FACULTY OF APPLIED SCIENCES

DEPARTMENT OF APPLIED CHEMISTRY

TITLE:

An investigation into the effect of introducing carbon dioxide to a Vinasse bio-digester on the rate of biogas production.

By

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ABSTRACT

Vinasse is a by-product of the ethanol production coming from sugar cane and is produced as waste-water at the bottom of the stripper column in hydrous ethanol distillation. It is characterized by high concentrations of organic nutrients and inorganic salts. Vinasse treatment using anaerobic digestion produces biogas. The student found no evidence of previous research where the effect of the Na_2CO_3/HCO_3^- buffer system on the rate of biogas production was investigated. This is important as it can reduce the biodigester residence time by introducing CO_2 which is a reactant in methanogenesis. The purpose of this study was to determine the effect of introducing CO_2 into a vinasse biodigester on the rate of biogas production by using Na_2CO_3 in pH-control. Experiments were conducted in laboratory-scale anaerobic digesters which had a capacity of 1litre. The biodigesters were operated in a batch system at room temperature for a period of 3 days. Rumen fluid was used as the source of methanogens. The results showed that a maximum biogas yield of 0.66 kg and 0.49 kg was produced from the experiment using Na_2CO_3 pH-control and NaOH pH-control, respectively. A maximum volume of 0.26 m^3 (0.66 kg) of biogas was obtained from 1 litre of Vinasse. The percentage composition of the biogas that was produced from the experiments was found to be (84 – 97 %) CH_4 and (2 – 22 %) CO_2. It was also determined, using Potentiometric titrations on Scrubber NaOH, that the use of NaOH in bio-digester scrubbers is an effective way of purifying biogas from CO_2 and other impurities. The conclusion can be drawn that the use of Na_2CO_3 in pH-control results in higher biogas production rates and greater yields as compared to NaOH pH-control.