TREATMENT OF DAIRY WASTEWATER BY EXPANDED GRANULAR SLUDGE BED (EGSB)REACTOR.

TULSISHYAM V ODA
Department of Environmental Engineering, L.D Engineering College, Navrangpura Ahmedabad, Gujarat (India)

***Guided by**: prof. Minrava.J.Pandya*

Department of Environmental Engineering, L.D Engineering College, Navrangpura Ahmedabad, Gujarat (India)

Abstract

Dairy industry is one of the major industries causing water pollution. In India, dairy industry generates about 6-10 L wastewater/L of milk processed depending upon the process employed and product manufactured. Considering the increased milk demand by 2020 A.D., the milk based food industries in India is expected to grow rapidly and have the waste generation and related environmental problems are also assumed increased importance. Poorly treated wastewater with high levels of pollutants caused by poor design, operation or treatment systems creates major environmental problems when discharged to surface water or land. Considering the above stated implications an attempt has been made in the present project to evaluate one of the WWTP for dairy waste. the treatment of dairy wastewater by UASB reactor worldwide spread but some problem occurring for the low strength wastewater thus, Here we provide another option in place of UASB reactor was EGSB reactor.

Key words: EGSB Reactor ,Dairy industries.

Introduction

Rapid growth of industries has not only enhanced the productivity but also resulted in the production and release of toxic substances into the environment, creating health hazards and effected normal operations, flora and fauna. These wastes are potential pollutants when they produce harmful effects on the environment and generally released in the form of solids, liquid effluent and slurries containing a spectrum of organic and inorganic chemicals.
Thus pollution is a necessary evil of all development. To combat the plethora of environmental evils of present day society, efficient and environmentally safe organic waste treatment technologies are needed.Beside like other industries that have serious waste disposal problem, the milk based food industry is faced with the prospect of having to erect a large number of relatively small treatment plants. Liquid effluent from milk based food industry pose environmental problems like water and soil pollution. Oil & grease in wastewater generated from milk based food industry poses a major threat to the environment besides lactose, another pollutant component considering the project demand by 2020 A.D.

The milk based food industry in India is expected to grow rapidly and have the waste generation and related environmental problems are also assumed increased importance. Poorly treated wastewater with high levels of pollutants caused by poor design, operation or treatment systems creates major environmental problems when discharge to surface water or land. During the last twenty years, the anaerobic digestion processes for the treatment of wastewater experienced an important development. In this evolution, the UASB reactor has played an important role, becoming probably the most used alternative. In this reactor, a high sludge concentration can be retained inside the reactor with simple and low cost equipment. This high sludge concentration allows the operation of the reactors under high organic loads.

The EGSB reactor is a modification of the traditional UASB technology. Both use granular sludge, but the EGSB reactor operates at high superficial velocities (7-1O m/h), which are obtained by high recirculation rates and an elevated height/diameter ratio. This causes high hydraulic mixing which improves the wastewater-sludge contact. No support matter is needed, which can be an important aspect for some applications.

Traditionally, anaerobic digestion has been applied to medium and high strength wastewaters. In recent years, growing efforts have been applied in order to establish the feasibility of high rate anaerobic digestion to the treatment of diluted effluents. Under dilute wastewater operation, low concentrations of substrates are present in the reactor, which will produce a low bacterial activity. In a traditional UASB reactor this may result in channeling of the wastewater through the bed and therefore in a poor water-sludge contact. The high superficial velocities of EGSB reactors enhance mass transfer rate . Besides, the EGSB reactor has shown to be suitable for the treatment of biodegradable toxic or inhibitory compounds.Since they operate with high recirculation ratios, the inlet is diluted to levels that are no longer dangerous for bacterial activity. Superficial velocities have shown also to have an effect over size and activity of anaerobic granules.

The present research deals with the comparison of EGSB and UASB reactors, operated with different substrates, focusing on the effect of the superficial velocity on the removal efficiency.

EXPERIMENTAL PROCEDURE

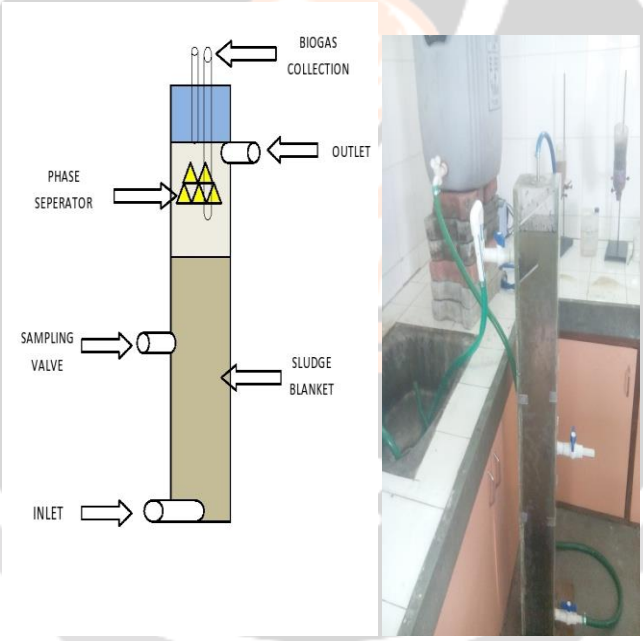


Diagram **fig.1**

The reactor consists of a column portion (11.7 L) and a gas-solid separators (GSS) portion (5.1 L). The height and inside diameter of PVC cylinder column are 130 cm and 10.2 cm. The total liquid volume of the reactor is 16.8 L including GSS . This volume was used for calculations of volumetric loading and hydraulic retention time. The EGSB reactor was operated for over 200 days under 20°C. The up-flow velocity was set to 5 m/h; effluent recirculation was set to maintain this required up-flow velocity. In previous work, it was found that inoculation of granular sludge was effective in shortening the reactor start-up period needed to maintain a sufficient SRT. Our reactor was inoculated with mesophilic granular sludge, obtained from a full-scale UASB reactor receiving sugar-containing wastewater, and started with 360 g VSS, giving a concentration of 45 g VSS/L of reactor.

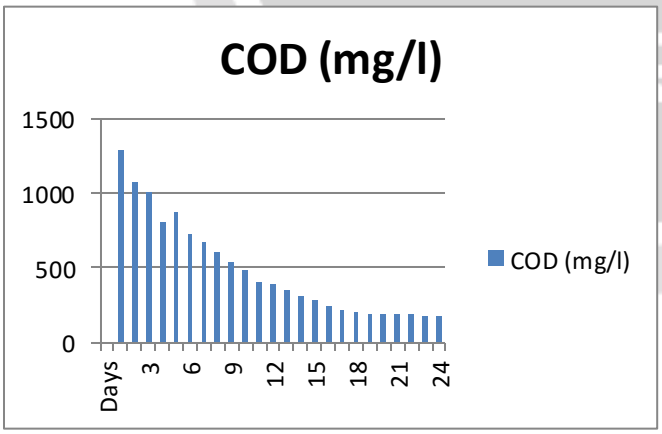
Characteristics of dairy wastewater

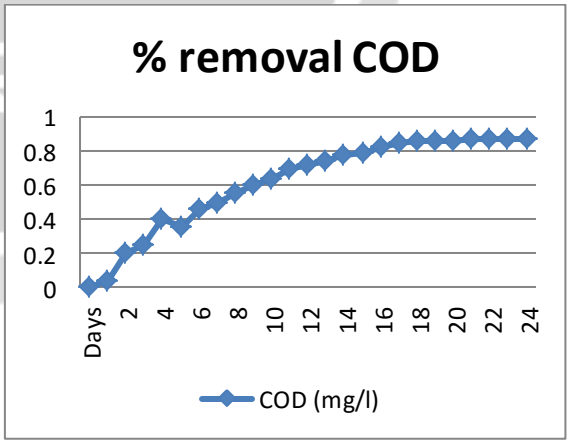
characteristics	Combine effluent	Test method
pH	6.1	
TSS	1650 mg/l	APHA 2540 C
BOD	810 mg/l	APHA 5210
COD	1340 mg/l	APHA 5220
TDS	1150 mg/l	APHA 2540 B

RESULTS

COD mg/l

Days	Inlet	After Using EGSB	COD Removal %	Days	Inlet	After Using EGSB	COD Removal %
1	1340	1286.4	4	13	1340	354	73.58
2	1340	1072	20	14	1340	309.2	76.93
3	1340	1005	25	15	1340	280	79.05
4	1340	804	40	16	1340	244.1	81.78
5	1340	871	35	17	1340	209	84.40
6	1340	723.6	46	18	1340	199.7	85.10
7	1340	670	50	19	1340	190.4	85.79
8	1340	603	55	20	1340	186.2	86.10
9	1340	536	60	21	1340	184	86.27
10	1340	482.4	64	22	1340	181.9	86.43
11	1340	406.9	69.63	23	1340	180.1	86.56
12	1340	387	71.12	24	1340	179.6	86.60





CONCLUSION

- Higher upflow velocities (in the range of 4-10 mph), and organic loading rates (up to 40 kg COD /m3 day) are applied, compared to UASB reactors
- More suitable for dilute wastewater than UASB reactors (in that case effluent recirculation is not applied).
- The sludge is always granular, very active, and the settleability is good.
- The mixing pattern is different from UASB reactors, due to the higher Vuv and the increased gas production (m3gas m-2 reactor area), leading to a different sludge-wastewater contact

REFERENCES

- J. Field, J. van Lier, G. Lettinga, G. Zeeman and L. W. HulshoffPol. " ADVANCED ANAEROBIC WASTEWATER TREATMENT IN THE NEAR FUTURE ", Pergamon. Wal. Sci. Tech. Vol. 35. No 10. pp. 5-12. 1997.
- D. Jeison and R. Chamy." COMPARISON OF THE BEHAVIOUR OFEXPANDED GRANULAR SLUDGE BED (EGSB) AND UPFLOW ANAEROBIC SLUDGE BLANKET (UASB) REACTORS IN DILUTE AND CONCENTRATED WASTEWATER TREATMENT "Pergamon .Wal. Sci. Tech. Vol. 40. No.8. pp. 91-97, 1999.
- A.Harada,H.Yamaguchi,T. Syutsubo,W.Ohashi and Yoochatchaval." Characteristics of Granular Sludge in an EGSB Reactor for Treating low Strength Wastewater ". ISSN: 1735-6865.Int. J. Environ. Res., 2(4): 319-328, Autumn 2008
- Jim A. Field , Gatze Lettinga and Mario T. Kato,"THE ANAEROBIC TREATMENT OF LOW STRENGTH WASTEWATERS IN UASB AND EGSB REACTORS ". Pergamo. Wat. Sci. Tech. Vol. 36, No. 6-7, pp. 375-382,1997.