

COLUMN STUDY ON LANDFILL LEACHATE USING NATURAL ADSORBENT

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ABSTRACT

This study has been carried out for the treatment of landfill leachate waste water by using natural adsorbent. Due to the resultant leachate from waste decomposition in landfills has polluter potential greater than domestic sewage, this is considered a problem related to the 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, Total 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 as pH, COD removals between 34.7% and 79.2%, Total solids between 15.4% and 83.5%, Total suspended solids between 33.4% and 83.3% respectively.

Key words : Landfill, Landfill Leachate, Rice husk, packed bed column, COD removal. Dumping yard.

1.INTRODUCTION

Landfill often cause problems due to lack of management. Landfill leachate is a liquid drained from landfill solid waste during the time of rainfall. The liquid which is formed by leaching process of disposal waste can percolate or infiltrate into groundwater then to surface water, can contaminate groundwater, soil and surface water. It contains complex contaminants including organic matter (both biodegradable and non-biodegradable carbon), ammonia-nitrogen, heavy metals, chlorine organic and inorganic salts. Iron generated by domestical and industrial waste is common heavy metal found in landfill leachate. Thus, it is a challenge to find appropriate treatment to reduce contaminant on landfill leachate. Due to its complexicity contaminants, combined treatment of physical, chemical, and biological have been usually used to improve the treatment efficiency of landfill leachate. But all the above methods are very expensive. Adsorption is a common method used in physical-chemical treatment. Rice husk is an adsorbent used in this study. This study has been carried on column experiment.

2. MATERIALS AND METHODOLOGY

2.1. Material preparation

Rice husk were collected from nearby rice mill in Thanjavur, rice husk were washed several times with distilled water and air dried. Acid treatment to the materials were carried out by mixing with 0.5 M citric acid in a ratio of 1000g materials to 7 ml citric acid for 30 minutes in order to ensure that materials had completely imbedded the liquid as described by ma et al (1999). These materials were dried in a hot air oven at 110°C for 24 hrs. These materials were washed with distilled water and were soaked in 2% of sodium carbonate (NaHCO₃) solution and were allowed to stand overnight to remove the residual acid. Then the materials were washed with distilled water. Finally, these materials were dried in hot air oven at 110°C for 24 hours. The dried materials were ground and sieved to get the particle size of 0.45 mm to 0.50 mm for this study.

2.2. Landfill leachate collection

Landfill leachate is collected from srinvasapuram dumping yard. Srinivasapuram dumping site is located at city of Thanjavur. The dumping site is located on 10.470 N and 79.80 E, the total area of the dumping yard is 22 acre. This city generates solid waste of 121 tons per day. The landfill is equipped with leachate collection system. However, there is no leachate treatment system prior to discharge. Leachate samples were collected from leachate collection pond.



Figure 1: Raw leachate collected from srinivasapuram dumping site

2.3.Characterization of Leachate:

About 40 liter of leachate sample was collected from landfill site. The parameters analyzed were pH, Total suspended solids (TSS), Total solids (TS), BOD and COD, turbidity.

Table 1.1: Initial test result for Leachate

LEACHATE PARAMETER	ANALYSIS RESULT	STANDARD LIMIT(CPCB)
pH	8.76	6.5-8.5
Temperature	27 ⁰ C	40 ⁰ C
Turbidity (NTU)	199.2	-
TSS(mg/L)	1695	350
COD(mg/L)	1416	250
BOD(mg/L)	42	30

2.4. PREPARATION OF COLUMN

Column used in research was made of a vertical cylindrical column with a depth of 75 cm, and diameter of 10 cm. The bottom of the column is flat and opening is kept at the side of the column, which is located 1 cm above the base line. Fine screen and coarse screen are placed at the outlet to collect the effluent free from any solids particles. The column was packed with rice husk upto and 60 cm.



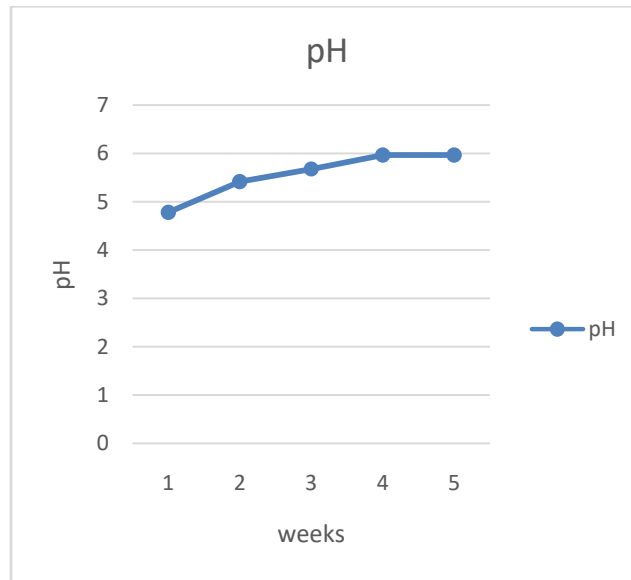
Figure 2: Experimental setup of 60 cm rice husk packed bed column

The column was packed with rice husk upto 60 cm depth and supported with steel stand. on the top of column to distribute landfill leachate onto the surface of adsorbent and to keep flow rate constant. The flow rate is 0.5 ml/sec. The outlet was to collect the effluent after leaching. Leachate influent was introduced to column by Rivotex peristaltic pumps. The column was also equipped with fine screen and coarse screen at the outlet to prevent clogging. The column was designated as rice husk packed bed column. The experimental setup was kept upto 40 days. The loading rate of leachate sample is maintained at 0.5 ml/sec for the entire experiment and samples were filled in the overhead tank for every 10 hrs. The 60 cm packed bed adsorb 5200 ml of leachate per day. Test on effluent were carried out for first 5 days continuously to checkout the pH, Total solids, Total suspended solids, COD. COD and Ph analysis were carried out in an regular interval of 6 days once to obtained effective results.

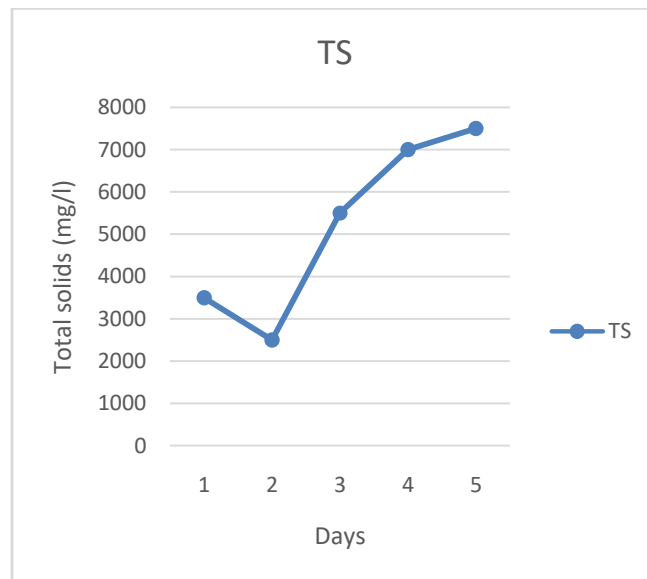
3. RESULT AND DISCUSSION

The results obtained after the treatment of leachate from column are analyzed for its physical-chemical characteristics such as pH, Total suspended solids, Total Solids (TS), and COD for 60 cm depth of rice husk packed column. The effluent after treatment were collected after two

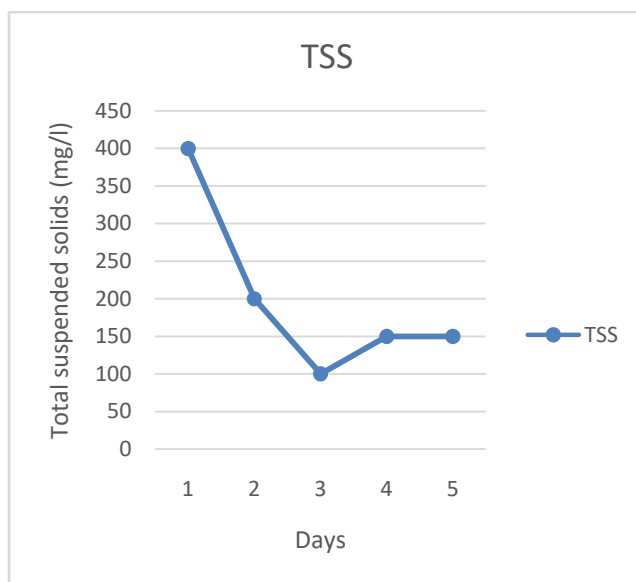
days of saturation from the column for analysis, The total solids and Total suspended solids are saturated in 4th day. pH and COD analysis are carried out upto five week to obtained effective results. The obtained results of the above said parameters have been presented in graphical and tabular form.



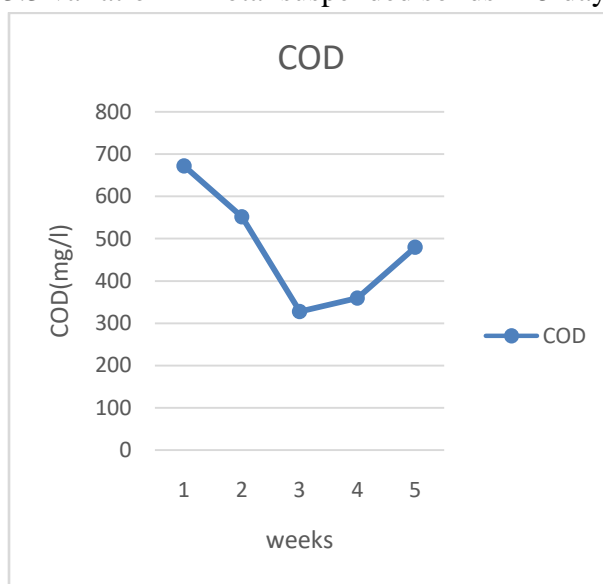
3.1 variation in pH in 5 weeks



3.2 variation in Total solids in 5 days



3.3 variation in Total suspended solids in 5 days



3.4 variation in COD level in 5 weeks

Table 3.1: Result obtained from rice husk packed bed column

Si.no	Day	Total solids(mg/l)	Total suspended solids(mg/l)
1	3 rd	3500	400
2	4 th	2500	200
3	5 th	5500	100
4	6 th	7000	150
5	7 th	7500	150

Table 3.2: Result obtained from rice husk packed bed column

SI.NO	WEEKS	pH	COD(mg/l)
1	1 st	4.78	672
2	2 nd	5.42	552
3	3 rd	5.36	328
4	4 th	5.73	365
5	5 th	5.97	480

4. CONCLUSION

The sample of leachate were collected and analyzed, its characteristics such as pH, COD, Total solids, Total suspended solids. It is estimated that the sample of leachate contains high amount of Total solids, Total suspended solids, COD beyond the standard limits. The result of present analysis shows that, the rice husk has been an effective adsorbent for the removal of organic matter from the effluent. Although higher doses of rice husk are required for the COD removal, the operation is feasible because of low cost of rice husk. In the column operation 79.2 % COD removal is observed. Further for more effective operation adsorption column in series can be used. Adsorption process is more effective to remove the biodegradable and non-biodegradable organic matter in landfill leachate. Experiment is done in lab scale for the flow rate of 0.5ml/per/sec for the reaction time of 40 days and it is found that this set up has removed 328mg/l of COD, 2500mg/l of TS, 100 mg/l of TSS, from 60 cm depth respectively. Due to its low cost and low maintenance and the availability level of adsorbent this method is very effective in the treatment of leachate.

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