Single-cell protein production by using *Methylococcus Capsulatus*

Zane Feodorova
Problem

1. Lack of food due to continuous exponential growth of world population

2. Amount of GHG released into atmosphere from unnecessary burning of biogas and natural gas
Work relevance

• Relevant to biogas cogeneration stations and natural gas cogeneration stations

• Possible relevance to natural gas and biogas storage facilities
Purpose of the work

• **Reduce CO2 and CH4 emissions from** biogas and natural **gas burning** in biogas torch, when cogeneration unit malfunctions or produced biogas is not fit for energy/heat production

• **Create single-cell protein** during biogas/natural gas processing
Research methodology

1. **Try various systems for bacteria growth** in natural gas (desiccator, sealed plastic bags, bioreactor system)

2. **Find automatic recirculative methane system** for microorganism growth, which could be integrated in biogas cogeneration plant (bioreactor system)

3. **Find out how to theoretically integrate chosen system** in biogas plant

4. **Measure and register protein content** in microbial biomass
Research results

• Created automatic recirculated methane system, which helps avoid wasteful biogas burning and creates SCP in the process

• Biomass **protein content** is yet to be determined…
Research results (II)

1) Growth in desiccator
2) Growth in sealed plastic
3) Growth in bioreactor
Research results (III)

Current system in biogas plant

- Biomass
- Homogenization tank
- 1st anaerobic reactor
- 2nd anaerobic reactor
- Reservoir
- Gas holders
- Cogeneration unit
- Gas torch

Scheme principle

- Gas outflow from bioreactor
- Gas inflow to bioreactor

Offered alternative in biogas plant

- 1st three-way ball valve
- Bioreactor
- 2nd three-way ball valve
- Methanotrophic bacteria
- Vacuum pump
- Biogas torch

System model in laboratory
Conclusions

• To evaluate if produced protein quality requirements fits EU regulation for animal protein foods

• This might be a potentially good way to cut emissions from wastefully burned biogas in biogas plants and biogas cogeneration stations

• To evaluate amount of protein biomass potentially created in biogas plant, it is necessary to analyze data of wastefully burned biogas in biogas torch from one of biogas companies
Conclusions (II)

• To evaluate the efficiency and potential integration of created recirculative methane absorption system, it is necessary to test it in real life at biogas production and cogeneration station.