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Comparison of hydrogen-producing bacterial communities adapted in continuous and discontinuous reactors

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ABSTRACT

We evaluate the bacterial composition during the anaerobic granules adaptation for hydrogen production using continuous and discontinuous feeding-regime. Adaptation was induced by employing short hydraulic retention times and low pH. The microbial community analysis revealed that both discontinuous and continuous adaptation strategies resulted in the selection of different microorganisms despite the use of the same initial inoculum. The dominant microorganisms present in the continuous process belong to the genus *Escherichia* and *Clostridium*; while in the discontinuous adaptation prevailed Clostridiales. The different feeding-regimes applied not only reduced the diversity, but also the composition of the microbial community. The Jaccard's and Shannon–Wiener indexes showed that the different operational strategies applied not only reduced the diversity, but also the composition of the microbial community.

1. Introduction

The selection of hydrogen-producing bacteria communities has important repercussions during the start-up phase of any reactor [1]. The microbial community composition has a strong effect on the process efficiency [2]. Pure and mixed bacterial cultures have been applied as source of inoculum to produce hydrogen [3,4]. Different genus of microorganism including *Clostridium*, *Escherichia*, *Enterobacter*, *Bacteroides* and *Bacillus* has been reported as the hydrogen producers in biological systems [5–7].

Up to now, the anaerobic sludge has been the main inoculum source to produce hydrogen [3,4]. In the anaerobic granules different types of microorganisms are distributed along the granule forming differentiated layers [8]. Fermentative bacteria are distributed mainly at the outer layer of the granule and are in contact with the fed substrate. The acetogenic microorganisms, including hydrogen-producing bacteria, are located in the middle of the granule [8].

From a practical point of view, bacterial consortia are more suitable than pure cultures since it is possible to produce hydrogen in non-sterile conditions [9]. Although mixed cultures can be more robust to the operational changes than pure

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