ANAEROBIC TREATMENT OF SEWAGE

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Introduction

This project investigates the effectiveness of a hybrid anaerobic reactor which combines biofilms with a sludge blanket for treatment of municipal sewage. Currently anaerobic processes tended to avoid low strength wastewaters and have focused on high strength industrial wastewaters.

Conventional aerobic treatment of municipal sewage involves use of external energy to destroy a wastewater carbonaceous source of energy. This project investigates the hybrid anaerobic system's potential for recovery of this energy as methane.

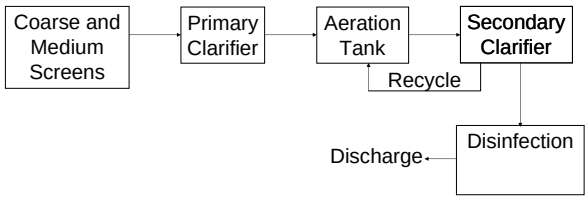
Quality of influent and effluents from 2 Hybrid reactors

Picture of lab scale reactor setup

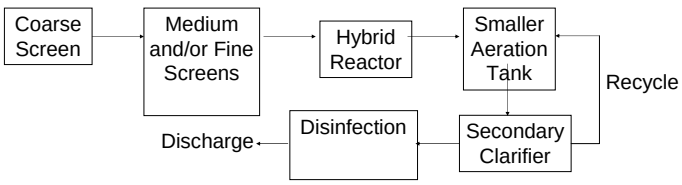
Conventional Technology

Conventional technology for sewage treatment uses the Activated Sludge Process or its variants. This typically requires aerating the wastewater in an aeration tank for a period of 4 to 6 hours to remove organic carbons as well as nitrification.

The conventional treatment train is as follows:



The proposed treatment train is as follows:



In the proposed train, the Hybrid reactor removes most of the organic carbon. Hence, the following ASP serves only to remove residual carbon and to nitrify. Due to this, the sizing of the ASP aeration tank would be much reduced.

Currently, the project has shown the hybrid reactor is effective at carbon removal. tCOD and tBOD removals of 80 and 87% have been achieved at 7.5h HRT. The Hybrid reactor has been able to match the higher end of ASP HRTs. Methane was generated at a rate of 0.17kg/kgBOD5 removed.

Benefits:

- Being anaerobic in nature, aeration is not required. Power consumption is low and hence operating costs can be reduced.
- The system has a small foot print which leads to savings in terms of land cost.
- Uses entrapped and flocculated biomass. Hence there is a higher tolerance for hydraulic surges.
- Aerobic pathogens will be killed in the anaerobic environment.
- Produces only about 40% of the ASP waste sludge. Hence savings can be made on the sludge handling process.

Economic Estimates:

Example based on a sewage treatment plant treating 140,000m^3/day of sewage:

For a typical ASP,
Q_{in}= 140,100m3/day BOD_{in}=235mg/l BOD_{out}=20mg/l
TN_{in}= 50mg/l

Taking into account sewage temperature, salinity, plant altitude and with operating dissolved oxygen = 1.5mg/l. Assuming Mechanical aerators are used and the field oxygen transfer rate = 0.578kg O_2/h-hp

		BOD Removal Efficiency by Hybrid Reactor	
	Without Hybrid	Worst Case (55%)	Anticipated (85%)
Mass of BOD entering ASP Tank, kg	283,000	115,000	23,000
Gas produced, m3	0	27,000	42,000
Electricity Generated, kW/d	0	2700	4100
Percentage of cost saved, %	0	58	81