World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:10, No:04, 2016

Anaerobic Digestion of Spent Wash through Biomass Development for Obtaining Biogas

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Abstract : A typical cane molasses based distillery generates 15 L of waste water per liter of alcohol production. Distillery waste with COD of over 1,00,000 mg/l and BOD of over 30,000 mg/l ranks high amongst the pollutants produced by industries both in magnitude and strength. Treatment and safe disposal of this waste is a challenging task since long. The high strength of waste water renders aerobic treatment very expensive and physico-chemical processes have met with little success. Thermophilic anaerobic treatment of distillery waste may provide high degree of treatment and better recovery of biogas. It may prove more feasible in most part of tropical country like India, where temperature is suitable for thermophilic micro-organisms. Researchers have reviled that, at thermophilic conditions due to increased destruction rate of organic matter and pathogens, higher digestion rate can be achieved. Literature review reveals that the variety of anaerobic reactors including anaerobic lagoon, conventional digester, anaerobic filter, two staged fixed film reactors, sludge bed and granular bed reactors have been studied, but little attempts have been made to evaluate the usefulness of thermophilic anaerobic treatment for treating distillery waste. The present study has been carried out, to study feasibility of thermophilic anaerobic digestion to facilitate the design of full scale reactor. A pilot scale anaerobic fixed film fixed bed reactor (AFFFB) of capacity 25m3 was designed, fabricated, installed and commissioned for thermophilic (55-65°C) anaerobic digestion at a constant pH of 6.5-7.5, because these temperature and pH ranges are considered to be optimum for biogas recovery from distillery wastewater. In these conditions, working of the reactor was studied, for different hydraulic retention times (HRT) (0.25days to 12days) and variable organic loading rates (361.46 to 7.96 Kg COD/m3d). The parameters such as flow rate and temperature, various chemical parameters such as pH, chemical oxygen demands (COD), biogas quantity, and biogas composition were regularly monitored. It was observed that, with the increase in OLR, the biogas production was increased, but the specific biogas yield decreased. Similarly, with the increase in HRT, the biogas production got decrease, but the specific biogas yield was increased. This may also be due to the predominant activity of acid producers to methane producers at the higher substrate loading rates. From the present investigation, it can be concluded that for thermophilic conditions the highest COD removal percentage was obtained at an HRT of 08 days, thereafter it tends to decrease from 8 to 12 days HRT. There is a little difference between COD removal efficiency of 8 days HRT (74.03%) and 5 day HRT (78.06%), therefore it would not be feasible to increase the reactor size by 1.5 times for mere 4 percent more efficiency. Hence, 5 days HRT is considered to be optimum, at which the biogas yield was 98 m3/day and specific biogas yield was 0.385 CH4 m3/Kg CODr.

Keywords : spent wash, anaerobic digestion, biomass, biogas
Conference Title : ICEST 2016 : International Conference on Environmental Science and Technology
Conference Location : Venice, Italy
Conference Dates : April 11-12, 2016