Poster 9-28

Mixed culture biotechnology for syngas conversion

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Bioconversion of recalcitrant biomass/waste into bulk chemicals or biofuels is not practicable. Gasification of these materials produces syngas (mainly composed of CO_2, CO and H_2) that can be converted to products of interest, both by thermochemical or microbial processes. Thus far, industrial microbial processes focus on syngas conversion to ethanol, but other products such as butanol, acetic acid, butyric acid, hydrogen and methane can be obtained as well. In this work, microbial syngas conversion by anaerobic mixed cultures was explored. The physiology and microbial composition of mesophilic (37ºC) and thermophilic (55ºC) communities degrading syngas were analyzed. Cultures were incubated in batch and, upon syngas conversion, transferred to bottles with increasing CO partial pressure (from 5% to 50% CO, total pressure 1.75 bar). Syngas utilization and fatty-acids and alcohols formation were monitored. Microbial composition was analyzed by PCR-DGGE and the 16S rRNA gene of predominant microorganisms sequenced. Under mesophilic conditions, CO could not be used at partial pressures higher than 10%. However, thermophilic enrichment cultures could convert CO at partial pressures up to 50%. Acetate and CO_2 were the main products formed by the mixed cultures. Predominant microorganisms in syngas-degrading communities were closely related to *Thermoanaerobacter, Thermoanaerobacterium, Desulfotomaculum* and *Thermincola* species. Syngas conversion in batch assays was rather slow and possibly limited by gas-liquid mass-transfer rate. Presently we are optimizing CO-water mass transfer and mixing performance using gas lift and oscillatory reactors. The final purpose is the development of a continuous process for efficient syngas conversion by mixed cultures.