutants in leachate have been obtained results of pH, COD, Total solids, Total suspended solids. The expectation generated is to continue evaluating the association of efficiency of other natural fibres with other landfill leachate treatment process. The results obtained after the treatment of leachate from column are analysed for its physical-chemical characteristics such as pH, Total suspended solids, Total Solids (TS), and COD for 25 cm and 35 cm depth of coconut shell and coir pith packed column. The effluent after treatment were collected after two days of saturation from the column for analysis, The total solids and Total suspended solids are saturated in 4th day. pH and COD analysis are carried out up to five week to obtained effective results. The obtained results of the above said parameters have been presented in graphical and tabular form.

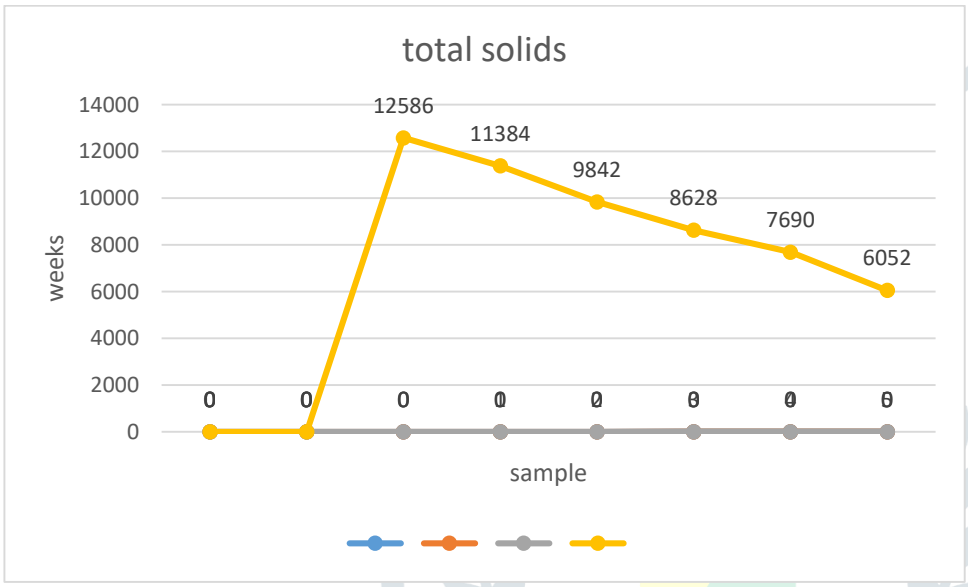
The column was designed as activate coconut carbon shell packed bed column. The experimental setup was kept up to 40 days. The 25 cm packed bed adsorb 1750 ml per day and 35 cm packed bed adsorb 3700 ml per day. Test on effluent were carried out for first 5 days continuously to check out the PH, Totals suspended solids, COD. After that the test were carried out 50 days continuously. Both setup are kept up to 5 weeks for observation.

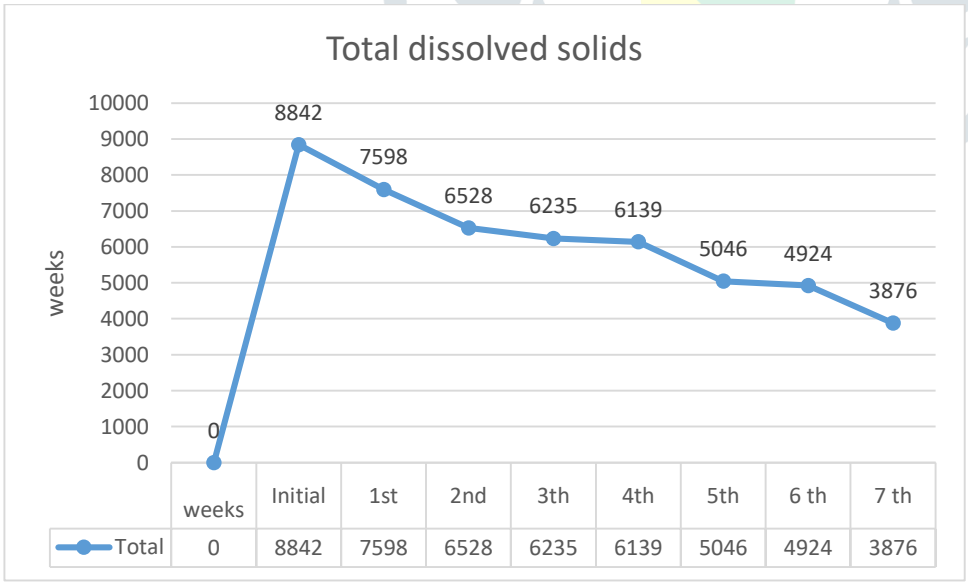
The column is fabricated by glass, from techno scientific. . The flow rate is 0.5 ml/sec. The outlet was to collect the effluent after leaching. Leachate influent was introduced to column by BT300-2J peristaltic pumps (Baoding Longer Precision Pump co., Ltd). The column was also equipped with fine screen and coarse screen to prevent clogging.

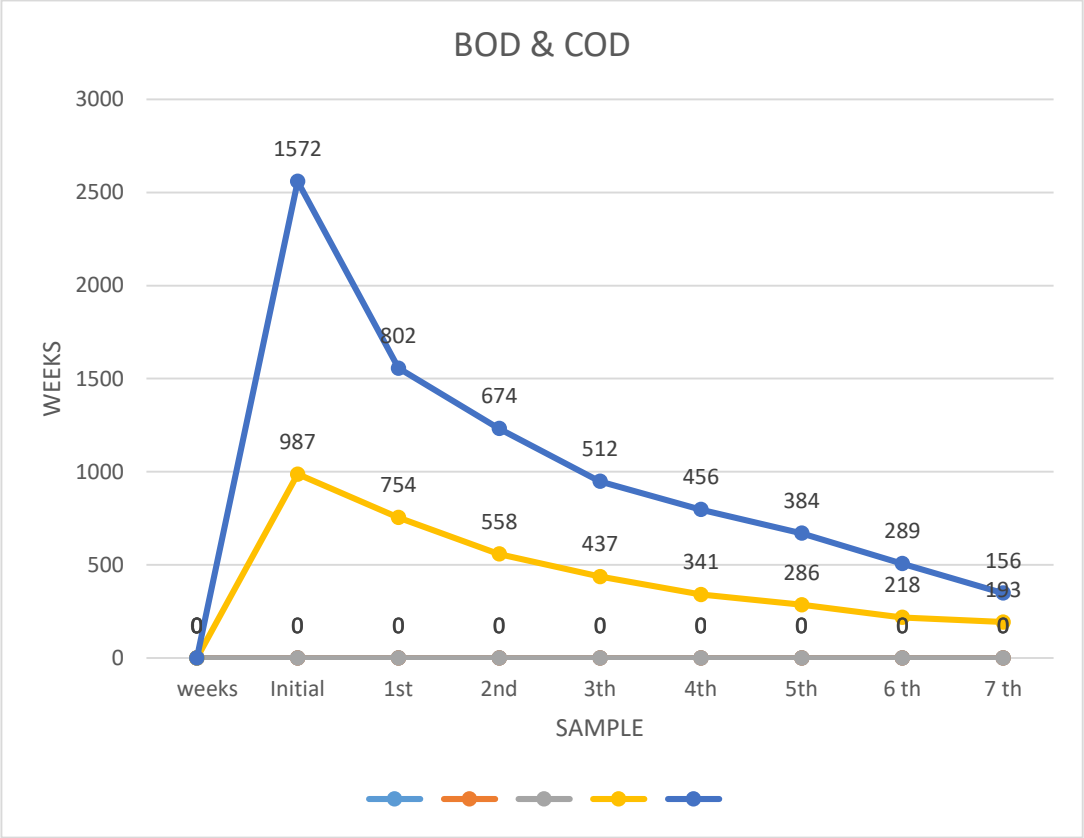
Table 3.1: After treatment the characteristics of leachate from 25 cm coir pith and 35 cm of activated carbon packed bed

SI.NO	weeks	pH	Total Solids(mg/L)	Total Dissolved Solids(mg/L)	BOD(mg/l)	COD(mg/l)
	Initial	8.31	12586	8842	987	1572
1	1st	7.87	11384	7598	754	802
2	2nd	7.48	9842	6528	558	674
3	3th	7.13	8628	6235	437	512
4	4th	6.78	7690	6139	341	456
5	5th	6.48	6052	5046	286	384
6	6th	6.36	5879	4924	218	289
7	7th	6.27	4648	3876	193	156


PH
WEEKS
SAMPLE
7.87
7.48
7.13
6.78
6.48
6.36
6.27
weeks
1st
2nd
3th
4th
5th
6 th
7 th
0
7.87
7.48
7.13
6.78
6.48
6.36
6.27


total solids
weeks
sample
12586
11384
9842
8628
7690
6052


Total dissolved solids
weeks
8842
7598
6528
6235
6139
5046
4924
3876
Initial
1st
2nd
3th
4th
5th
6 th
7 th
Total
0
8842
7598
6528
6235
6139
5046
4924
3876



CONCLUSION

The leachate samples were collected and its characteristics were analysed and observed such that pH as 8.36, Turbidity as 420 NTU, Chemical oxygen Demand as 1572 mg/l, Biological Oxygen Demand as 912 mg/l, Total Solids as 17724 mg/l and Total Dissolved Solids as 8842 mg/l. Thus the evaluation of the performance of Landfill Leachate treatment using two locally available low cost natural adsorbents such as Coir Pith and coconut shell were analysed by using fixed bed Vertical column adsorption Studies separately for each adsorbent. The treated outlet collected at the interval of 7 days from the outlet Nozzle provided at the bottom of the column and their characteristics were analysed regularly. There is no remarkable difference in pH variation between these two adsorbents and is reduced to the value around 6.2. There is a remarkable change in Chemical Oxygen Demand and Biological Oxygen Demand at 5 weeks of time as 12 mg/l and 105 mg/l for coconut shell while for coir pith, the same is observed after 7 weeks of time as 64 mg/l and 142 mg/l. From the results analysed, it is observed that coconut shell as an Adsorbent is more efficient in reducing the Biological Oxygen Demand and Chemical Oxygen Demand when compared with the coir pith and showing better results in lesser duration of treatment. Hence coconut shell activated carbon can be used more efficiently in Leachate treatment which is cost effective, easy to handle and easily available.

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