Anaerobic Treatment of Effluent A Viable Wastewater Treatment Option for Energy Generation

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ABSTRACT: Anaerobic wastewater treatment is a relatively recent development in the field of environmental technology. Treatment of selected streams of wastewater from pulp & paper industry by anaerobic method is now an established technology. Anaerobic treatment produces energy rich biogas which would suppliment mill's energy requirement and also reduces subsequent treatment energy requirement.

Introduction

Treatment of effluent is generally considered as economic liability to mills as most of the effluent treatment systems are different form of classical aerobic system. Aerobic system needs external aeration which consumes electrical power. Besides, aerobic treatment of effluents produces significant quantity of bio-solids. Dewatering and handing of this bio-solids consume much energy. In contrast anaerobic treatment has much advantages as compared to aerobic treatment system. The advantages are:

(a) No external aeration is required.

(b) Less bio-solids are produced (about 1/3 to 1/5th of aerobic system).

(c) Dewatering of anaerobic sludge is comparatively easier.

(d) Anaerobic treatment produces significant quantity of methane gas which contributes substantially to the mill's energy requirement.

(e) Less energy (aeration) requirements in subsequent aerobic treatment.

Thus anaerobic treatment of effluent can be a potential source of energy generation and also reduces energy requirement for subsequent treatment.

Anaerobic treatment perspective

Although anaerobic processes have been used for the treatment of concentrated municipal and industrial waste waters for well over a century. The technology has hitherto been little applied on waste waters from pulp and paper industry. The reasons being:

- The often low strength of effluent
- The assumed low anaerobic biodegradability.
- The presence of toxic chemicals, which are thought to inhibit anaerobic degradation.

Attempts were made in 1950's and 1960's to treat pulp and paper mill effluents by anaerobic process. However, limited success were achieved. Problems resulted from the lack of sound understanding of the biochemistry and microbiology of anaerobic process and inadequate experience of translating the fundamental concepts into reliable fullscale system designs. Continued research and development in the 1970's and early 1980's resulted in significant advances in the state of the art of anaerobic treatment technology. These advances has led to the successful use of fullscale anaerobic treatment systems in the pulp and paper industry for selected streams.

Energy Balance

In anaerobic process the biochemical energy potential is substantially recovered as biogas and the balance is utilized in cell production as well as work energy.

Organic matter	+ Combined oxygen	Anaerobic bacteria ——→	New cells + Energy for cells + CH_4 & Co_2 + Other products

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The other products can be H_2S, H_2 or N_2 depending on the starting material.

The material and heat balance of anaerobic digestion is as under:

Carbon:	95% ———	$CH_4 + CO_2$
	5% ———	Biomass
Energy:	90% ———	Retained in CH_4
	5% ———	Biomass Production
	5% ———	Heat production

Analysis of a Hypothetical 30 TPD Agro-Residue Based Mill

Waste water characteristics of agro-residue based mill (average values) is given below:

Parameters	Unit	Value
Volume	m^3/t	285
pH	-	6-8.5
SS	mg/l	758
BOD_5	mg/l	644
COD	mg/l	3442

Therefore, COD generated/day

= 3.442 x 285 x 30 kg.

= 29429.1 kg.

1kg. COD red = 0.45 m^3 of bio-gas.

Assuming 70% COD reduction in anaerobic stage, bio-gas production per day

= 29429.1x0.7x0.45 m^3

= 9270.2 m^3

Calorific value of bio-gas = 6400 K.Cal/m^3

(75% Methane + 25% CO_2)

Therefore, total calorific value of bio-gas produced

= 9270.2x6400 K.Cal/d

= 5932, 9280 K.Cal/d.

The above energy is equivalent to 5.47 tonnes of LSHS oil/day.

Conclusion

Anaerobic Treatment is now an established technology for treatment of pulp and paper industry waste waters. Anaerobic treatment not only produce energy rich bio-gas but also reduces energy requirement for subsequent treatment.

Literature Cited

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