ABSTRACT

A 20.6 litre Upflow Anaerobic Sludge Blanket (UASB) reactor was constructed and used to biologically treat rum distillery waste water with an average chemical oxygen demand (COD) index of 85,000 milligrams per litre. Experiments were performed at three different temperature ranges, namely, 24 - 28°C (ambient), 36 - 38°C (mesophilic) and 53 - 55°C (thermophilic) at three hydraulic retention times (HRT's) namely 1, 3 and 5 days (3, 4 and 5 days in the case of the ambient temperature operation).

Best results were obtained in the mesophilic range. During this period, COD reduction efficiencies decreased with a decrease in HRT, (75.9%, 52.9% and 49.9% for the 5, 3 and 1 day HRT respectively). These HRT's corresponded to organic loading rates of 16.2, 27.3 and 82.0 kg COD$m^{-3}d^{-1}$ respectively. The resulting average gas production rates corresponding to these HRT's and COD reduction efficiencies were 32.5, 33.7 and 35.4 litres of gas per day and the methane percentages were 70.4%, 64.6% and 60.8% respectively. Similar trends resulted in both the ambient and thermophilic ranges although values were generally lower in the ambient temperature operation and skewed somewhat in the thermophilic temperature operation.

From these initial results, liquid phase reaction constants based on simple first order kinetics were also computed by evaluating both the changes in volatile solids percentages and chemical oxygen demand. These generally increased with temperature of operation from the ambient to the mesophilic ranges with a subsequent decrease in going from the mesophilic to the thermophilic range. Similar, though less discernable trends, were seen for the gas phase reaction constants and specific methane yields.

Lastly, a superficial economic analysis showed that the implementation of a treatment facility for a waste flow of 540 cubic metres daily would be economically attractive if the system is properly designed and integrated into the existing processing operations.