© 2018 IJSRST | Volume 4 | Issue 5 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X
Themed Section: Science and Technology

Leachate Treatment from Municipal Solid Waste Landfill by Using Natural Coagulant of Zea Mays

M. Vinodh Kumar, S. Srivarushan, R. Gowthami
Civil Engineering Department, Bharathidasan engineering college, Anna University, Tamilnadu, India

ABSTRACT

In this paper, leachate treatment efficiency was evaluated on the basis of Leachate treatment value of leachate before and after treatment by using coagulation techniques passing through permeable ZEA MAYS powder (CORNCOB) in a laboratory scale study. Leachate treatment value can be used as a tool to assess the leachate pollutant potential of landfill sites particularly at places where there is a high risk of leachate migration and pollutant of groundwater and thus can help to take necessary decisions as deem fit. Permeable zea mays (CORNCOB) powder consisted of low cost locally available waste materials, which is an innovative technology to treat landfill leachate contamination. Leachate sample of vaniyambadi municipal solid waste landfill site of Vellore City, Tamilnadu (India) was collected and analyzed for 8 significant leachate pollutant variables viz pH, TDS, BOD5, COD, Chloride (Cl–), phosphate, calcium and ammonia nitrogen to estimate its pollutant potential. The concentration of all the studied leachate pollutant variables exceeded the permissible limits. Vaniyambadi area has 19, 5061 population and total area is 9.54 km^2. Therefore, all the leachate generated finds its path into the surrounding environment. Based on adsorption studies, maximum adsorption was observed at room temperature under acidic condition of pH 7.4. Based on the study, zea mays Powder is used as an effective Natural for reducing the leachate pollutant Concentration present in municipal solid waste.

Keywords: Corncob, Landfill, Leachate, Zea Mays, Pollutant, Coagulant.

I. INTRODUCTION

India currently is facing a municipal solid waste problem, for which all elements of the society are responsible. The community sensitization and public awareness is low. There is no system of segregation of organic, inorganic and recyclable wastes at household level. Solid waste management is a difficult task which includes the control of generation, storage, collection, transfer and disposal of solid waste in an environmentally acceptable manner. The disposal of solid waste currently relies principally on landfills. Landfill of MSW is the simplest, cheapest and most cost effective method of disposing of waste in both developed and developing nations of the world. Most landfills are usually open dumps/unlined landfills. Landfills are considered one of the major threats to groundwater. The scale of this threat depends on the concentration and toxicity of contaminants in leachate, type and permeability of geological strata, depth of water table and the direction of groundwater flow. Modern Sanitary landfills have been reported to leak leachate and pollute groundwater. Wastes placed in landfills are subject to either groundwater underflow or infiltration from precipitation and as water percolates through the waste, it picks up a variety of inorganic and organic compounds, flowing out of the wastes to accumulate at the bottom of the landfill. The resulting contaminated water is termed leachate and can percolate through the soil. Municipal landfill leachate is highly concentrated complex effluents which contain dissolved organic matters;

inorganic compounds; heavy metals and xenobiotic substances. The management of leachate is among the most important factors to be considered in planning, designing, operation, and long-term management of an MSW landfill.. The processes for leachate collection and treatment are complex and the costs are usually quite high. Therefore the remedial and preventive measures cannot be undertaken at all the existing closed and the active landfill sites in one go because of the financial constraints. The overall pollutant potential of landfill leachate can be calculated in terms of Leachate pollutant value. Because identification and quantification of pollutants in landfill leachate is the major limitation for its successful treatment, it can be used as a mean to determine whether a landfill requires immediate attention in terms of introducing remediation measures. Leachate treatment value has many applications including ranking of landfill sites, resource allocation for landfill remediation, trend analysis, and enforcement of standards, scientific research and public information.

II. MATERIALS AND METHODS

A. Landfill site

Vaniyambadi is the town in Vellore, tamilnadu, both in terms of area and population. It lies between latitude 12.68' N and longitude 78.62' E. The Municipal Corporation limit of city is spread over an area of 9.54 sq.km. The population of the city within the Municipal Corporation area is estimated at 195061 in 2011. The climate of vaniyambadi is semi-arid with maximum mean temperature reaching to 38°C and minimum mean temperature is as below as 20°C. The average annual temperature is 27.2 °C in Vaniyambadi and About 786 mm of precipitation falls annually. Waste generated at vaniyambadi as 100 tons per annum. No cover of any description is placed over the spread waste to inhabit the ingress of surface water or to minimize litter blow and odour or to reduce the presence of vermin and insects. Rag pickers regularly set fire to waste to separate non-combustible materials for recovery. Since, there are no specific arrangements to prevent flow of water into and out of landfill site, the diffusion of contaminants released during degradation of landfill wastes, may proceed uninhibited. No proper compaction is done to compress the waste into the site.

B. Leachate sampling

Leachate sample was collected from landfill site on Chennai to Bangalore highway Road at vaniyambadi town having land area. This site is non-engineered low lying open dump. It has neither any bottom liner nor any leachate collection and treatment system. Therefore, all the leachate generated finds its paths into the surrounding environment. The landfill site is not equipped with any leachate collectors. To determine the quality of leachate, integrated samples were collected from different landfill locations. Leachate samples were collected from the base of solid waste heaps where the leachate was drained out by gravity. Various leachate pollutant variables viz pH, TDS, BOD5, COD, Chloride, phosphate, calcium and ammonia nitrogen were analyzed to determine pollutant potential of leachate discharge from MSW landfill site to estimate its pollutant potential.

Figure 1. Municipal Landfill site At Vaniyambadi

Figure 2. Leachate sample

C. Leachate treatment method

Leachate treatment value of a landfill was determined using data from municipal landfill site of vaniyambadi town, Vellore (India) for 8 significant leachate pollutant variables pH, TDS, BOD5, Chloride, phosphate, calcium and ammonia nitrogen viz. Leachate treatment efficiency was evaluated as leachate pollutant value of leachate before and after treatment by using coagulation techniques passing through permeable ZEA MAYS powder (CORNSTORVE) in a laboratory scale study. Permeable zea mays consisted of low cost locally available waste materials, which is an innovative in-situ remediation technology to treat landfill leachate contamination. Detail description about the treatment method adopted is out of scope of this paper.

D. Preparation Of coagulant

Zea mays (CORNSTORVE) were collected from the local area and washed repeatedly with water to remove dust and soluble impurities. It was dried in natural sunlight for a period of almost 1week. The coagulant was carbonized by heating it upto a temperatures of around 200 ° C in the absence of oxygen. We then used a ball mill to crush the adsorbent to reduce its size into smaller particles. The adsorbent was then sieved and activated.

Figure 3. Collection Zea mays (Corncob)

Figure 4. Crushed Zea mays (Corncob)

E. Analytical work

Analytical methods were according to Standard methods for examination of water and wastewater specified by American Public Health Association . The pH was measured by electronic pH meter . TDS was determined by filtered sample through Whatman filter paper-44 and estimated .BOD5- Winkler‟s method was used for estimating initial and final DO in the sample and BOD5 was. Argentometric volumetric titration method in the presence of Potassium chromate provides reliable result of chloride. Phosphate - Stannous Chloride Method using of ammonium molybdate formed yellow color development.

F.coagulation method

Coagulation techniques using as zea mays (CORNSTORVE) coagulant. It was effectively

removed for total dissolved solids and turbidity also. Leachate having before and after treatment of TDS is 46.88 mg/l and 18.3 mg/l.

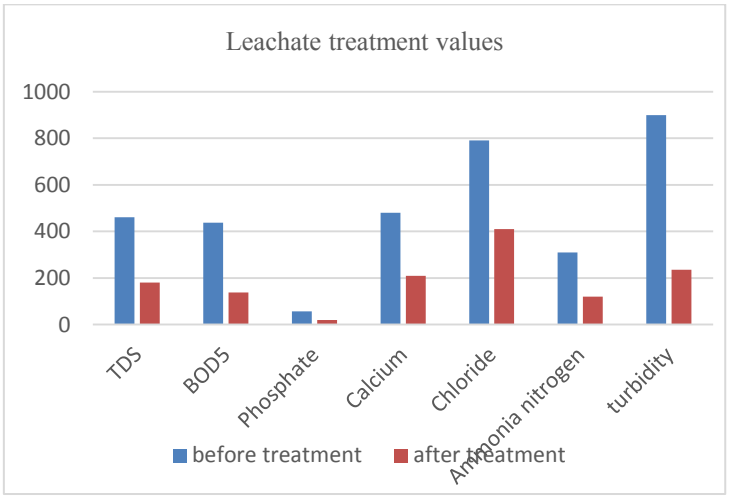
Figure 5. coagulation process in jar test apparatus

III. RESULT AND DISCUSSION

Leachate sample of vaniyamabdi landfill site was collected and analyzed for for 8 significant leachate pollutant variables pH, TDS, BOD5, Chloride, phosphate, calcium and ammonia nitrogen viz to estimate its pollutant potential. The concentration of all the studied leachate pollutant variables exceeded the permissible limits. Leachate treatment efficiency was evaluated on the basis of leachate pollutant value of leachate before and after treatment by passing through zea mays coagulant in a laboratory study. The procedure explained above has been used to calculate the leachate pollutant value for the MSW landfill site. leachate pollutant variables pH, TDS, BOD5, Chloride, phosphate, calcium and ammonia nitrogen viz were shown in . The LPI value of leachate of vaniyambadi landfill site before and after treatment and also the Leachate pollutant value of leachate disposal standards to inland surface water as per Municipal Solid Waste (Management and Handling) Rules, 2000, Government of India were calculated using the above procedure and reported in Table 1.

Table. 1. leachate treatment value of before and after treatment using various method.

S. No	Leachate pollutant variable	Limits (before treatment)	Limits (after treatment)	Analytical methods
1	Total dissolved solids. (mg/l)	460.88	180.3	Gravimetric method
2	BOD_5 (mg/l)	438	138	Winker azide method
3	Phosphate (mg/l)	57	19.3	Stannous Chloride Method
4	pH	5.6	7.4	pH meter
5	Calcium (mg/l)	480.093	210.09	Titration method
6	Chloride (mg/l)	790.78	410.23	Argentometric method
7	Ammonia nitrogen (mg/l)	310.2	120.2	Spectrometric method
8	Turbidity NTU	900	235	Turbidity meter



Graph1. Leachate treatment values

IV. REFERENCES

[1]. Barrett, A., and Lawlor, J.,"The economics of waste management in Ireland", Economic and Social Research Institute, Dublin, 1995.

[2]. El-Fadel, M., Findikakis, A.N., and Leckie, J.O.,"Environmental impacts of solid waste landfilling", Journal of Environmental Management, Vol. 50(1), pp. 1-25, 1997.

[3]. Daskalopoulos, E., Badr, O., and Probert, S.D.,"Integrated approach to municipal solid waste management", Journal of Resources, Conservation and Recycling, Vol. 24(1), pp.33-50, 1998.

[4]. Jhamnani, B., and Singh, S.K.,"Groundwater contamination due to Bhalaswa landfill site in New Delhi", Department of Civil and Environmental Engineering, Delhi College of Engineering, Delhi, India, Journal of Environmental Science and Engineering, Vol. 1(3), pp.121-125, 2009.

[5]. Longe, E.O., and Balogun, M.R.,"Groundwater quality assessment near a municipal landfill, Lagos, Nigeria", Research Journal of Applied Science, Engineering and Technology, Vol. 2(1), pp. 39-44, 2010.

[6]. United States Environmental Protection Agency (USEPA) Office of Drinking Water,"A Groundwater Protection Strategy for the Environmental Protection Agency", 1984.

[7]. Fatta, D., Papadopoulos, A., and Loizidou, M.,"A study on the landfill leachate and its impact on the groundwater quality of Greater Area", Environ. Geochem. Health, pp. 175-190, 1999.

[8]. Al-Khaldi, S.,"Assessment of groundwater contamination vulnerability in the vicinity of Abqaiq landfill- A GIS Approach", King Fahd University of Petroleum and Minerals, Saudi Arabia, 2006.

[9]. Lee, G.F., and Jones-Lee, A.,"Landfilling of Municipal Solid Waste", Report of G.F Lee and Associates, El Macero, CA, 2004.

[10]. Tchobanoglous, G., Theisen, H., and Vigil, S. A.,"Integrated solid waste management engineering principles and management issues (1st ed.)", New York: McGraw-Hill, 1993.

[11]. Municipal Solid Waste (Management and Handling) Rules, Notification by Ministry of Environment and Forests, Government of India, 2000.

Author Profile

M.Vinodh kumar as a student in B.E Secured Civil engineering at Bharathidasan engineering college, Anna University Tamilnadu, India.

(E-mail: vinoanu1928@gmail.com)

S.Srivarushan as a student in B.E Secured Civil engineering at Bharathidasan engineering college, Anna University Tamilnadu, India.

(E-mail: srivarushans@gmail.com

R.Gowthami presently working as Assistant Professor in Civil Engineering at Bharathidasan engineering college, Anna University, Tamilnadu, India. The degree of B.E secured in civil engineering and M.E. Environmental Engineering. Research papers Published in various Journals/Conferences and International Journals.

(E-mail: gowthami.rajendiran@gmail.com)