Biohydrogen production and VFA recovery

from complex organic substrates under hyperthermophilic conditions

Social Impact

The worldwide growing energy demand is currently ~~is~~ met primarily through the burning of fossil resources (~80 %).~~–~~ However, the negative effects on human health, global warming~~,~~ as well as the inevitably exhaustion of oil, coal and gas in the following couple of decades emphasize the necessity ~~of~~ to ~~to~~ find and establish contemporary and renewable energy sources. Hydrogen has thereby shown enormous potential. Due to its high energy density and the high conversion efficiency without the release of further greenhouse gases, it is regarded as one of the best energy carriers of the future.

Technological challenges

The main objective of this study is to establish a process for the efficient simultaneous production of hydrogen and lactic acid using *Thermotoga neapolitana*.

Thermotoga neapolitana is a unique organism. It offers fast growth and effective hydrogen production through dark fermentation from a wide range of substrates. The achieved hydrogen yields are exceptional reaching the theoretical maximum of 4 mol H_2 / mol glucose while contamination risk is low due to extreme culture conditions. This underlines the suitability of *Thermotoga neapolitana* for industrial hydrogen production. Recently, a new metabolic pathway named “Capnophilic Lactic Fermentation” was introduced, coupling hydrogen with increased lactic acid production by sparging culture broth with CO_2. The additional recovery of this ~~thought~~ sought after ~~chemical~~compound represents an opportunity to improve the overall profitability of the process. To assure high yield hydrogen production challenging conditions need to be established. Most importantly exclusion of oxygen, 80°C, pH control to 7 and avoidance of hydrogen pressure build up. Former research has ~~successfully~~ primarily applied those conditions in small scale batch fermentations focusing on the optimization of the process conditions to maximize hydrogen yield. This study will focus on various approaches to push this process towards an efficient large scale production. Increased biomass concentration will be tested for its potential to increase production rates. A continuous process favorable in industrial processes will be developed and the operative inclusion of Capnophilic Lactic Fermentation into the production process will be tackled.

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