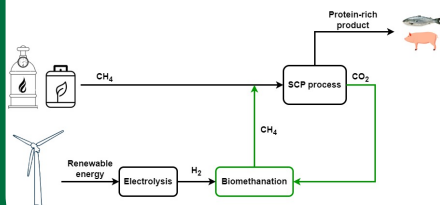
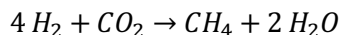


Introduction

- Rapid population growth and increasing demand for high-quality protein necessitates alternative and sustainable protein production.
- Single Cell Protein (SCP) is a promising alternative to conventional protein sources.
- Unibio A/S produces SCP through a gas fermentation using CH₄, but the current production contributes to CO₂ emissions.
- Potential for circular production by converting CO₂ to CH₄ through the power-to-methane technology biomethanation.



Methods

Examination of various scenarios for implementing a biomethanation process into Unibio's process chain.

Technical analysis based on theory and Unibio's practical experience.

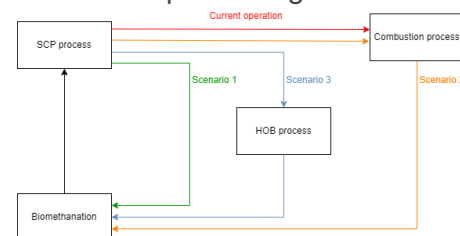
- Process flows.
- Comprehensive stoichiometric equations for the scenarios.
- CH₄ utilization for biomass production.

Economical evaluation

- Economy of different scenarios based on prices for CH₄, H₂, CO₂ and value of biomasses and how much of these are consumed and produced in each scenario.
- 2023 and 2050 forecasts based on Danish prices.

Outcome

- Different scenarios for implementing a biomethanation process.



- In a circular system, introduction of an inert compound (N₂) should be avoided.
- An O₂ removal step is necessary between the SCP process and the anaerobic biomethanation process.
- O₂ removal by combustion (Scenario 2) or by a biological process using Hydrogen Oxidizing Bacteria (HOB) (Scenario 3). These bacteria consume H₂:O₂:CO₂ in different ratios depending on growth rate.
- Each scenario produces varying biomasses (SCP, HOB, and methanogens) with different demands for H₂ reducing equivalents, impacting the economy.
- Economy depends on prices for reactants and value of biomasses.

Perspectives

- Experimental testing on the biological systems.
- Evaluating market potential of biomasses.
- Investigate opportunities for co-culturing, combining processes.