TITLE: COFERMENTATION OF SUGARCANE MOLASSES AND CRUDE GLYCEROL IN AN ANAEROBIC FLUIDIZED BED REACTOR

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ABSTRACT:

By-products from the production of biofuels such as crude glycerol (CG) and sugarcane molasses (M) can be interesting carbon sources for the biological production of hydrogen through anaerobic digestion. Thus, the objective of this research was to evaluate the cofermentation of these two substrates in an anaerobic fluidized bed reactor, with consequent production of soluble metabolites (acids and alcohols), H_2 and CO_2. The reactor had total and useful volumes of 1.2 and 0.9 L, respectively. The source of microorganisms was anaerobic sludge from an Upflow Anaerobic Sludge Blanket (UASB) reactor treating raw domestic sewage. Before inoculation, the sludge was subjected to thermal pre-treatment in order to eliminate methanogenic microorganisms. Shredded tires were used as support material inside the reactor to ensure microbial adhesion. Different CG/M feed ratios were studied, by keeping molasses constant (4 $g.L^{-1}$) and varying the crude glycerol (1 $g.L^{-1}$,2 $g.L^{-1}$, 3 $g.L^{-1}$ and 0 $g.L^{-1}$) with a hydraulic retention time (HRT) of four hours. The highest average hydrogen yield was obtained in the fourth oerational phase (without crude glycerol) – 3.8 $mol_{H2}.mol_{glicose}^{-1}$, while the highest average volume of hydrogen production was obtained when the crude glycerol was completely withdrawn from the reactor feeding - 0.3 $L_{H2}.L_{reactor}^{-1}.h^{-1}$. The major soluble metabolites produced were 1.3-propanediol (14.4 to 38.8%), acetic acid (13.3 to 26.9%) and propionic acid (12.1 to 37.5%). It can be concluded that the increase in glycerol concentration throughout the operating phases inhibited the hydrogen production. Although molasses alone has great potential to produce H_2, the cofermentation with crude glycerol favor H_2-consuming metabolic pathways, resulting in intermediary products with high added value, such as 1,3-propanediol and propionic acid.

Keywords: anaerobic fluidized bed reactor, molasses, crude glycerol

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