
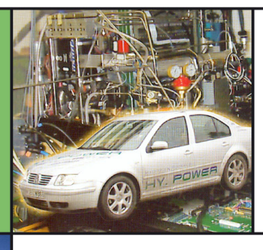
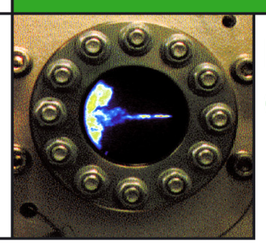

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SunChem – Bio-Synthetic Natural Gas from Microalgae

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Why Microalgae?

The production of liquid biofuels from food crops such as corn, soya, and sugarcane are in direct competition with food production for human consumption.

In contrast, microalgae grown in photobioreactors, offer the following advantages:

- Microalgae are the most productive photosynthetic organisms on earth and grow several times faster than other energy crops.
- They can grow in reactors on non-fertile land, thus not competing with food production.
- They require less water for growth than land cultivated crops.
- They can directly convert industrial CO_2 emissions into organic matter.

Why Bio-Synthetic Natural Gas?

Wet biomass feedstocks can efficiently be converted into Bio-Synthetic Natural Gas (Bio-SNG) through **catalytic hydrothermal gasification**. The major advantages are:

- Bio-SNG can be used in the existing infrastructure (natural gas grid).
- It can be sold as transportation fuel in the form of natural compressed gas.
- Technology with high efficiency for power production is available (CHP).
- No biomass drying or product distillation steps are necessary.

catalytic hydrothermal gasification

400°C, 30 MPa, catalyst

CH_4

CO_2 +

H_2

SunChem Process: Closed-Loop System with Respect to Nutrients

1. Microalgae use sunlight energy, CO_2 and H_2O for growth. They are cultivated in photobioreactors.

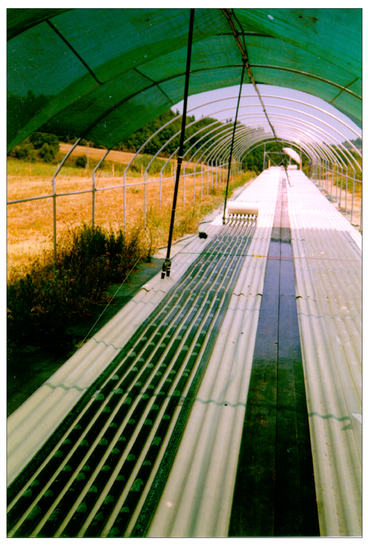
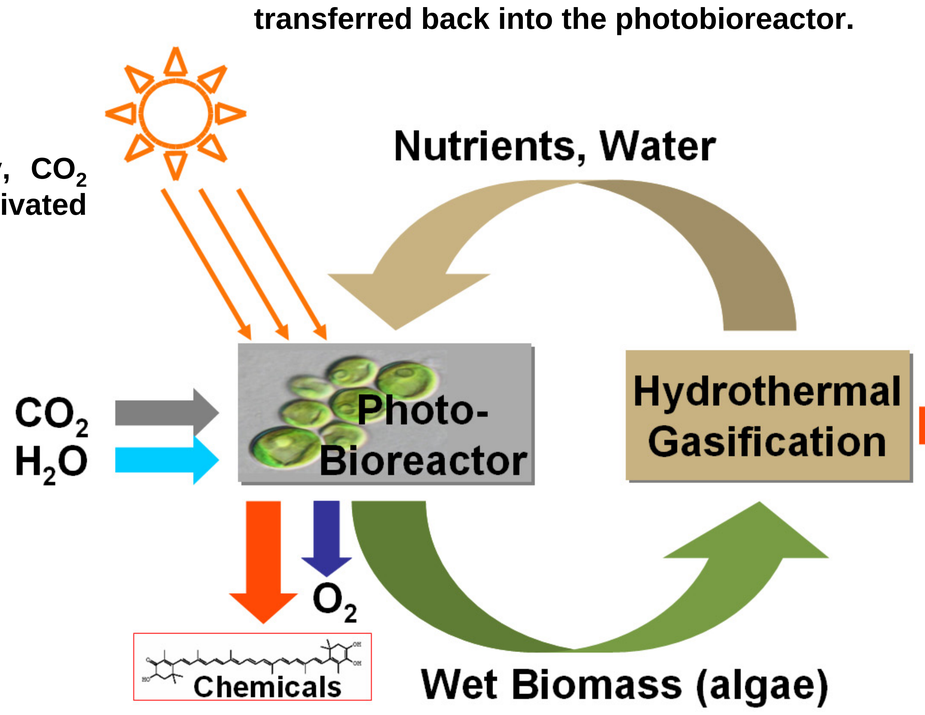


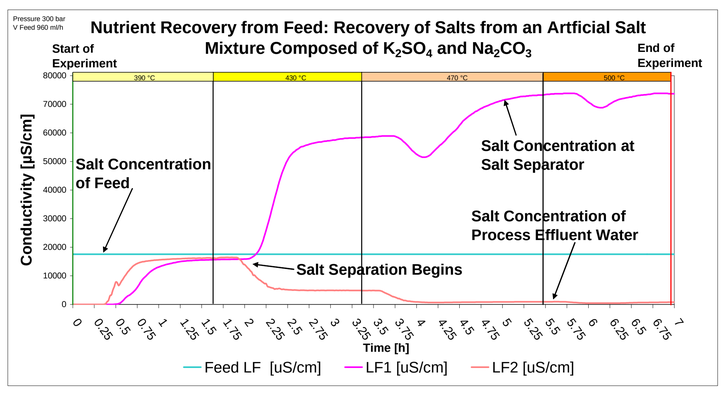
Photo source: Courtesy of Marine Biotechnology Group, UR Wageningen

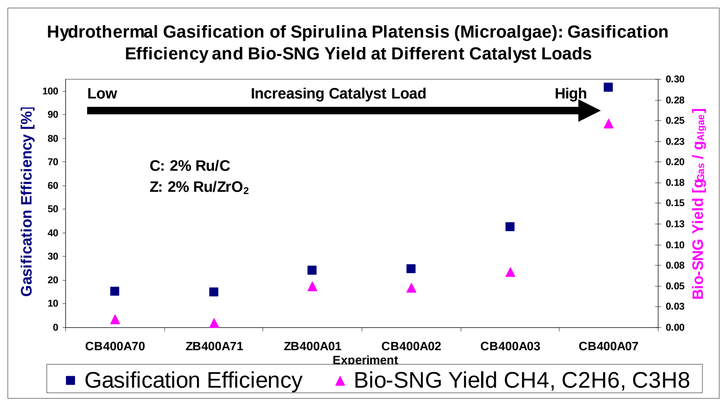


2. Bio-active chemicals can be extracted from the microalgae, before feeding them into the hydrothermal process.

3. The biomass is converted into Bio-SNG by catalytic hydrothermal gasification. Nutrients and water are separated during the process from the Bio-SNG.

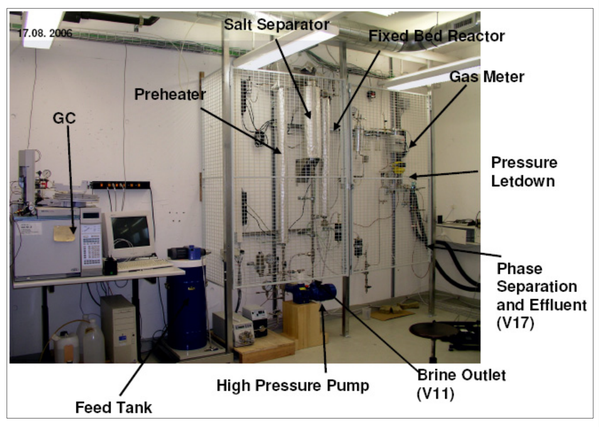
4. The recovered nutrients and water are transferred back into the photobioreactor.





The Hydrothermal Laboratory Plant

- 1 kg feed stream per hour
- Concentrations up to 20 wt % organic material
- Operated almost fully by remote control
- The rig consists of three sections:
  - Preheating
  - Salt separation
  - Fixed bed catalytic reactor
- In order to remove the nutrients quantitatively, the salt separator is the hottest part of the rig



Conclusions

If proved feasible, SunChem is an innovative way to produce renewable transportation fuel and power.

Nutrients can be recovered from the microalgae feedstock in the form of a concentrated salt brine.

Microalgae can be produced at high specific rates in photobioreactors, surpassing the area yield of crops and other plants.

Technical challenges such as the coupling of the biological process with the hydrothermal process need to be tackled in the future.

The economic feasibility of the SunChem process has to be assessed and demonstrated.

- Project-Partners: Velux-Stiftung, Axpo Naturstrom Fond