

Low Cost Anaerobic Treatment of Municipal Solid Waste Leachate

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Abstract : Anaerobic treatment of municipal solid waste leachate is the treatment process of leachate generated in solid waste disposal site. Biological treatment removes the most contaminants, by converting it into less harmful substances. This process is natural process which use the naturally available organisms in the environment. In this paper the process of anaerobic treatment of municipal solid waste leachate and recovering the methane gas produced is presented. The UASB bioreactor was operated at 3 different processes i.e. batch process, semi-continuous process and continuous process. The results of these three processes are compared and semi-continuous process gives the best results. The results of semi-continuous process at 3 day HRT are 96.6% COD reduction, TVA reduced from 954 mg/L, alkalinity increased from 160 mg/L to 1180 mg/L. Total solids reduction was 68.14%, suspended solids reduction was 86%, volatile solids reduction was 86.7% and biogas production was 2650 ml.

Keywords: - Biological anaerobic treatment, batch process, continuous process, semi-continuous process, solid waste landfill leachate.

I. Introduction

Solid waste management problem has become the greatest concern now a days. Various environmental pollution problems i.e. contamination of soil, water and other health related problems etc. are caused due to the traditional method of solid waste disposal. The waste dumped into the landfills are the major sources of emission of methane to atmosphere which has global warming potential. The main environmental problem of the landfill sites is infiltration of leachate and its subsequent contamination of surrounding land and aquifers, odour problem etc. Processes which have been the lowest cost and consistently successfully applied, for municipal waste landfill leachate from controlled landfills, are biological processes.

Anaerobic treatment of municipal solid waste leachate is a series of processes in which microorganisms break down the biodegradable material in the absence of oxygen. Anaerobic digestion reduces the emission of landfill gases into the atmosphere. Anaerobic digestion produces methane gas and CO₂ rich digestate which can be used as fertilizer. Up flow anaerobic sludge blanket reactor (UASB) is a modern anaerobic treatment process which have high treatment efficient and a short hydraulic retention time.

The work in this paper is divided in two stages. 1) Design and setup of reactor 2) Determination of various parameters and methane generation study. Reactor includes the designing the cylindrical reactor of plastic fibre having capacity 26 L arrangement for feeding, gas collection, and draining out the residue. Setup include stabilization of the reactor. In second stage the operation and determination of various parameters and methane collection is carried out for 3 day HRT for batch, semi continuous and continuous processes.

II. Reactor Setup

Reactor includes the designing the cylindrical reactor of plastic fibre having capacity 26 L arrangement for feeding, gas collection, and draining out the residue. Thereafter the municipal solid waste landfill leachate is collected from charholi village and after passing hot water from that waste leachate is collected and used as feed for reactor. Inoculum is prepared by mixing 300 gm of cow dung which contains millions of methanogenic bacteria with 3 L of water and sieved through filter for 3 to 4 times to remove bigger particles and stored in capped bottle to maintain anaerobic condition. After 20 days 12 L of cow dung slurry mixed with secondary sludge of treatment plant and stabilized by recirculation process. Fig. 1 shows the reactor setup.

III. Operation Of Reactor

Inside the reactor pressure drops due to sudden contraction and expansion in the organic matter present inside the reactor. Formation of eddies create sufficient turbulence which help in retaining the solid mass in suspension by preventing settling of particles.

The up flow pattern of liquid in the column reactor help in the stratification of individual type of biomass such as hydrolytic, acidogenic biomass and methanogenic biomass.

Difference in density of water/liquid and biomass/solids creates the velocity difference at same pumping energy due to difference in densities and velocities.

Clarified liquid is desired to be treated as effluent it may not be possible.

Clarified effluent can be recycled for slurry preparation and so the settled sludge can be considered as compost.

The generation of biogas makes this process more economical.

IV. Figures And Tables

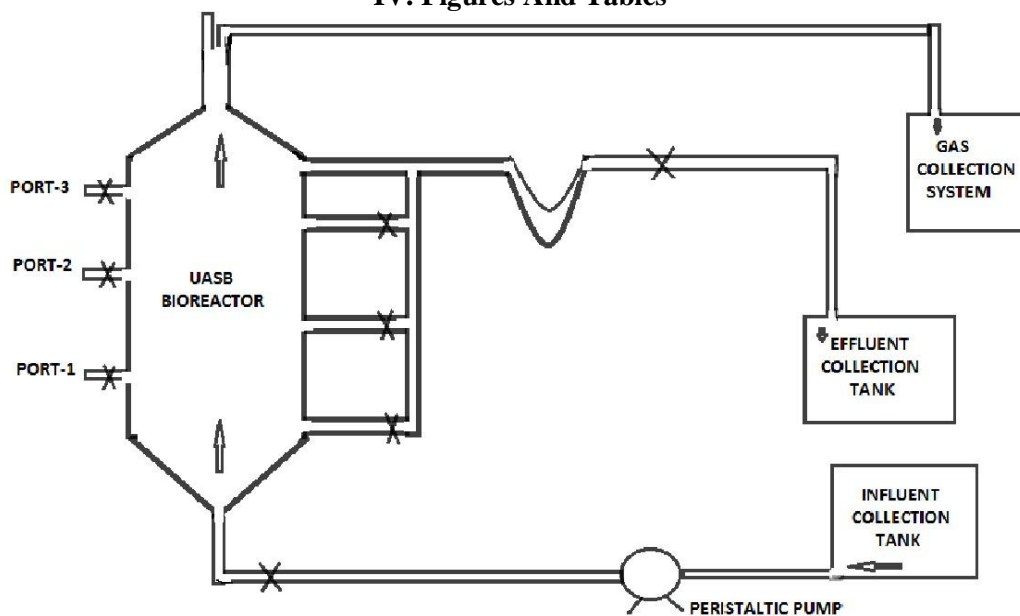


Fig.1: Reactor set-up of laboratory scale reactor for treatment of MSW leachate.

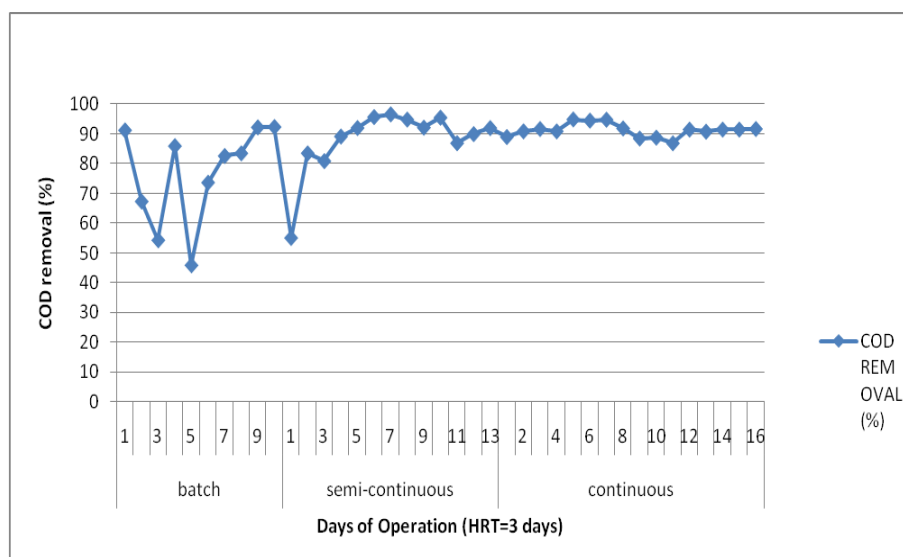


Figure 2: COD removal (%) profile throughout the process.

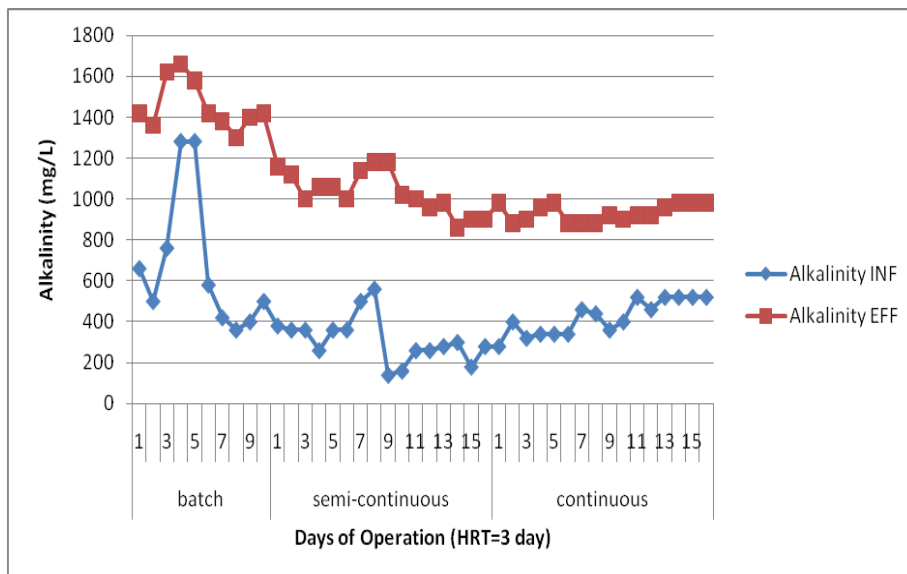


Figure 3: Variation in Total Volatile Acids profile throughout the process at 3 day HRT

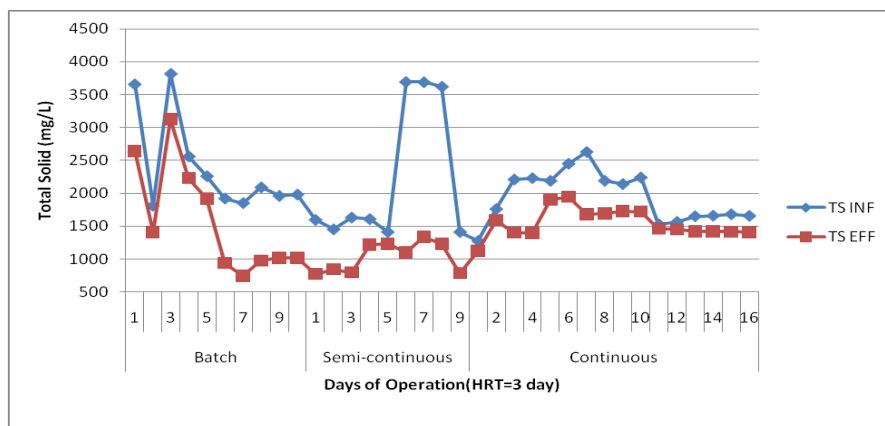


Figure 4: Variation in Total Solids (mg/L) conc. in reactor throughout the process.

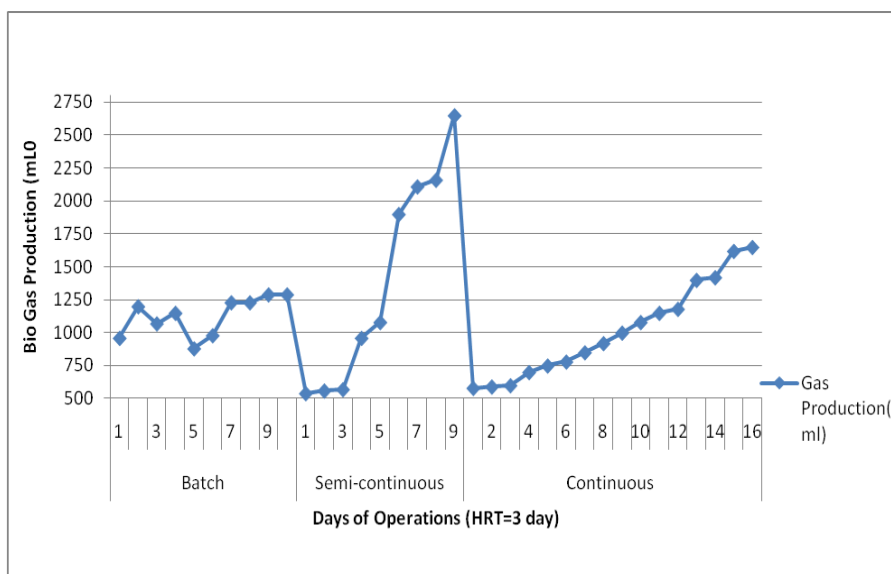


Fig 5: Graph showing Biogas production throughout different processes.

V. Conclusion

The best performance of reactor in treatment of landfill leachate was obtained at semi continuous process at 3 day HRT with 96.6% COD reduction, TVA reduced from 954 mg/L to 20 mg/l, alkalinity increased from 160 mg/L to 1180 mg/L. Total solid reduction was 68.14 %, suspended solid reduction was 86 %, volatile solid reduction was 86.7% and biogas production was 2650 ml.

From this study, it is concluded that anaerobic treatment of municipal solid waste landfill leachate is feasible.

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