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Biological fermentation of syngas

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Syngas (synthesis gas) is produced during the gasification of different materials, e.g. coal, oil and natural gas, tar sands, recalcitrant wastes, lignocellulosic biomass. Syngas is composed of mainly H_2, CO and CO_2 that can be used in a biological process for the production of fuels or usable chemicals. The objective of this work is to explore the potential of converting syngas to methane or other combustibles, such as ethanol or butanol. Mesophilic (37ºC) and thermophilic (55ºC) microcosm experiments were performed with synthetic syngas mixtures as sole carbon and energy sources. Mesophilic and thermophilic microcosms were inoculated with suspended sludge from anaerobic bioreactors. During incubations, headspace composition was analysed by GC and fatty-acids and alcohols present in the liquid by HPLC. Microbial community changes were monitored by PCR-DGGE. At mesophilic conditions, CO was not used at concentrations higher than 0.15bar. At 55°C, after successive transfers using 0.15bar, all CO was consumed and converted mainly to acetate. The thermophilic suspended sludge showed to be less inhibited by presence of CO than the mesophilic suspended sludge. Currently, series of thermophilic experiments, using a CO partial pressure of 0.3bar, is ongoing in order to adapt microbial communities to higher CO concentrations. A thermophilic enriched culture, consisting of two microorganisms and able to convert syngas was obtained. Identification of these microorganisms is being conducted using cloning and sequencing techniques. We expect to isolate these bacteria in order to characterize their physiology regarding CO conversion and to explore their potential for biotechnological applications.

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