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PERFORMANCE STUDY OF AN UP-FLOW IN AN AEROBIC SLUDGE BLANKET REACTOR IN THE TREATMENT OF LAUGHTER HOUSE WASTE WATER

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ABSTRACT

High biochemical oxygen demand (BOD), high suspended particles, and complex mixtures of lipids and proteins are the key characteristics of wastewater released by slaughterhouses, which need meticulous treatment prior to disposal. The goal of this research was to determine, under controlled laboratory settings, how well an anaerobic sludge blanket reactor performed in treating slaughter wastewater. (pH) 7.1–7.8, TSS 900–1500 mg/l, TDS 1600–3000 mg/l, COD 3000-5000 mg/l. At temperatures ranging from 29 to 35 degrees Celsius, the reactor was operating at intermittently variable OLR (0.025) and HRT (7.00, 11.00, 15.00, 19.00, 23.00 hours). At an OLR of 0.015 kg/COD/m2/day and a HRT of 23 hours, the greatest total demand for COD removal efficiency was 82.83%.

KEYWORDS: Slaughterhouse wastewater, UASB Reactor, COD, OLR, and HRT,

INTRODUCTION

The nature of abattoir effluent, which is mostly a complex combination of lipids and proteins, led several European laws to label it as "extremely polluting" (Tritt & Schuchardt, 1992). As a whole, a poultry processing facility uses a lot of water—about 10 to 12 litres for each bird that is processed for human food. The wastewater, which accounts for 60% of the water, has a pH ranging from 6.1 to 7.1, a biochemical oxygen demand (BOD) of 4500 to 12,000 mg/l, and a high-fat content due to the high percentage of particles, the majority of which are clots of blood (more than 40% in volume) (Mercado, 1995). Runoff carries away the remaining effluent during processing.

The majority of slaughterhouses in Tamil Nadu do not collect blood for beneficial purposes, do not separate their manure, and do not cleanse their effluents. As a result, these facilities release very complicated effluents into land or water. These activities not only pollute surface and groundwater, but they also cause problems with smell, flies, and mosquitoes. The majority of this effluent is transformed by physical-chemical, which requires a great deal of energy and chemical resources to dry the effluent and produce 20 grammes of sludge for every litre of water. Sludge deposition is challenging, which

restricts the technique's application. Anaerobic digestion using up-flow anaerobic sludge blanket reactors (UASB) might be a superior choice for reducing the bio solids created (Speece, 1983; Young and Dahab, 1983; Young, 1991).

Anaerobic bacteria in the USAB process clean the wastewater while converting organic matter into biomass, carbon dioxide, and methane (Del Nery et al., 2001). Economically and technologically, USAB systems were appealing because to their minimal sludge output, high volumetric treatment rates, and strong CH4 productivity. Del Pozo et al. (2000) reports on this.

As said earlier, the purpose of this research was to assess the efficacy of an anaerobic sludge blanket reactor's upflow in treating wastewater from slaughterhouses. When it comes to treating wastewater from slaughterhouses, the studies were conducted in UASB reactors to determine their effect on OLR and HRT.

RELATED WORK

A wide range of the organic loading rates and the HRT have been reported in literature forUASB reactors, depending on their substance used and their microbial community's quality. Inthisstudy,theremovalefficiencyofCODforvaryingOLR(0.013,0.023,0.037kg/COD/m^2/day)wasstudied.InitialreductionwiththeincreasedOLRwasmoderate,andittends to increase with the decrease in OLR.

The effect of varying HRT was investigated; removal efficiency was optimum at the highretentiontime.ThedecreaseintheefficiencyofreducingtheHRT,despiteincreasingtheturbulence of reactor, is that contact time of the wastewater with the sludge granules will bedecreased, so less organic matters was been utilized.

EXPERIMENTAL SET-UP

Abench-scale continuous of up-flow in the Anaerobic Sludge Blanket (UASB) reactormade of fiberglass was used in this study. The reactor had an internal diameter of 11.5 cm and atotalheightof98cmresultingintotalvolume of 10lit and a working of 5.4lit with a gasheadspace of 1lit. The reactors was fed with the substrate using the peristaltic pump (Model: PP-30, Miclins)

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A peristaltic pump can maintain the straight flow of rate in a range of 2 ml/h to 10 l/h,present with the timer and L.E.D. Display for the flow rate of the function and time. Five samplingports were installed along with the length of the reactor. The experimental setup of the UASBreactor was shown below.

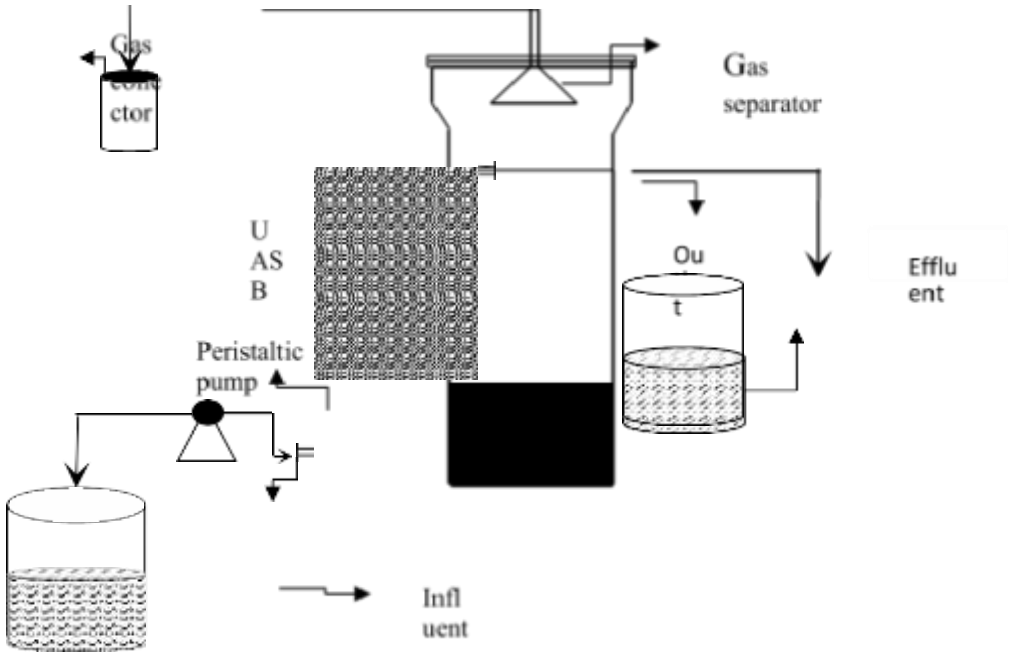

Fig.1ExperimentalSetupofUASBSystem

INFLUENT WASTEWATER

Wastewater for this research mostly came from two places in Tamil Nadu: Chidambaram and Cuddalore, where there are local slaughterhouses. The effluent from combining several phases made up the wastewater. Along with the washwaters from the stomach and intestines, there was blood from the killing procedures. The properties of the wastewater suggested an appropriate concentration of the needed proteins and trace elements, hence it was determined that fertiliser addition was unnecessary. From the very beginning to the very end of the trial, no dilution or recycling feed was made.
Following the Standard Methods, chemical tests were carried out to assess the parameters of wastewater quality, including pH, BOD, TSS, VSS, TDS, and COD (APHA, 2005).

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EXPERIMENTAL METHODOLOGY

Starting with anaerobic sludge collected from Annamalai University's wastewater treatment facilities, the reactor was filled to the bottom and fed continually with screened household wastewater for 15 days to get it up and running. All reactors were kept at room temperature, which was 30±2°C, over the course of the investigation.

The experimental investigation was conducted using synthetic wastewater after stabilisation in order to ensure consistency. The reactor was used to study the chemical oxygen demand (COD) removal efficiency as a percentage under different organic loading rates (OLR) and hydraulic retention times (HRT) using synthetic wastewater.With different HRT (7.00, 11.00, 15.00, 19.00, 23.00 hours) and OLR (0.013, 0.023, 0.037 kg/COD/m2/day), the average influent of COD applied across the system was 27,89.4, 3770, 4738.8, 5741.6, 6354, and 6818 mg/l. Using the Standard Method of Analysis, the influent and effluent COD levels and gas amounts were monitored under each operating state.

The average values of biochemical characteristics of slaughter wastewater effluent are listed in

Table 1.

Sl.no	Parameters	Concentration (mg/l)
1	Ph	7.4
2	COD	3850
3	Total Solids	3072
4	Total Suspended Solids	979
5	Total Dissolved Solids	2093
6	Total Nitrogen	127
7	Sulfate Concentration	110

Table.1 Typical characteristic of slaughter wastewater

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RESULTS AND DISCUSSION

AftertheUASBreactorwasstabilized,syntheticwastewaterwaspreparedandusedforthe experimental study. The experiment was conducted to evaluate UASB system in the terms ofCOD removal. The reactor ran continuously of 45 days.

The average influent of COD was prepared 2789.4, 3770, 4738.8 5741.6, 6354 and 6818mg/l.Initially,CODremovalefficiencywaspoor,aftersome period of reactor reached thesteady-state condition and removal condition efficiency was improved 82.83%. The graphicalrepresentations to the assess reactor performance for different operating conditions was drawn,using the observed values. COD removal of efficiency for varying OLR (**0.013, 0.023, 0.037kg/COD/m^2/day**).AndCODremovalofefficiencyforvaryingHRT(7.00,11.00,15.00,19.00, 23.00 hrs)**.**

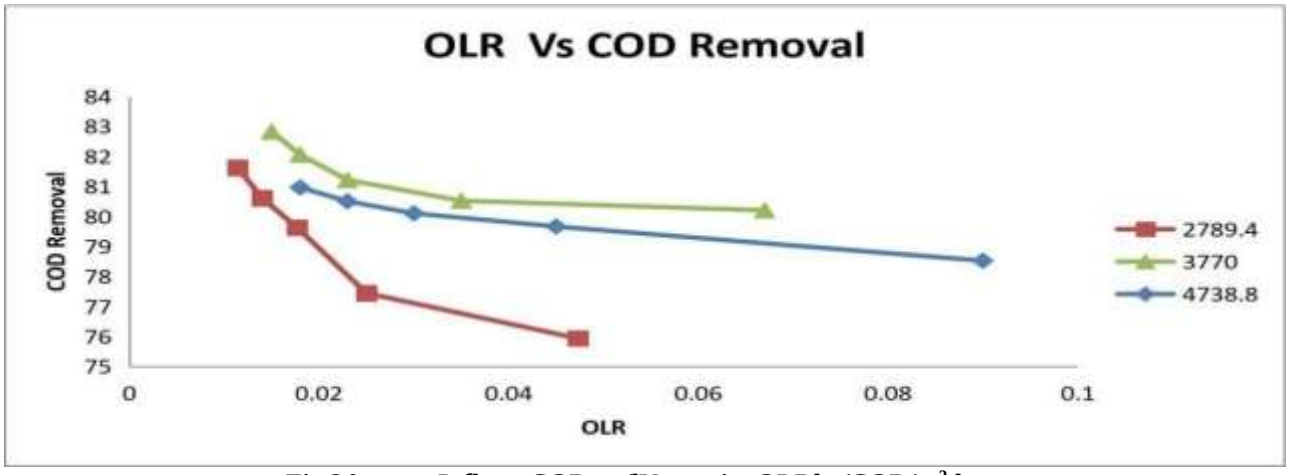

Fig.2AverageInfluentCODmg/lVsvaryingOLRkg/COD/m^{2}day

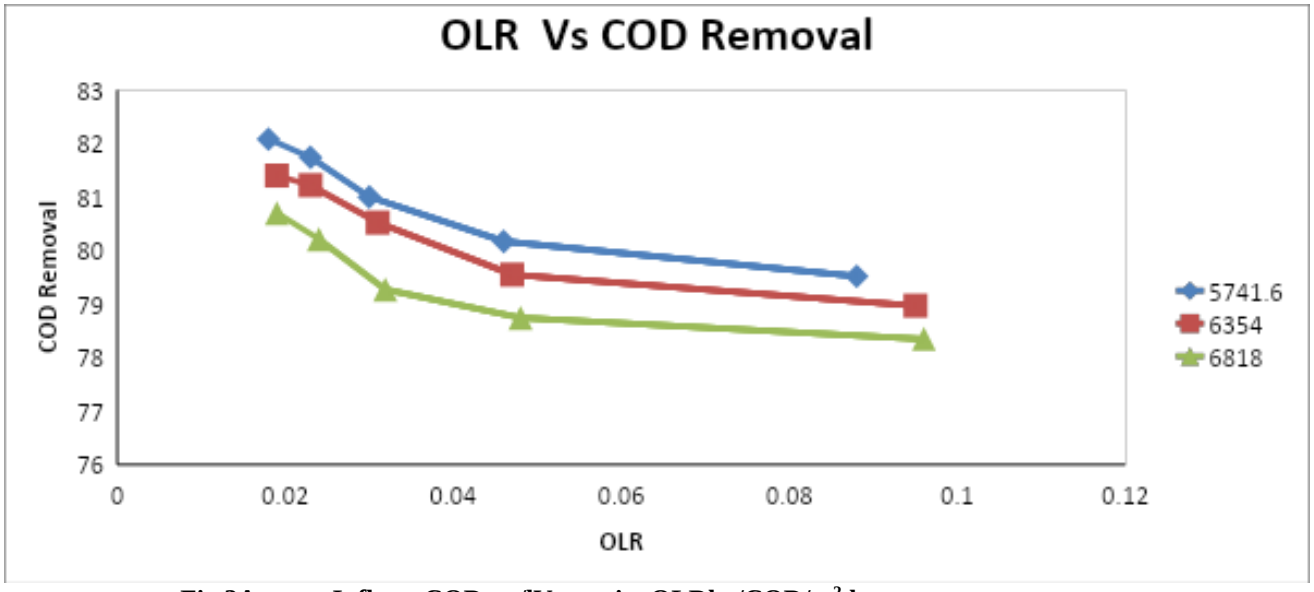

Fig.3AverageInfluentCODmg/lVsvaryingOLRkg/COD/m^{2}day

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It shows the treatment of the performance of reactor as % removal under the varying OLR,kg/COD/m^2/day.Anditdepictedtheunderstandingofthealldifferentinfluent CODconcentration .

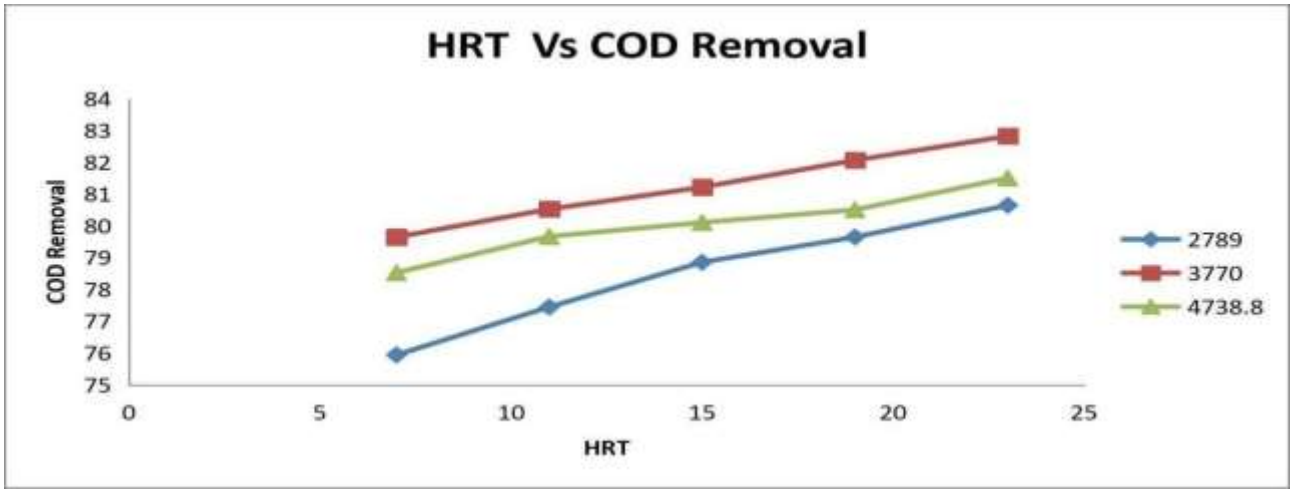

Fig.4AverageInfluentCODmg/lVs.varyingHRThrs

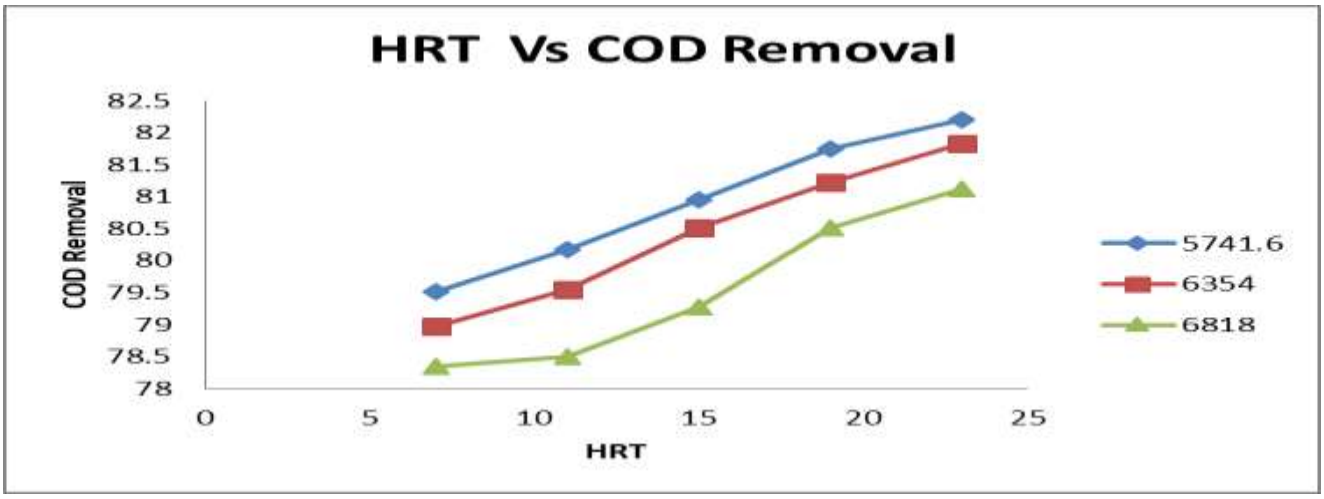

Fig.5AverageInfluentCODmg/lVs.varyingHRThrs

It was drawn on reactor's performance in the terms of % COD removal under varying HydraulicLoading Rates, hrs.

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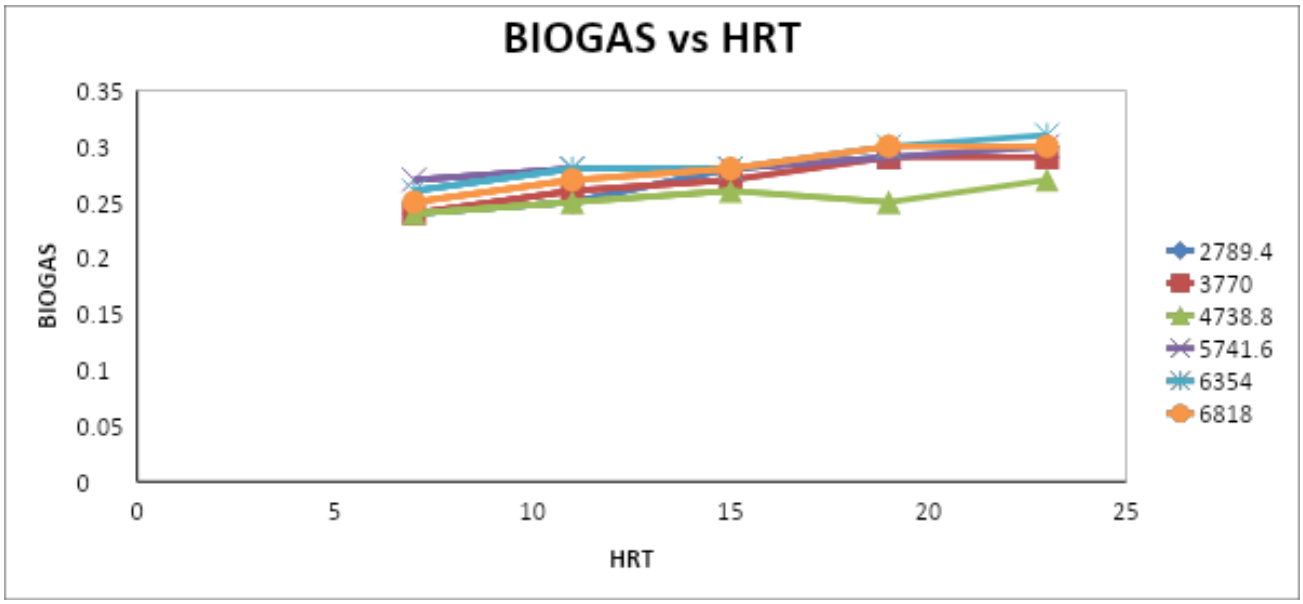

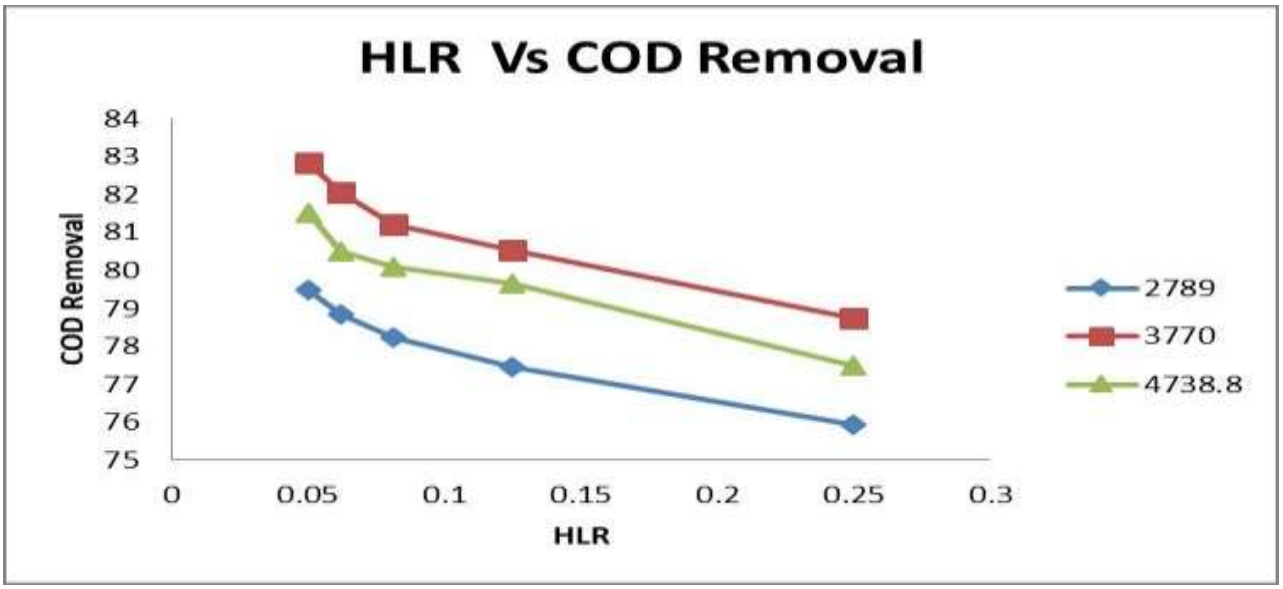

Fig6AverageInfluentCODmg/lVsvaryingHLRm^3/m^2/day

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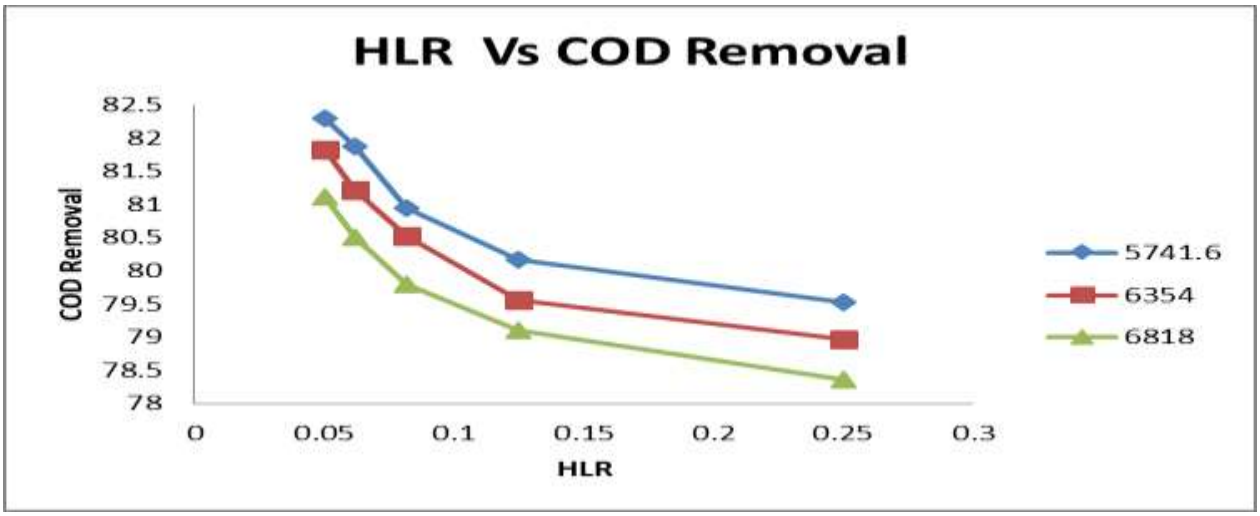

Fig7AverageInfluentCODmg/lVsvaryingHLRm3/m2/day

The COD removal of efficiency for varying HLR (0.25, 0.125, 0.082, 0.062, 0.05 m3 /m2 /day) .

CONCLUSION

At an organic loading rate (OLR) of 0.015 kg/COD/m2/day and a hydraulic retention time (HRT) of 23 hours, the UASBR was found to attain an efficiency of 82.83%, which is the highest demand for COD. Therefore, it is possible to study UASBR as a viable option to treat the effluent streams of abattoir wastewater to meet the reuse criteria.

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