

“Design of Leachate Bioreactor for Dilkap College”

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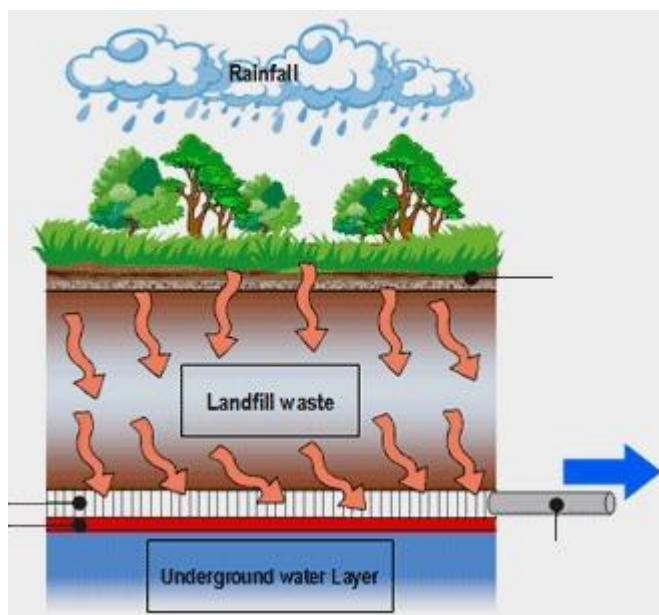
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Abstract - The landfill leachate is a main issue in the waste management because of its various pollutants contain in the leachate. This leachate pollutes and infiltrates the ground waters. Increased population growth has accelerated the generation of solid wastes and at the same time available land suitable for proper waste disposal is very limited. The main aim of this research is to study about treatment of leachate, and converting them to usefull gas.

Key Words: leachate, landfill.

1. INTRODUCTION

For this a model was created using a tank having dimension 1.15m x 0.65m x 1.08m and a outlet was provided on the lower side so that leachate can be collected. The model consisted of 4 layers comprising of gravels in the lowest layer covered by soil above it. The gravel and the soil both was collected and dug up from the campus of the college. The waste collected from canteen of Dilkap college, Neral, Maharashtra made up the third layer. A big layer of soil was again placed on this waste and the whole tank was placed in a pit that was dug up for the experiment and covered it up by soil on the exterior part. This setup was done to protect the model from direct sunlight. The leachate thus formed with the passage of time will be used in bioreactor to convert it into methane gas. This gas can further be used in our day to day life.



2. LITERATURE REVIEW

To understand the process of leachate and its effect on environment certain research papers have been reviewed. This research papers helped us to know the leachate formation in different areas around the globe and how it was converted in to fuel and gas production by various means. This way the leachate formed can be converted into fuel production and reduce the pollution it causes by percolating into the groundwater.

Sandip.T.Mali et.al. (2010) etc. stated that in his study lab scale anaerobic bioreactor of 0.0742 m³ was used to investigate the effect of leachate recirculation on degradation of organic matter and stabilization of leachate. He stated that leachate quality was regularly checked by means of pH, alkalinity, oxidation reduction potential (ORP), biochemical oxygen demand (BOD₃), chemical oxygen demand (COD), solids, total nitrogen, volatile fatty acids (VFA), sulphate, chloride, sodium, calcium and potassium. Physical observations such as temperature, quantity of leachate generated and re-circulated was monitored. After the study he came to conclusion that pH was significant parameter for anaerobic digestion process. Leachate recirculation reduces post treatment of leachate. Chemical characteristics and properties of leachate reduces with the time during acidic condition but higher removal efficiency was not achieved with less time. Therefore anaerobic bioreactor landfill operational parameters should be maintained.

Dr. A. Gandhimathi et.al. (2017) etc. stated that the landfill leachate is a major issue in the waste management because of its various pollutants presence in the leachate. It will pollute the groundwater and surface waters. The main aim of his research was to study about treatment of leachate using solar photocatalysis. The natural source of solar radiation is used in the process. This study was carried out to examine the percentage of pollutant removal in the leachate sample and also to determine the effects of pH, Catalyst dosage and reaction time in it. Different ZnO catalyst concentration ranging from 0.2, 0.4, 0.6, 0.8, 1.0 and 1.2 g/500ml was used for the experiment. The photocatalytic experiment was conducted in 5 hours of time period exposure to sunlight. This experiment reveals that solar photocatalytic treatment is an effective technique for the leachate treatment. Further work is necessary to increase the removal efficiency of pollutant in the leachate sample by controlling the pH of

the leachate sample from 4 to 6 and also by increasing the catalyst dosage.

Jenin Rajasingh J, Sundararajan R, Ashiga T.S and Jenisha G et.al. (2017) etc. discusses about the characteristics of leachate generation from municipal solid waste landfilling site of *Vellalore* town panchayat, *Coimbatore* city, *India*. It stated that the main aim of the research work was to implement most suitable techniques and methods to reducing leakage contamination before discharge in to the soil. Leachate samples were collected at the landfill sites and were analysed for various characteristics parameters to estimate its pollution potential and content. The research concludes that due to disposal of municipal solid waste at dumping yard, the quality of leachate contamination is increased. The result shows that the leachate was highly deterioration and may leads to increase in ground and surface water and soil contamination.

Imran Ahmad, Shreeshivadasan Chelliapan, Norazli Othman, Roslina Mohammad, Samira Albati Kamaruddin et.al. (2018) etc. stated that Solid Waste Management (SWM) has become an issue of concern ever since humans began to build communities within a concentrated area. Greater the population density, more important is a proper waste management system. The main objective of the disposal system was to take care of the sanitation and health of the community. So for that various strategies have been introduced to improve the concepts of waste management and sustainable landfilling is a necessary part of an efficient integrated waste management system. The degradation of the wastes in combination with percolating rainwater leads to the production of a dark coloured and highly polluted liquid called leachate. If not treated and disposed off carefully the movement of leachate into surrounding soil and ground water, may lead to serious pollution. This research highlights the landfill management, landfill leachate generation and its characterization and the treatment methods for leachate landfills.

Sa'adat Vahdani, Mina Rezaei, Sajad Rahimi and Mohammad Ahmadian et.al. (2015) etc. stated that this study was undertaken to examine feasibility of biological and physico/chemical treating of high-strength landfill leachate that was collected from *Tehran* municipal landfill for roughly 50 years. The aim of this study was to estimate the optimal concentration of leachate in the reactor influent and process parameters on the base of aerobic digestion efficiency. Using MBR the technology was developed to treat landfill leachate over 32 days. Water quality parameters such as pH, BOD₅, COD were measured daily. The conclusion was such that there was a decrease of more than 89% for COD in the initial leachate, ammonia also decreased. Nitrate concentration in the effluent also got reduced. The bacteria in the MBR system adjusted to the presence of leachate. Heavy metals were removed by 82.7%. These successful results concluded that the MBR technology is effective and efficient method for the treatment of municipal landfill leachate

Asst. Prof. Dr. Alaa H. Wadie Al-Fatlawi et.al. (2015) etc. stated that Sanitary landfill is still the most cost-effective and appropriate method for waste disposal in *Iraq*. Since the landfill is located in an arid environment, leachate generation is low and potential infiltration through the lining system is minimal. A drainage pipes having diameter of 250mm and longitudinal slope upto 1% to reduce sedimentation and allow adequate flow capacity. Leachate will be collected through 10 mm pipe perforations in four rows, set 900 apart on the pipe circumference and spaced 300 mm center to center. Sumps were sized to handle a weekly flow from the maximum average monthly drainage collected from the drainage layer. Two leachate collection and storage pit was used. A storm water management unit within a space of 520 m³ was present which was used as a storage facility for the storm water collection during the monsoon season. Two evaporation pond was there at permanent landfill. Based on the studies and report of the study area, it is concluded that leachate collection systems should be operated under unsaturated conditions as long as possible to extend the service life of leachate collecting systems.

3. METHODOLOGY

3.1 STUDY AREAS :

We have selected the area in our college DILKAP COLLEGE OF ENGINEERING which is as following:

College name : DRIEMS

Address : At Village-Mamdapur, post- Neral, Tal- Karjat, Dist- Raigad-410101

Elevation/Altitude: 57 meters

3.2 MATERIALS:-

1. The materials used for the model are tank, coarse aggregate, fine aggregate, soil and canteen waste, vessel, gas pipes, stove and a tube.
2. The tank having dimension 1.15m x 0.65m x 1.08m was used for the experiment. It was thoroughly cleaned and fittings were made for the outlet at the bottom for collection of leachate.
3. The coarse Aggregates of size greater than 10 - 20 mm of well graded sieve quality is used and fine aggregates 3 - 6.25mm. These aggregates were taken from the campus of the college.
4. The soil used was also excavated from the college premises and properly sieved using sieve size of 6.5mm, 10mm and 12.5mm.
5. The waste used for the experiment was provided by the college canteen. The waste comprised of food

materials, leafy vegetables, meat and seafood. utmost care was taken no plastic item could come into the experiment with the waste, also vegetables such as tomatoes, onions and those which are acidic in nature were also not part of the experiment.

6. The stove, gas pipes, vessel and the tube was used to heat the vessel and the leachate in it which in turn form the gas needed which was collected in the tube.

7. A hole was made in the vessel on the mid portion so as to connect the gas pipes to the tube through which gas will flow.

3.3 Procedure:

Firstly a pit was dug upto a depth of 1.2m and size little bigger than tank dimension.

The tank was placed in the pit.

The bottom most layer comprised of coarse aggregates which was taken from the campus of our college.

A layer of soil which was initially sieved was placed over the aggregates which made up the second layer.

The canteen waste which included vegetables, meat, seafood etc. excluding acidic substances (lemon, oranges, etc) was used. This made up the third layer.

The fourth and the final layer again was the sieved soil. But this time the thickness was bigger than that was used in the second layer.

This setup was covered by soil again on the exterior part of the tank and was totally covered making it an anaerobic environment dug under the ground.

After a period of 40 days the tank was removed from the pit and the leachate sample formed was collected from the outlet provided on the lower side of the tank.

This leachate was then poured into the vessel and was sealed with m-seal on the circumference of the gas pipe so that gas leak can be avoided.

The vessel was also closed with lid on the top and sealed again so as to create a closed container model.

This vessel was kept on the stove and allowed to heat at 39°C. The temperature was kept constant and regularly noted.

The tube which was connected to the vessel by means of gas pipes started to inflate.

After some time when the tube was inflated almost fully the heating was stopped and the temperature was noted again.

This tube was then taken for testing of the gas which we received after the experiment.

4. CONCLUSION

Here we conclude that for proper management of leachate, the initial stage is according to the literature research, it is to study the circumstances in generation of landfill leachate. All the characteristics of leachate and the typical landfill design how to control and monitoring the generation. The constructed wetland is an efficient natural system for leachate treatment. It can be economical and be efficient method in pollutant removal. The biological, physical and chemical processes are always needed in leachate treatment technology. Key properties for leachate monitoring are chemical oxygen demand, biological oxygen demand content and chloride and ion content. Landfill gas generated during waste degradation with the highly dependent on landfill operation and local climate. Gas collection and control system are design to collect methane. Through monitoring of leachate gas and in situ condition the waste degradation process can be better understood and this knowledge applied to operation of leachate landfill.

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