VALIDATION OF ORGANIC REMOVAL EFFECIENCY IN EGSB REACTOR ON SLAUGHTERHOUSE WASTEWATER

Asha.B*, Rajayogam.R** and Sivaraman.N***
*Assistant Professor: **P G Student: *** Research Scholar
Department of Civil Engineering, Annamalai University, Annamalai Nagar, TamilNadu.
ashrasgo@rediffmail.com; rajayoham92@gmail.com; sivaramenv@gmail.com.

ABSTRACT

Poultry slaughter houses produce significant volumes of wastewater with highly charged in soluble and insoluble organics. This wastewater contains high levels of organics such as Biochemical Oxygen Demand (BOD_5), Chemical Oxygen Demand (COD), Nitrogen and Phosphorus from such as blood, fat, grease, and proteins. The aim of this work is to validate the performance of Expended Granular Sludge Bed Reactor (EGSB) to treat the slaughter house wastewater in a simple up flow manner, expected to remove high COD efficiency resulting from high biomass retention in the system. Slaughterhouse wastewater contains diluted blood ,protein, fat, and suspended solids. The highly contaminated wastewater should be treated before discharged in to the river, streams, sewers, and other water bodies. The experimental work was carried out on performance of expanded granular sludge bed (EGSB) system with varying organic loadings. Five hydraulic retention time was maintained throughout the study such as 1.98, 2.45,3.20,4.63, and 8.36 days. Removal efficiency of COD was achieved from 44.6%, to 87.5% with mesophilic range.

Keywords : Anaerobic process, Chemically oxidation demand, Expanded granular sludge bed reactor, Hydraulic retention time, Slaughterhouse wastewater.

INTRODUCTION

The high water consumption by slaughterhouses results in large volumes of wastewater characterized by high organic load, due to the presence of blood, manure, fat, undigested stomach contents, and intestinal contents. It has high concentration of suspended solids, soluble and insoluble organics and exhibits high COD and BOD. The contributors of organic loads to these effluents are paunch, feces, fat and lard, grease, undigested food, blood, suspended materials, urine, loose meat, soluble proteins, excrement, grit and colloidal particles(Asselin M, 2008; Tezcan Un U,2009).

Moreover the slaughterhouse wastewater is highly pretentious and putrefies faster leading to environmental pollution problems. Anaerobic treatment systems are more suitable options for the slaughter house wastewater treatments. This option has been successfully applied to slaughter house wastewater. Anaerobic treatment provides high COD, BOD and SS removals, while producing recoverable source of energy inform of methane gas. The anaerobic treatment generates a very low quantity of sludge and also does not require chemical pretreatment. Wastewater discharges generated from slaughterhouses typically contain high concentrations of organics, fat, and proteins (Al-mutairi et al., 2003).

The reuse of treated wastewater constitutes a viable alternative in many cases as wastewater generation rates can be as high as 80% of the total water consumption (Metcalf and Eddy, 2003). From the environmental engineering point of view, this indicates that their treatment might be more demanding than domestic wastewaters. However, these wastewaters may be quiet useful when it comes to wastewater reuse for agriculture. Slaughterhouse wastewater is very harmful to the environment. Effluent discharges from slaughterhouses can result in the depletion of oxygen from water bodies, and the contamination of groundwater.

It cannot be stored for longer period due to its fast putrefying nature leading to bad odour and fly, mosquito nuisance. This wastewater is highly amenable to biological treatment. Anaerobic processes have been proposed as a good treatment system for wastewaters with high to medium organic loads. They are suitable for the treatment of effluent from slaughterhouses. Advantage of anaerobic process is its sustainable, cost effective and eco-friendly nature and is most suitable for slaughterhouse wastewater. Moreover, high calorific value fuelin the form of methane gas, a value added by-product is also derived. This article discusses in detail the efficiency of the anaerobic expanded granular sludge bed reactor packed with high COD reduction about in the slaughterhouse wastewater treatment.

MATERIALS AND METHODS

The laboratory experimental model was fabricated and installed(Fig 1). The experimental laboratory model was made up of plexiglass. A schematic diagram of an EGSB reactor is shown in Fig3.1. The reactor consists of a column portion 9.54liters and a gas-solid separators (GSS) portion 4.93liters. The height and inside diameter of PVC cylinder column are 121.5 cm and 10 cm. The working volume of the reactor is 14.47liters including GSS. The physical feature of the experimental setup is shown in Table 1.1. A variable speed of peristaltic pump (PP-10) is used to control the flow rate. The schematic of the experimental setup is shown in Figure .1. The wastewater was collected from the market area of Chidambaram municipality. The characteristics of the wastewater was analysed and tabulated in Table.1.2

Table .1.1.Physical features and process parameters of experimental model

Specification	**Dimensions**
Total height of the reactor	152.5cm
Column portion	121.5cm
Diameter of the cylinder column	10cm
Triangle portion	9cm
Total liquid volume	14.47liters
Peristaltic pump	PP – 10 model
Free board	11cm

Table.1.2 Characterization of slaughterhouse wastewater

Parameters	Raw wastewater
Ph	**6.9**
Total solids,mg/l	**6000**
Total volatile solids,mg/l	**2400**
Suspended solids,mg/l	**2200**
Chemical oxygen demand(COD) ,mg/l	**2080**
Biochemical oxygen demand(BOD_5), mg/l	**1120**
Turbidity,NTU	**31.5**
Phospharous ,mg/l	**55**
Sodium,mg/l	**680**
Potassium,mg/l	**90**
TKN,mg/l	**480**

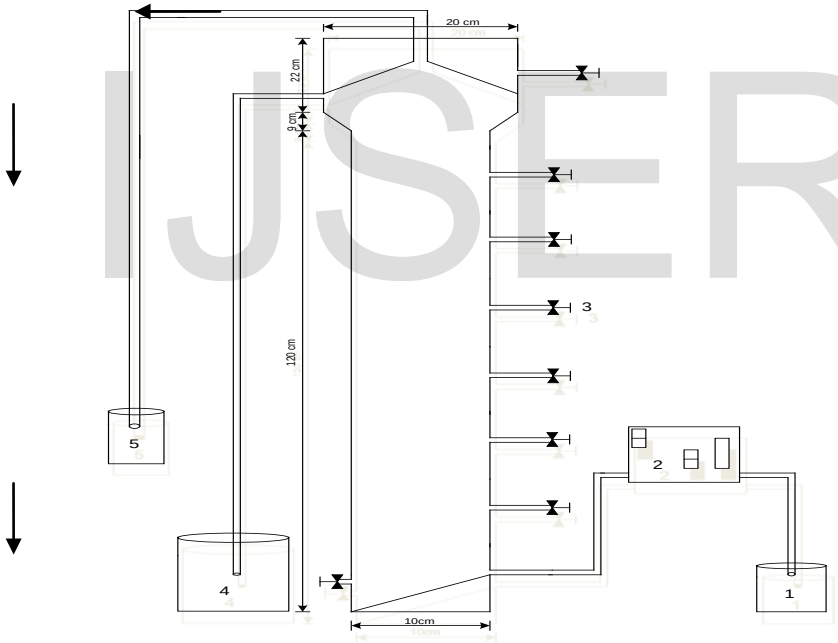

Fig..1 Schematic of Expanded Granular sludge bed reactor

1. Influent
2. Peristaltic Pump
3. Sampling Ports
4. Effluent
5. Gas collecting jar

RESULTS AND DISCUSSION

The real time slaughterhouse wastewater was used during the experimental study period. The EGSB reactor was pumped with three set of COD loading with the flow rates such as 15.120, 12.240, 9.360, 4.480 and 3.6 l/day continuously using peristaltic pump. The influent COD of the slaughterhouse wastewater was ranging from1520 to 2080 mg/l with HRT of 1.98, 2.45, 3.20, 4.63 and 8.36 days. The performance characteristics of HRT in days with respect to percentage COD removal efficiency is shown in figure.2. The overall performance of the EGSBR at room temperature got a good agreement between the retention time and COD removal efficiency. The maximum COD removal was achieved at 87.50% with a HRT of 8.36 days with an influent COD of 1600 mg/l. Due to the high proportion of organics is in suspended form supports the higher efficient degradation in the reactor.

GRAPH

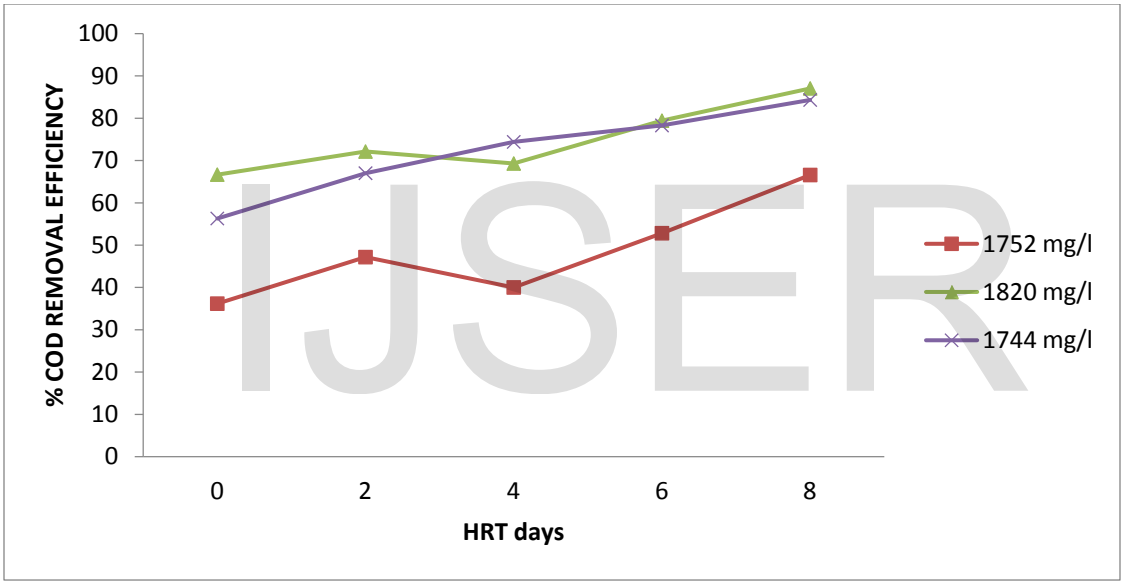

Fig 2. performance characteristics of HRT in days with respect to % COD removal efficiency

CONCLUSIONS:

The EGSB reactor seeding with the granular sludge from treatment facility at Annamalai University exhibits a better process performance for the treatment of slaughterhouse wastewater at mesophilic temperature. Raw slaughterhouse wastewater with high organic concentration was treated by expanded granular sludge bed reactor. The good ability of sludge retainment promotes the methanogens in granular sludge and good maintenance of properties in retained sludge. The hydraulic retention time was sufficient to allow for degradation of organics in the reactor. The maximum COD removal efficiency was achieved at 87.50% with a HRT of 8.36days.

REFERENCES

1. APHA (2005) Standard Methods for Examination of Water and Waste Water. (20thedn), *American Public Health Association*, Washington DC.
2. Ameen Sarairah and Ahmad Jamrah (2008) "Characterization and Assessment of Treatability of Wastewater Generated in Amman Slaughterhouse, Dirasat, Engineering Sciences, Volume 35, No. 2008
3. Budiyono (2010) "Study on Treatment of Slaughterhouse Wastewater by Electro coagulation Technique,Internat. J. of Sci. and Eng. Vol. 1(1):25-28, July 2010.
4. Budiyono (2011) "Study on Slaughterhouse Wastes Potency and Characteristic for Biogas Production. Internat. J. of Waste Resources, Vol. 1(2):4-7, Sept. 2011,
5. Bazrafshan (2012)Wastewater Treatment by Combined Chemical Coagulation and Electrocoagulation Process| Volume 7 | Issue 6 | e40108
6. Bazrafshan E., Mostafapour F.K., Farzadkia M., Ownagh K.A. and Mahvi A.H. (2012), Slaughterhouse wastewater treatment by combined chemical coagulation and electrocoagulation process. PloS one, 7, e40108.
7. Asselin M, Drogui P, Benmoussa H, Blais JF (2008) Effectiveness of electrocoagulation process in removing organic compounds from slaughterhouse wastewater using monopolar and bipolar electrolytic cells. Chemosphere 72: 1727–1733.
8. Tezcan Un U, Koparal AS, Bakir Ogutveren U (2009) Hybrid processes for the treatment of cattle-slaughterhouse wastewater using aluminum and iron electrodes.J Hazard Mater 164: 580-586.