

TITLE: MICROBIAL COMMUNITY INVOLVED IN HYDROGEN PRODUCTION FROM SUGARCANE MOLASSES AT DIFFERENT HYDRAULIC RETENTION TIMES

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ABSTRACT:

Hydrogen stands as a promising clean fuel in a society looking for renewable and efficient energy alternatives. Hydrogen production via dark fermentation has been carried out in several types of bioreactors. Among them, anaerobic fluidized bed reactors (AFBR) emerge as a favorable configuration, since the suitable adhesion of biomass to support materials allows high organic loading rates (OLR) and low hydraulic retention times (HRT). This study used an AFBR to produce hydrogen from sugarcane molasses fed at 25 g-DQO.L^{-1} . The reactor of 1.2 L contained shredded tire as support material and the inoculum was sludge collected from a sludge blanket reactor of a sewage treatment plant. Hydraulic retention time (HRT) of 12, 6, 4 and 3 h were analyzed. Microbial community related to Bacteria Domain was studied using Denaturing Gradient Gel Electrophoresis (DGGE) technique. PowerSoil[®] DNA Isolation Kit from MOBIO Laboratories was used to carry out DNA extraction from the samples. In the amplification reaction the primer set specific for Bacteria, 968 FGC and 1401 R was used. DGGE was performed using DGGE DCodeTM - Universal Mutation system. BIO-RAD Detection System. For DGGE profiles analysis the dendrogram was elaborated using the software Bionumerics 2.5 and the diversity indexes of Shannon-Wiener (H) and Pearson's correlation. The maximum hydrogen production rate ($1.44 \text{ L-H}_2\text{.h}^{-1}\text{.L}^{-1}$) was achieved at HRT of 4 h. The highest hydrogen yield (HY) ($3.07 \text{ mol-H}_2\text{.mol}^{-1}\text{-glucose}$) was obtained at HRT of 6h. The main metabolites were ethanol (44-67%) and acetic acid (18-38%). Analysis of DGGE showed bands similarity reduced along with HRT, achieving correspondence of 88% between HRT of 3 and 4 h. It means that the structure of the microbial community altered as organic load has increased. Shannon-Wiener indexes (SWI) of similarity were 2.43, 2.77, 2.69 and 2.44 for HRT of 12, 6, 4 and 3 h, respectively. It infers that microbial diversity was directly proportional to hydrogen yield, where higher SWI of 2.77 corresponded to higher HY of $3.07 \text{ mol-H}_2\text{.mol}^{-1}\text{-glucose}$. It could be concluded that HRT of 6 h presented higher Shannon-Wiener index of 2.77, inferring that highest community diversity and variety of metabolic pathways favoured the hydrogen production in this study.

Keywords: anaerobic fluidized bed reactor, hydrogen production, sugarcane molasses, DGGE profiles

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