

Evaluation of Biohydrogen Production from Cheese Whey and Assessment of the Associated Microbial Community

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ABSTRACT

Biological H₂ production could be an attractive alternative for cheese whey (CW) treatment and reclaiming. In principle H₂ production at ambient temperature could lead to energy savings in heating both the feed and bioreactor. On the other hand, it is important to study the microbial communities associated to biological processes in order to find eventual relationships between process performance and biocatalysts. Therefore the aim of this work was to evaluate the H₂ production in lab scale anaerobic fluidized bed reactors at ambient temperature using CW as substrate as well as the related changes in the microbial community. There were 3 stages of operation with an organic volumetric load (Bv) of 10 g/(L.day) using: (i) sucrose, (ii) CW, and (iii) CW with 1 g/L of NaCl. The main response variables were: H₂ productivity (NmLH₂/Lbed.day), Jaccard similarity index (IJ) and Poggi's discrete divergence index ΔP. In experiment with sucrose the H₂ productivity was 1 011 NmLH₂/Lbed.day. In the CW stage, H₂ productivity was 101 NmLH₂/Lbed.day, 10 fold lower than in the first stage with sucrose. We detected moderate concentration of lactic acid in the effluent that suggested the presence of lactic acid bacteria (LAB). LABs are microorganisms related to low H₂ production due to two main effects: substrate competition and excretion of bacteriocins. Some studies showed that the effect of bacteriocins diminish with the presence of NaCl. So, we run a third period of operation with CW plus 1 g/L of NaCl and heat treatment to the bioparticles. In this period we observed that the H₂ productivity increased 3 times (316 NmL H₂/Lbed. day) compared to the value with only CW. The IJcw-CWNaCl was 0.18 and the ΔP was 0.35, this indicates that the community profiles are almost completely different, maybe due to the NaCl addition and the heat treatment to the bioparticles. One of the identified microorganisms was *Propionibacterium cyclohexanicum*, this strain is considered to be a competitor of hydrogen-producing microorganisms in dark fermentation. We could conclude that the addition of NaCl had a positive effect on H₂ productivity.

Keywords: Biohydrogen production, cheese whey, microbial community

