University of South-Eastern Norway

Faculty of Technology, Natural Sciences and Maritime Sciences, Campus Porsgrunn

Master's Thesis

Title: The Life Cycle Assessment of Methane Production with anaerobic digestion integrated with pyrolysis techniques for Sludge waste minimization

supervisors: Thea Lucia Sauro Indrebø/ Gamunu.L Samarakoon Arachchige

Task background:
Renewable energy is high demand sector due to the depletion of traditional energy sources fossil fuels. Global energy demand and concerns about the unintentional release of fossil fuels contribute to the requirement for an alternate energy-generating option that promotes social, environmental, and economic well-being. Biogas generation technology has a significant influence on reducing important environmental and economic challenges addressed all over the world. The anaerobic digestion (AD) process is the fundamental method of biogas production. Biogas mainly consists of methane (CH4, 50–70%) and carbon dioxide (CO_2, 30–50%). Biogas is mainly used for electricity and heat. The presence of a significant amount of carbon dioxide (CO_2) and other causes environmental problems and limits the usage of biogas.

Combining two processes with a pretreatment method researched with several process flows to identify the most optimized biogas production as a Ph.D. coursework. The most efficient method needs several environmental validations and quantifications to develop the next step. Life cycle assessment is essential to identify the environmental impact of this production process. This course work identifies the environmental impact of optimized methane Production process through Life cycle Assessment in addition to comparison with traditional Biogas production.

Task description:

Objectives: -

- Inventory Analysis of Methane Production in a traditional biogas plant and integrated biogas production system.
- Development of LCA for the process scenarios.
- Comparison of two production scenarios' environmental impacts to quantify the environmental impacts of these two production pathways, with a particular focus on methane production and the management of digested sludge.
    - THP→ AD
    - THP→ DW→AD
                ↳PY→ AD

Methodology

- Characterization of municipal waste sludge and development of a lab-scale high-rate AD reactor
- Measuring and analysis of data for optimized parameter conditions

- Development of LCA for process scenarios
- Comparison of product scenarios environmental impacts
- Result Interpretation
- Thesis completion and publications

Student category: (Energy and Environment technology- EET)

Is the task suitable for online students (not present at the campus)? No

Practical arrangements:
The necessary accessories and instruments will be provided. The supervisor will provide the experiment set-up and operational training at USN, Porsgrunn Campus.

Supervision:
As a general rule, the student is entitled to 15-20 hours of supervision. This includes the necessary time for the supervisor to prepare for supervision meetings (reading material to be discussed, etc.).

Signatures:

Supervisor (date and signature): ....Thea Indrebø.....

13.03.24

Student (write clearly in all capitalized letters): R.G.S.B. Samarasinghe

Student (date and signature): . ……

….13/03/2024……