Treatment of landfill leachate by using membrane filtration

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ABSTRACT

Rapid increase in population and industrialization leads to huge generation of solid waste throughout the country with land filling as the most common practice for management of solid waste. There are many methods available like physical, chemical, biological and membrane filtration. Membrane filtration can be defined as separation of solid immiscible particles from a liquid or a gaseous stream based primarily based on size difference. By study it is concluded that as compare to all methods membrane filtration is very efficient, Hence, in this study membrane filtration technique is applied. In this review membrane is prepared with readily available materials. We have used Cellulose acetate which is renewable, biodegradable, bio-based polymer & it is cheap material. Initial characteristics of leachate and after treatment final characters are again determined and compared. Removal efficiency is found.

Keywords: Landfill leachate, Membrane filtration, Cellulose acetate

1. INTRODUCTION

For the disposal of municipal solid waste sanitary landfill is used as primary method in many countries leachate which is generated from the landfill will exhibit acute and chronic toxicity[1]. There is also a risk of soil, ground water and surface water pollution from untreated leachate. Among the many problems in the world land filling of municipal solid waste is also a very big issue. It was expected that 75% of waste is reduced by its weight by 2010. Composition of leachate depends upon the age of landfill and type of waste it contains. Leachate consists of both dissolved and suspended materials. The migration of the leachate into natural environment is source of soil and ground water pollution and due to fermentation of organic matter biogases are produced these results in source of air pollution. Some of the countries like Iran about 60% of MSW is converted into compost and it is estimated that about 50m³/day leachate is created from high moisture content delivered in organic waste[2]. It may contain large amounts of organic, inorganic and heavy metals etc. Leachate is nothing but the liquid that has dripped through solid waste and has pull out dissolved or suspended materials. Still there are growing concern about groundwater and surface water pollution from leachate. Depending on the extent of decomposition and composition of waste and hydrological factors, the leachate may be highly contaminated.

1.2 Materials and Methodology

The leachate grab samples were collected from the Municipal Solid Waste Management (MSWM) site, Turamuri village Belagavi which is located around 10km away from the city. M/s Ramkya Enviro Engineers Ltd. Preliminary characterization of leachate was carried out immediately at the laboratory in accordance with the Standard Methods for the Examination of Water and Wastewaster 20th edition published by American Public Health Association, American Water Works Association, Water Environment Federation (APHA, AWWA, WEF). Then the synthesis of membrane is done according to following steps.

a) Preparation of CA polymer solution
b) Preparation of CA dispersion
c) Production of membrane sheet
d) Removal of CaCO₃ particles

In the first step 20gms of CA and 200gms of acetone is taken in 250ml of conical flask. Magnet is added to it ,using magnetic stirrer it is stirred for about 1hour until solution becomes clear. In second step, the complete solution in poured to kitchen blender add 17.6gms of glycerol and 41gms of calcium carbonate is added. Total suspension is stirred at highest rate of kitchen blender for
3 min. remaining waste is thrown in household refuse. Next in third step, Take a mirror or a glass plate. Two parallel edges of that plate were plastered with 4 consecutive layers of scotch tape. The thickness of layer of scotch tape will decide the thickness of membrane. Then, the layer of glass plate is rinsed with an amount of ethanol. Take a small beaker to that approximately 10gms of cellulose acetate polymer dispersion was transferred from conical flask to facilitate the pouring process. On a glass plate pour amount of dispersion as an approximately 1-inch-wide strip using edges of stainless-steel ruler. The strip of dispersion was distributed from the top to bottom of glass plate for about 5 min. The membrane sheet was kept to dry in ambient air. In last step, the calcium carbonate particles are removed by dipping membrane glass plate in plastic containing 5 lit of HCL then through water basin then, membrane sheet is loosened from itself from plate glass bubbles indicates the removal of CaCO$_3$ particles. Then leachate is filtered through membrane. Removal efficiencies are discussed.

![Preparation of cellulose acetate polymer dispersion](image1)

![Production of membrane sheet](image2)

![Experimental set up](image3)
2. RESULT AND DISCUSSION

The initial characteristics of collected sample are determined as follows. pH is determined by pH meter was found to be 8.1, conductivity by conductivity meter was found to be 10570µS/cm, TDS was 7399mg/l, chemical oxygen demand was found to be 7677mg/l by open reflux method, Biochemical oxygen demand was 4222mg/l, sulphate concentration was about 82mg/l, chloride was found to be 2102 mg/l by argentomeric method, total organic carbon was about 1518mg/l. After filtering through membrane, the leachate shown the following values. The COD was reduced to 3762mg/l by this we can conclude that about 50% removal efficiency. BOD was reduced to 1520mg/l based on this value we can conclude that about 58% of removal efficiency. Total organic carbon removal efficiency was about 52% value found to be 759mg/l. TDS removal efficiency was 58%. Chloride and sulphate were reduced to 54% and 48% respectively.

3. CONCLUSION

There are number of membrane technology applications in treating wastewater. Leachate is composed of different organic and inorganic compounds that may be dissolved or suspended in wastewater. Leachate has high BOD, COD, TOC, nutrients and heavy metals. This paper attempted to summarize the application and scope of membrane filtration and synthesizing the nano membrane by readily available materials with low cost. Also by studying some of papers it is concluded that membrane technology is more effective in treating leachate and it is more efficient in removing too small particles but one disadvantage is it is of high cost. Hopefully, this paper will be useful for further research about membrane filtration technology in treatment of leachate. By this study it can also be concluded that treatment of leachate is very important and by filtering the leachate through membrane we can remove BOD, COD, TOC and nutrients about 50 to 60%. As mentioned in paper it has very bad effect on environment and public health.

4. REFERENCES