Quantitative Bioprocess Development for Production of Biofuels and CO_2 Fixation

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Motivation:

- CO_2 emissions are made responsible for climate change.
- Sources of renewable energies (such as wind or solar energy) need to be made storable.

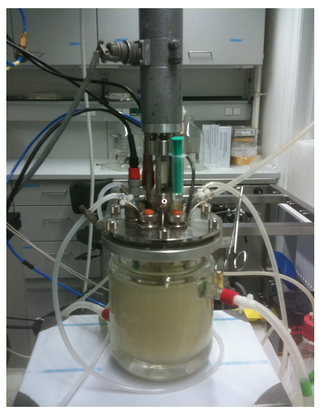
Mission:

- Development of a robust and economic competitive process for the generation of biofuels
  - Using raw material from renewable energy sources
  - Fixation of CO_2
- Prove the feasibility to use real emission gases

Methods and Results:

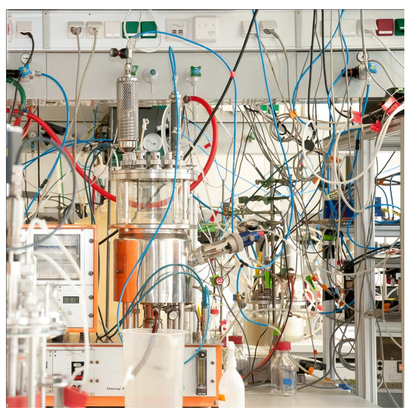
On-line and off-line analytics as well as PAT are used for real time data exploitation

H_2 + **CO_2** + **Integration** → **CH_4**



Fermenter for the production of biohydrogen by using *E. aerogenes*.

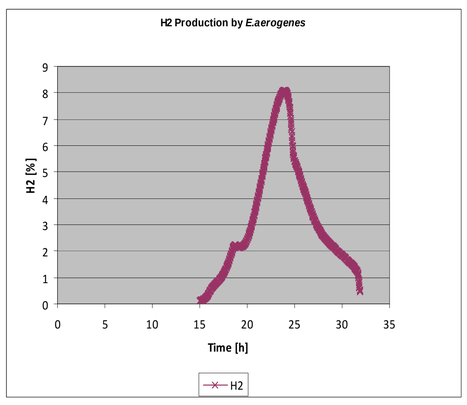
Fermenter for glucose fermentation by *S. cerevisiae* for the production of bioethanol and CO_2.



Process integration of bioethanol, biohydrogen and biomethane production. Fermenters are shown on the picture in from front to back.

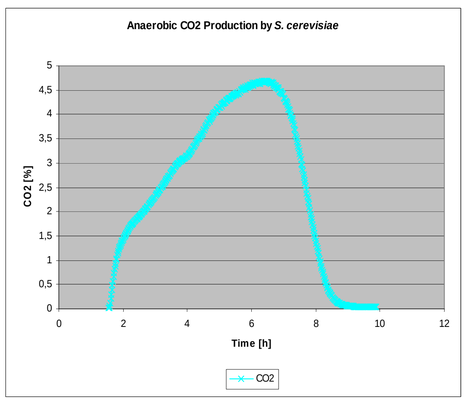
Fermenter for biomethane production using pure culture of a thermophilic methanogenic strain

Facultative and strict anaerobic bacteria



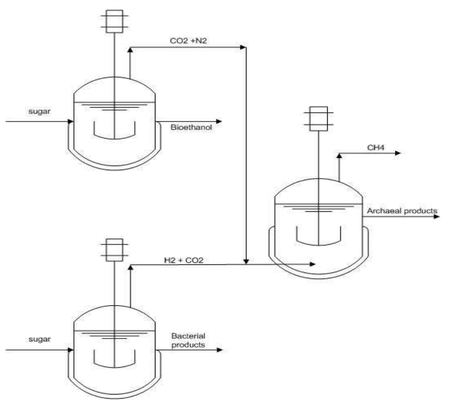
Results for the fermentation of glucose by *E. aerogenes* for the production of H_2.

S. cerevisiae for bioethanol and concomitant CO_2 production



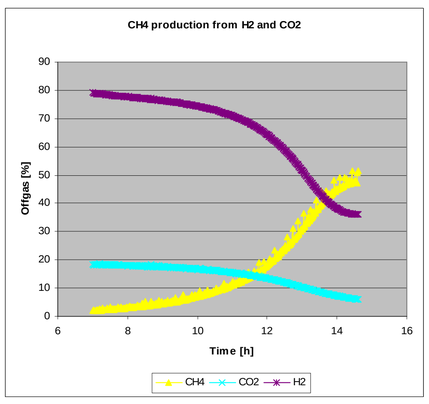
Results of anaerobic glucose fermentation by *S. cerevisiae* for the production of CO_2 by batch technique.

Automation & bioprocess control



Schematic overview of process integration of biohydrogen, bioethanol and biomethane production.

Methanogenic Archaea convert H_2 and CO_2 to CH_4



Results for the production of biomethane using hydrogen and carbon dioxide as substrates.

Output:

Our research focuses on:

•Technology development and integration of 2nd and 4th generation of biomass utilization

•Quantification and scale up of biohydrogen, bioethanol and biomethane production

•Comprehensive and quantitative process development aiming for industrial application

The technology will be very important in respect to the global carbon cycle and renewable energy production.

References:

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