

**Title: Biogas production from vinasse with high COD content**

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Brazil is the second largest producer of ethanol in the world. In Brazil's ethanol production, a large volume of vinasse is generated, about 10 to 13 liters of this residue per liter of ethanol produced. This means an annual output of about 300 billion liters of this waste material. Because of this and the risk of environmental contamination by this material, there is a need to reduce the volume of this waste. This will minimize the cost of managing this environmental liability. This can be done by concentrating the vinasse. In addition, the electricity market has presented itself with a good opportunity for the sugar-energy sector. For these reasons, the objective of this study was to produce methane from concentrated vinasse. For this purpose, concentrated vinasse was obtained from a mill that uses a multi-purpose vinasse concentrator in São Paulo State. Two reactors (R1 and R2) of UASB type (up-flow anaerobic sludge blanket) with capacity for 50 L and reactional volume of 34.5 L each one were used. The reactors were operated at 38 °C, with hydraulic retention time of 24 hours for 103 days. The reactor R1 received increasing organic load rate (OLR) during 9 phases (3.94, 3.5, 3.89, 4.66, 4.94, 5.33, 5.66, 6.08, 6.38 And 8.96 g COD (L d)<sup>-1</sup>), with affluent COD ranging from 23.927 mg L<sup>-1</sup> to 44.060 mg L<sup>-1</sup>. The R2 reactor was operated as a control treatment, with OLR ranging from 3.83 to 4.32 g COD (L d)<sup>-1</sup>. The evaluation of the anaerobic biodegradation process was carried out based on biogas production, COD removal efficiency, pH, alkalinity, total volatile acid concentration (TVA), sludge solids concentration and sludge specific methanogenic activity (SMA). R1 showed to be more efficient, with pH and alkalinity within the ideal range and effluent with lower concentration of TVA. The process performance was stable, achieving maximum COD removal efficiency of 90% in R1. The higher volume of biogas production occurred concurrently with the higher specific biogas production, when the COD was 42.003 mg L<sup>-1</sup>, the volumetric biogas production was 135.24 L day<sup>-1</sup> and the biogas production in relation to removed COD was 0.362 Lbiogas gCODremoved<sup>-1</sup>. At the end of the experiment, the SMA of R1 was 1.19 gCODCH<sub>4</sub> gTVS.day<sup>-1</sup>, 40% higher than R2, which had 0.85 gCODCH<sub>4</sub> gTVS.day<sup>-1</sup>. The high efficiency of organic matter removal and biogas production in the reactor fed with high COD concentration was obtained through the gradual adaptation of the microbial consortium.

**Keywords:** biogas production, vinasse, high COD content.

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