Design and Control of DC Power Supply for Microbial Electrochemical Synthesis

Master's thesis number: MT-59-22

Introduction and background:

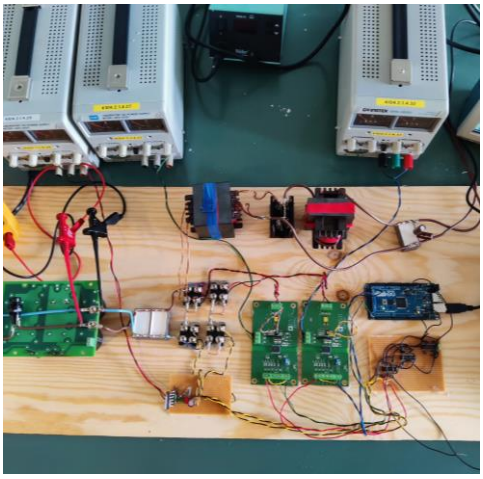
Microbial Electrochemical Synthesis (MES) produces methane or other valuable products from carbon dioxide using electricity as the source of energy. Upgradation of the biogas production system with MES will expand methane generation and minimize the release of carbon dioxide into the environment.

The research group at the Department of Process, Energy, and Environmental Technology at the USN has conducted experiments with MES to obtain the methane content. The MES requires an optimal DC power supply system which should be able to energize electrodes for the electrochemical process. The requisite power is high with low voltage and high current. Previously, different power supply models with various converter design and configuration have been studied and concluded that the electrically isolated system with a half-bridge dc-dc converter in a series configuration is the most efficient design.

Problem description and objective:

The aim of the thesis is to design a low voltage, high power DC power supply system with a bridge dc-dc rectifier for the MES. The design is focused on the laboratory scale setup; thus, the system should be able to supply around $2-3\ kW$ power. The objectives are listed below:

1. Literature research into half and full-bridge DC converters, transformers, and active rectifiers.
2. Design of half-bridge DC-DC converter with electrical isolation power supply that can be used for a small-scale laboratory setup.
3. Modelling and simulation of the power supply with simulation software.
4. Control and optimization of the power supply output by reducing losses in the system.
5. Build the power supply system operatable at low voltage and perform relevant tests with the reactor if enough time is available.
6. Evaluating the scalability and expansion of the found solution for the full-scale reactor setup.



Candidate:

Elisha Thapa

Telephone:

94737151

Email:

238814@usn.no