EXPERIMENTALSTUDY ON TREATMENTOF SAGO WASTEWATER USINGFIXEDBED REACTORIN THE PRENCE OF EFFECTIVE MICROORGANISMS

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ABSTRACT

This study assesses the recital of fixed bed reactors in anaerobic treatment of sago industry wastewater using Effective Microorganism. A laboratory scales Up flow Anaerobic fixed bed reactor, having a working effective volume of about 13. L was operated and Polypropylene rings were used as packing media. The initial Hydraulic Retention Time range was about 0.6. days and further increased. Various effluent characteristics ranges of COD concentration, Total Suspended Solids, VFA, and biogas production were studied until the attainment of steady state. The Hydraulic Retention Time of a sago wastewater was 3.0, 1.50, 1.00, 0.75, 0.60 days. The maximum COD removal efficiency of 83% was attained at a prefixed flow rate of 0.18 l/day with the average COD of 5320mg/l at 3.0 days HRT. It was accomplished that the influence of COD reduction was increase to increases the HRT The gas production was increased with increased OLR. The maximum gas production of 0.255 m^3/kg COD in fixed bed reactor in the presence of effective microorganisms was obtained.

Keywords: Biogas, COD, Fixed film Reactor, Hydraulic Retention Time, Sago mill effluent.

INTRODUCTION

Sago, the common edible starch in the form of globules is processed from the tubers of tapioca (Mannihot utillisema). Processing of tapioca requires 20,000 to 30,000 L of water per ton of Sago; besides it produces equal quantity of wastewater, which is highly organic, foul smelling and acidic (Murthy and Patel, 1961; Sastry and Mohan, 1963). Various anaerobic technologies including conventional anaerobic treatment (Sastry et al., 1964; Tongkasane, 1970; Saroja and Sastry, 1972; Pescod and Thanh, 1977), high rate anaerobic treatment such as Anaerobic Filter (AF- Khageshan and Govindan, 1998) and Fluidized Bed (FB - Saravanane et al., 2001) have been attempted to treat Sago wastewater. The conventional treatment options are known to have low treatment efficiency owing to high concentrations of solids present in the wastewater. Published works indicate that most of the negative aspects of high rate anaerobic digestion can be overcome by restricting the supporting material to the top 25 to 30% of the reactor volume (Guiot and Van den berg, 1984; 1985). This would further help realize the advantages of both fixed film and up flow sludge blanket treatment.

Packing material is used for the growth of microorganisms in the attached manner (Elmitwalli et al. 2000). New technologies are being produced to optimize the anaerobic treatment of wastewater, one of these new technologies being proposed is the use of Effective Microorganisms (EM). A microbial inoculant containing many kinds of naturally occurring beneficial microbes called 'Effective Microorganisms' has been used widely in nature and organic farming (EI Karamany et al. 2001). EM is a mixture of group of organisms that has a reviving action on humans, animals and the natural environment (Higa & Parr 1994). Many different organisms live within the wastewater itself, assisting in the breakdown of certain organic pollutants. The basis for using these EM species of microorganisms is that they contain various organic acids due to the presence of lactic acid bacteria, which secrete organic acids, enzymes, antioxidants and metallic chelates (Higa & Chinen 1998).

MATERIALS AND METHOD

The sago mill wastewater sample was analyzed to determine some of its general characteristics. The seed sludge was collected from an anaerobic reactor of sago mill wastewater, and was used for the inoculation in the fixed film reactor. This was used as the inoculum because the sludge had sufficient number of acetogenic and methanogenic bacteria (Bischofsberger et al. 2005). The Laboratory model consists of anaerobic biofilm reactor having a working volume of **13.0** liters. The reactor was made up of clear acrylic Plexiglas which was sealed to avoid any air entrapment and filled with the solid support media, consisting of PVC rings namely *Fugino spirals*. The rings were of 19mm outer diameter, 1mm thickness and 15mm height, which were randomly packed. And they were light, durable inexpensive and easy to install, and their high porosity to prevented any clogging by the increased bio mass. Thematerial was packed in the reactor to avoid flow tortousity and other physical factors at a height of 50cm. The reactor was continuously fed with real time **Sago** wastewater at an influent flow rate of 0.18, 0.36, 0.54, 0.72; 0.90 l/day by means of Peristaltic Pump with varied Hydraulic Retention Time (HRT).The experimental model design was based on flow rates, Hydraulic Retention Time, Organic Loading Rate and influent Chemical Oxygen Demand. The % reduction of Volatile Fatty Acid (VFA) was calculated, and Bio gas generations were continuously measured by water displacement method in the reactor.

RESULTS AND DISCUSSION

Effect of Hydraulic Retention Time on Dairy Effluent

The attached growth microbial reactor was continuously fed with real time dairy wastewater with an influent flow rate of 0.18, 0.36, 0.54, 0.72, 0.90 l/day with varying Hydraulic Retention Time of 3.0, 1.50, 1.00, 0.75, 0.60 days. It increased the flow rate from 0.18 l/days to 0.90 l/days at an average value of COD concentration of 3620, 4060, 4300, 4570, 5200 mg/l and attained the %COD removal efficiency of 66% to 84%. The maximum %COD of removal efficiency of 84% was attained at an influent COD of 5250mg/l with the corresponding flow rate of 0.18 l/days at 3.0 days Hydraulic Retention Time. The 66%

removal efficiency was attained at 0.6 days HRT in COD concentration of 3640mg/l. It was concluded finally that the COD reduction was largely affected by HRT as shown in **Figure 1.**

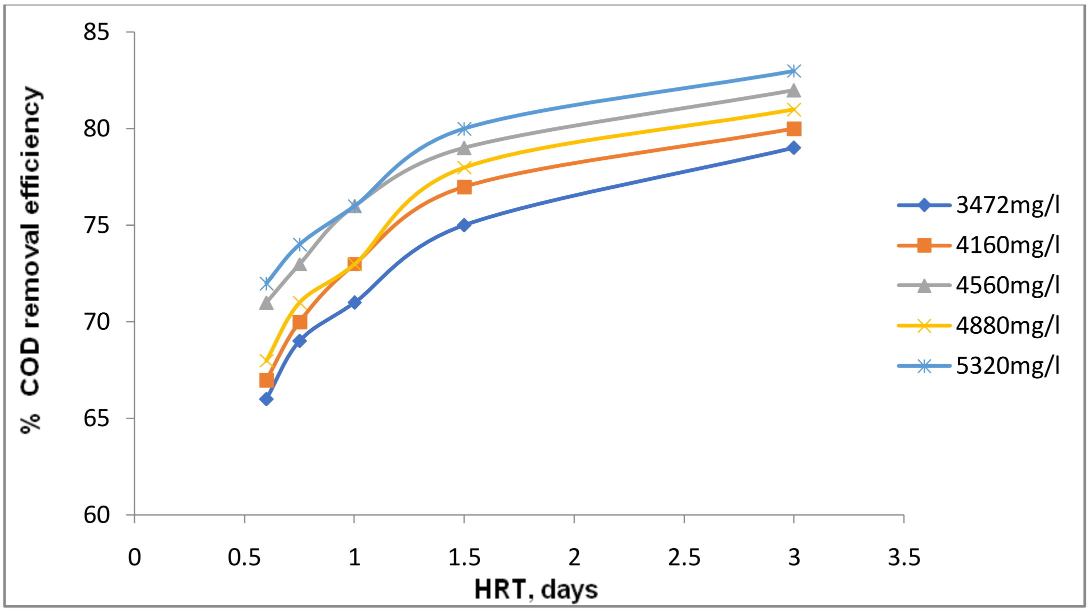

Figure: 1 HRT, days Vs % COD removal efficiencyof sago effluent

The maximum biogas of 0.048m^3/kg COD removed was achieved at an influent flow rate of 0.18 l/days at 3.0 days Hydraulic Retention Time with an influent COD concentration of 4500 mg/l. as shown in **Figure 2.**

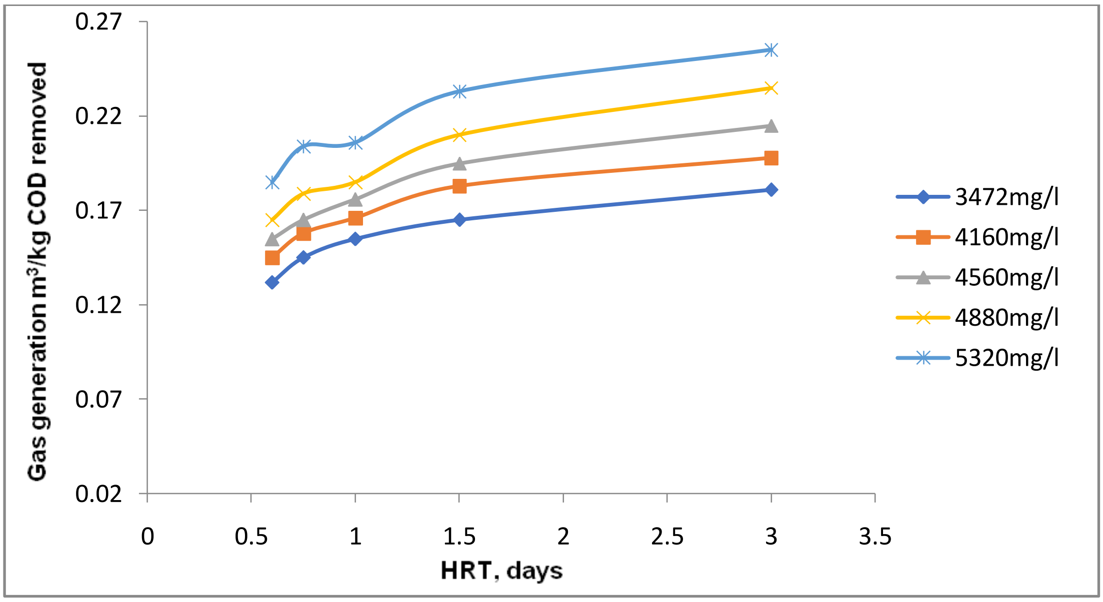

Figure: 2 HRT, days Vs Gas generation m^3/kg COD removedfor

Sago effluent

CONCLUSION

The study concludes that fixed bed reactor with polypropylene ring as packing medium in the presence of effective microorganisms is superior and a promising technology as compared to other fixed bed reactor with rosette and PVC carrier in the treatment of sago industry wastewater. The optimum HRT for fixed film reactor with polypropylene ring and PVC carrier is the maximum COD removal efficiency of 83% was attained at a prefixed flow rate of 0.18 l/day with the average COD of 5320mg/l at 3.0days HRT for sago wastewater. Treatment performance of the lab scale fixed film reactor was evaluated at different HRTs using Sago industry waste water. From the experimental study it was evident that the anaerobic fixed film reactor could be effectively used for the treatment of sago industry waste water treatment without clogging and short circuiting. The lab scale fixed film reactor attained The up flow anaerobic filter region of the fixed film reactor was highly helpful to minimize the escape of biomass from the system which increases the solids retention time in the reactor and hence improves the overall performance efficiency of the Anaerobic fixed film Reactor as well.

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