Mendelova univerzita v Brně

Influence of specific materials on the methanogenic process

Ing. Martin Haitl

Classification of materials depending on their influence on methanogenic process

- Stimulants:
  - Easy degradable organic materials, with qualitative and quantitative composition suitable for anaerobic fermentation process – energy rich materials (fats, proteins, sugars)
  - Trace elements
- Inhibitors:
  - Heavy metals
  - Pharmaceutical residues
  - Disinfectans

List of tested materials

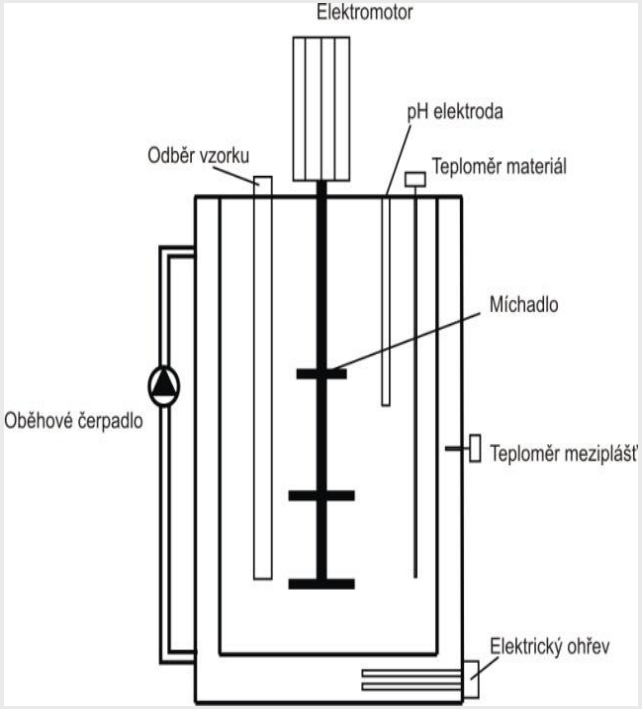
- G – phase
  Waste from methyl ester production
- Biomass ash
  Short rotation crops – willow, popple
- Disinfective solution of formaldehyde
  Disinfection of cow hoof
- Waste of cereals
  Spring barley - Malting plant

Labscale tests

- In biogas lab on the Department of agriculture, food, and environmental engineering
- Tests of stimulants and inhibotors of the liquid anaerobic fermentation in mesophilic conditions

Methods of the tests

- Batch lab scale reactors of volume 0.1 m^3 and 3 dm^3
- Tested materials were analysed at the beginning of each test (pH, TS, OS of TS, FOS/TAC)
- Every day were monitored quality (CH_4, CO_2, H_2S, O_2) and quantity of developed biogas(BiogasMeter BGK-4, Ritter MilliGasCounter, biogas analyser Drägger X-am 7000)

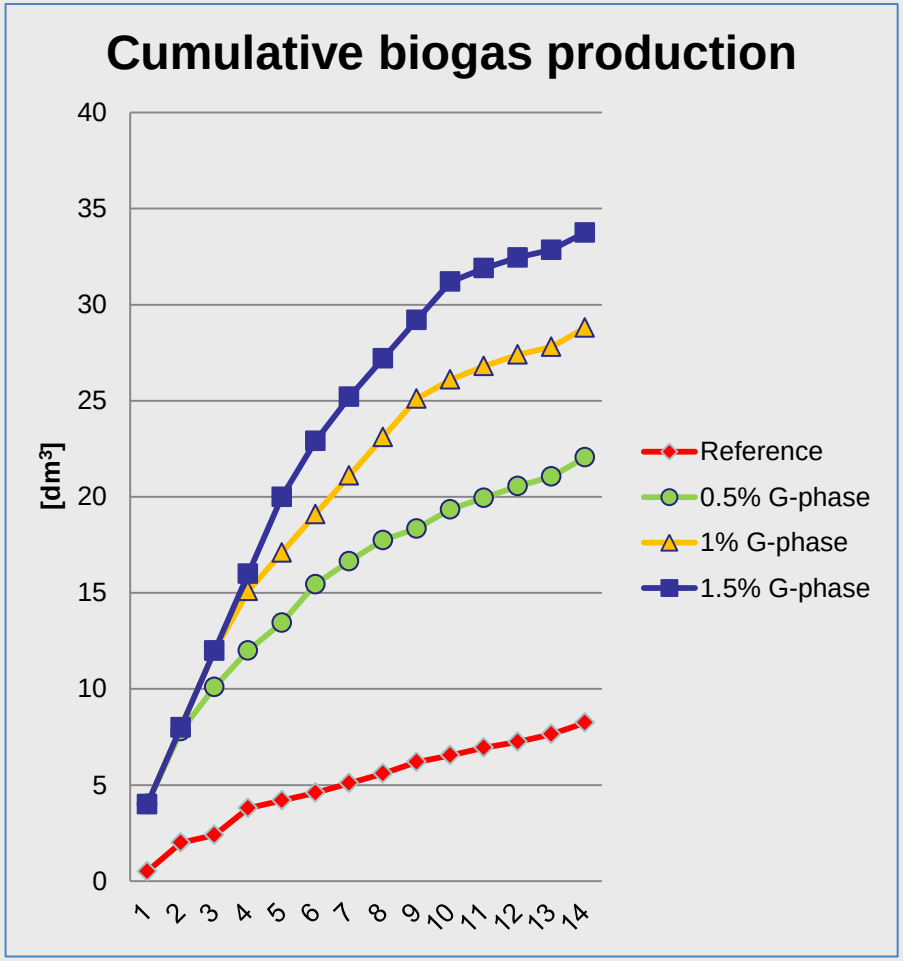


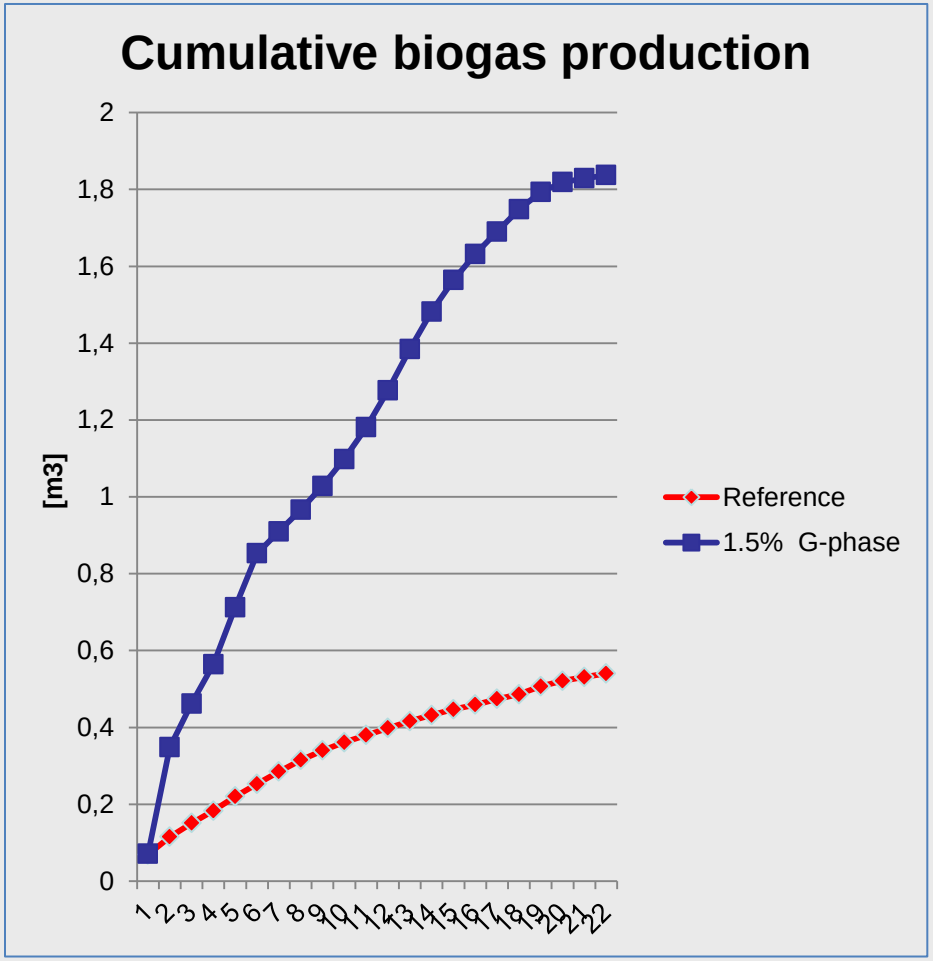
Test of G – phase influence

- Main compositions of G – phase are glycerine 46 – 65%, water 5 – 15%, fats (FFA + soap) 10 – 20% and methanol
- 2 tests, first test, in batch lab scale bioreactors (3 dm^3), to explore the ideal dosage of the G – phase, second test in batch lab scale reactors (0.1 m^3) was to confirm results from the first test
- In both tests was used as inoculum material from agriculture biogas plant, operating silage maize and liquid swine manure

Test of G - phase influence

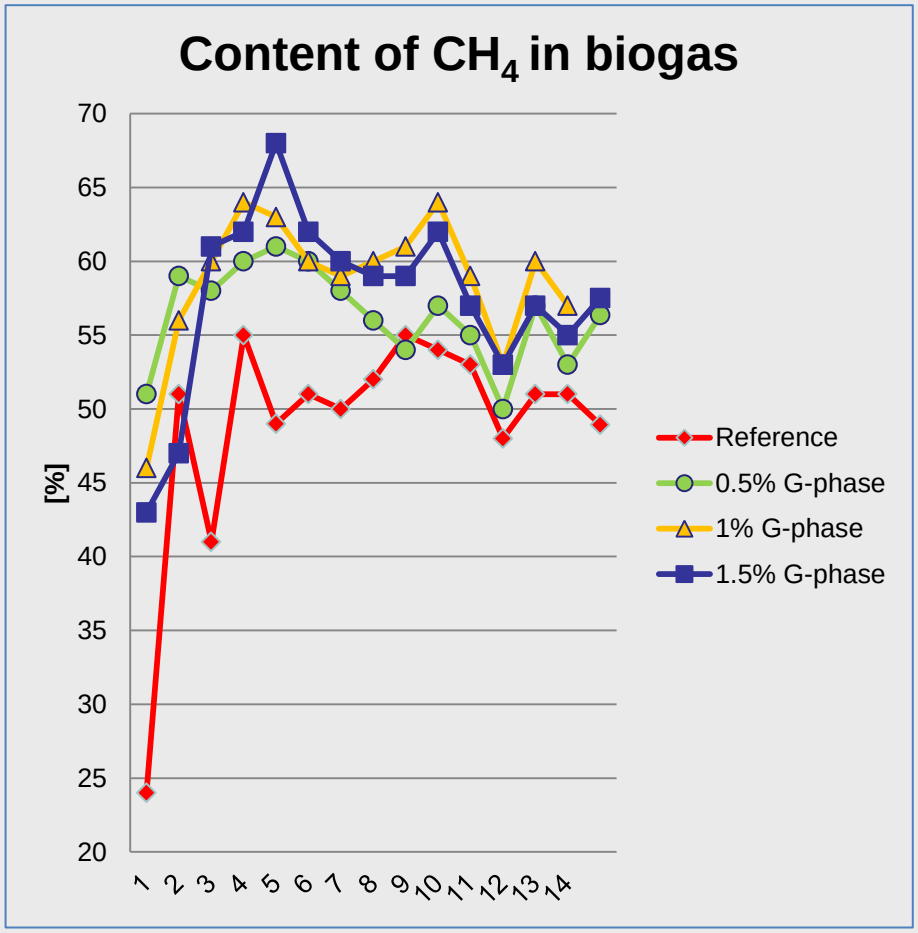
- Results of the test: increase of produced biogas about 340% in second test

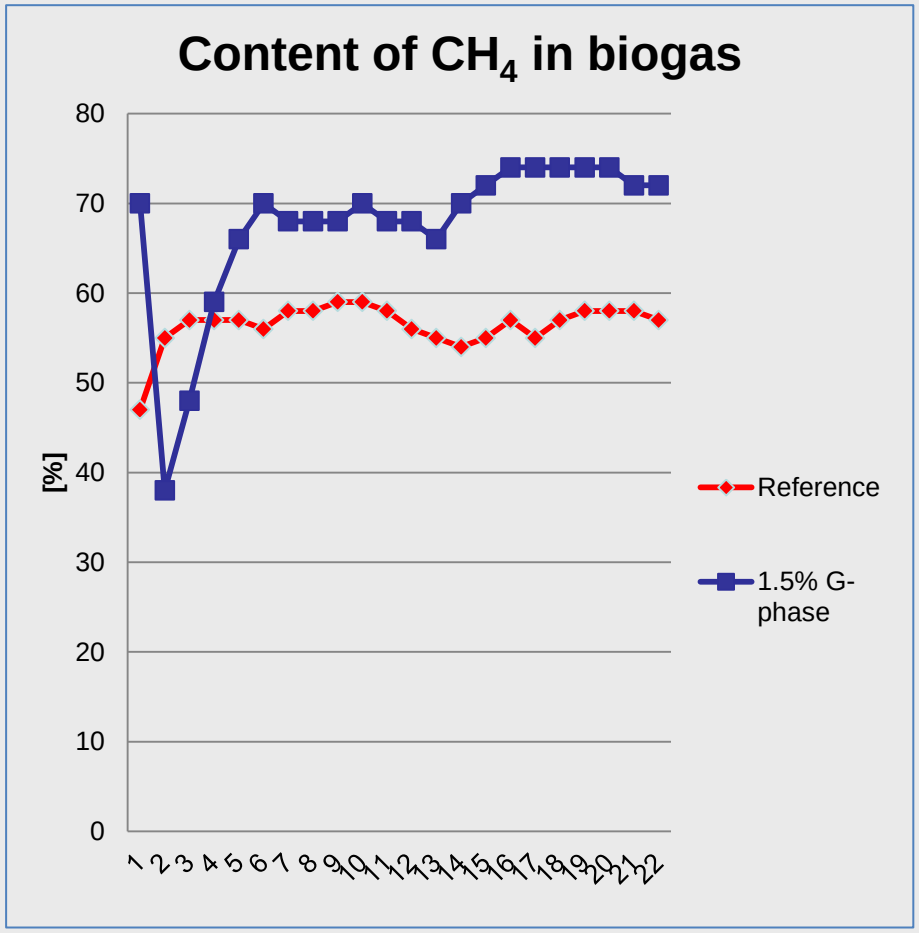




Test of G - phase influence

- Higher content of CH_4 in biogas from reactor with added G-phase
- Decrease at beginning – overfed of the reactor



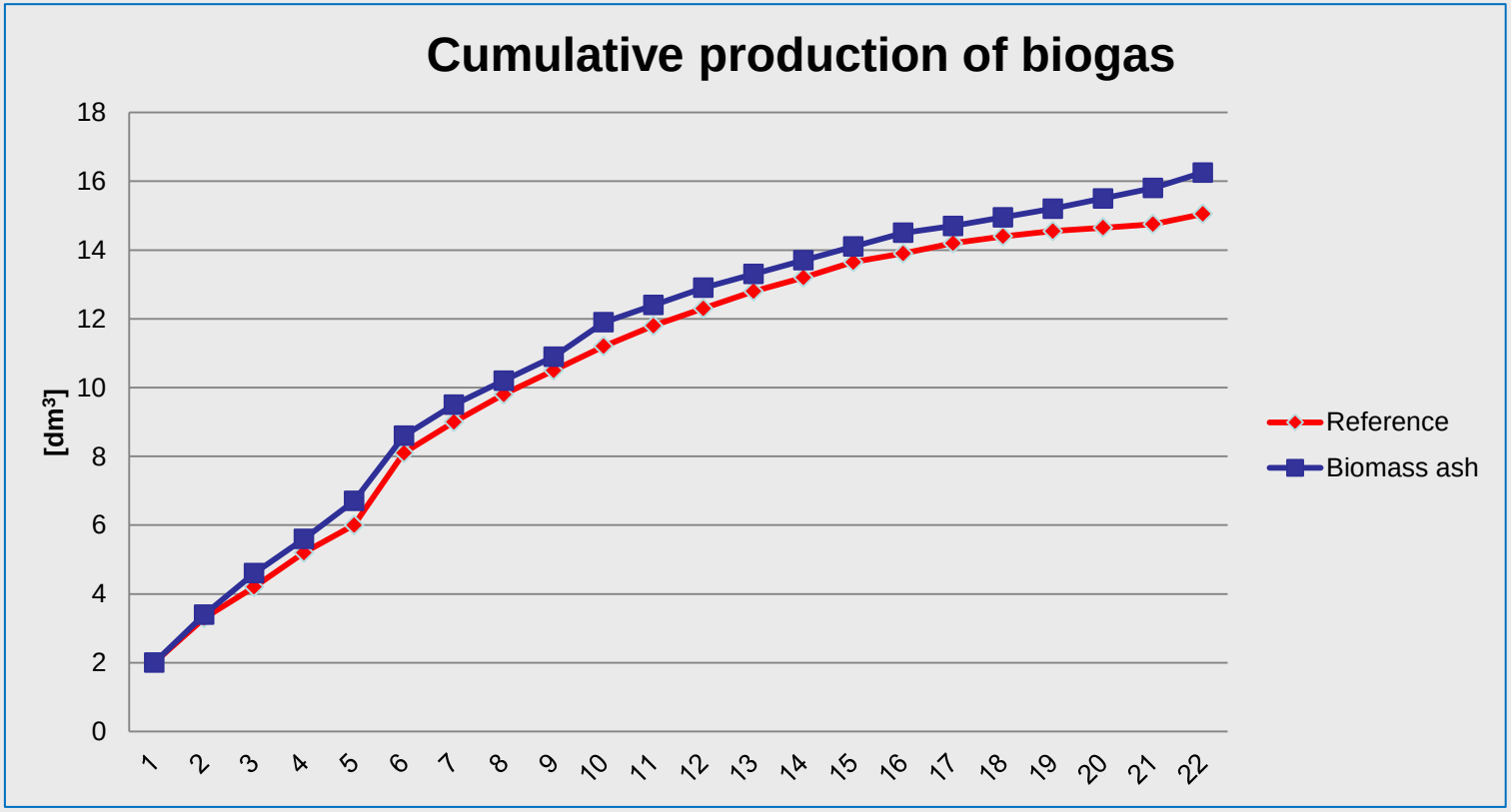


Test of biomass ash

- Biomass ash from short rotation crops
- Increasing number of plants producing biomass ash
- Legislative regulation about treatment with biological waste, in close future limitary possibilities to depose this material on landfills
- Resource of trace elements important for anaerobic fermentation

Test of biomass ash

- Small lab scale reactors, volume 3 dm^3
- Dosage of materials: Inoculum – 2.5 dm^3 , Biomass ash – 0.35 g
- Increase of produced biogas to reference about 8.5 %
- Increase of H_2S in biogas from material with added ash in first 12 days of the test

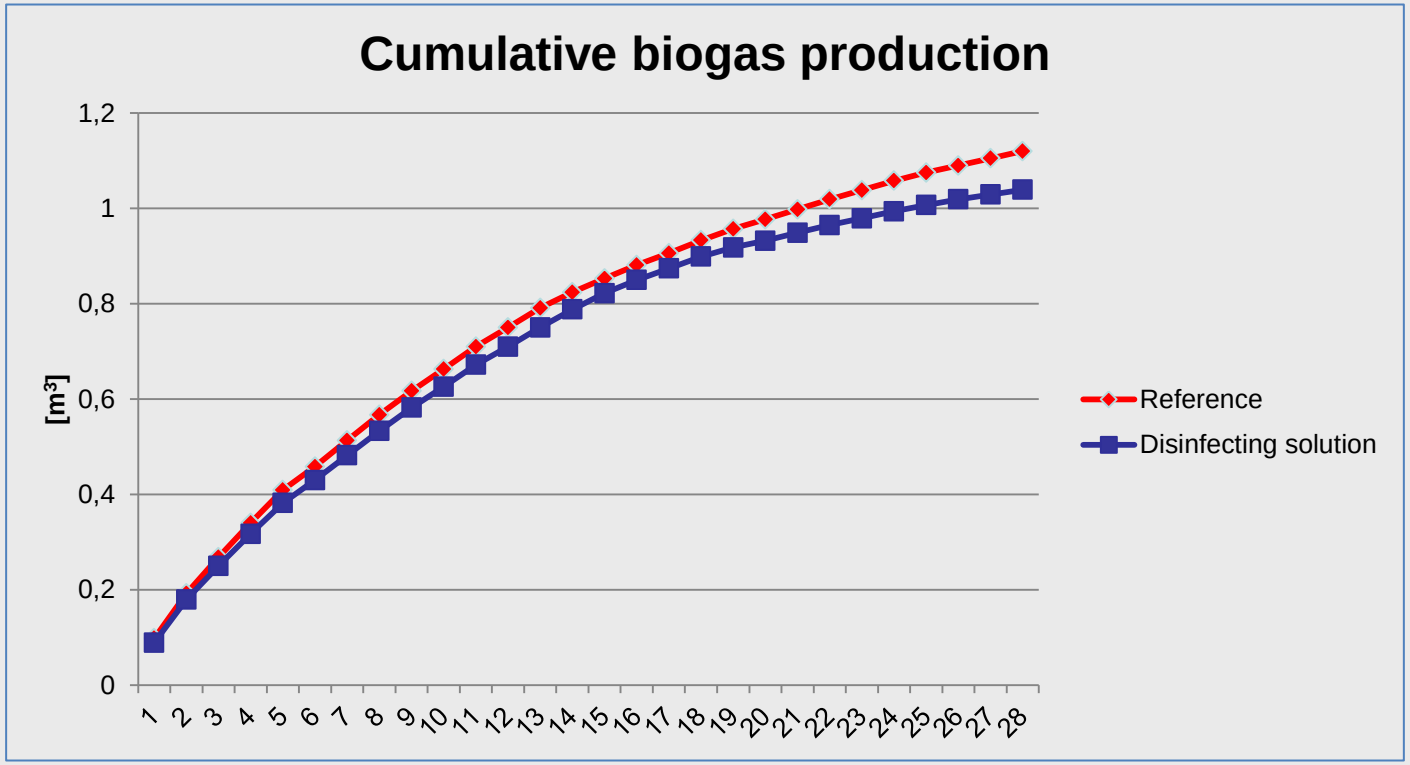


Test of formaldehyde disinfecting solution

- Farmer has to disinfect cow hoof, waste water from disinfection goes to the same tank as a liquid manure treating in biogas plant
- Our goal was to find possible inhibition effect of this waste solution on the anaerobic fermentation

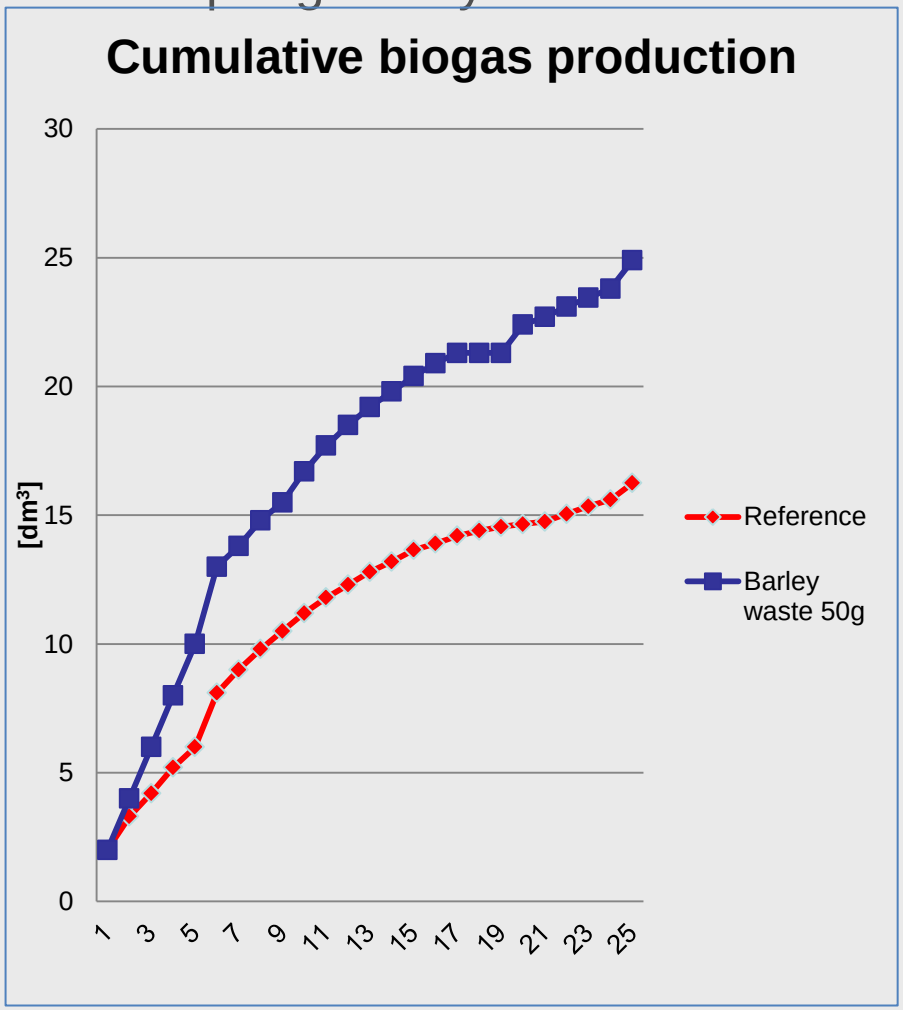
Test of disinfecting solution of formaldehyde

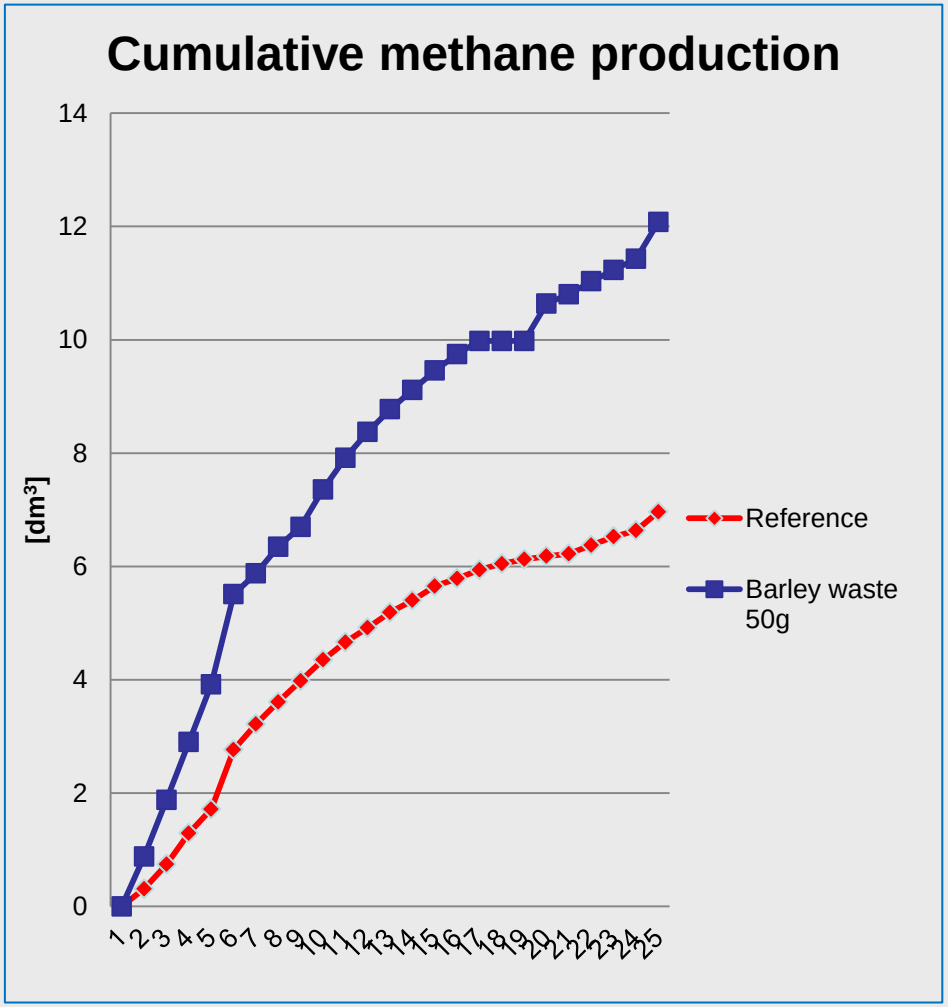
- In lab conditions the same concentration of disinfection solution that use the farmer
- Test in lab scale reactors (0.1m^3), mesophilic condition, inoculum from farmers biogas plant
- Qualitative parameters of produced biogas were on the same level from both reactors



Test of cereal waste

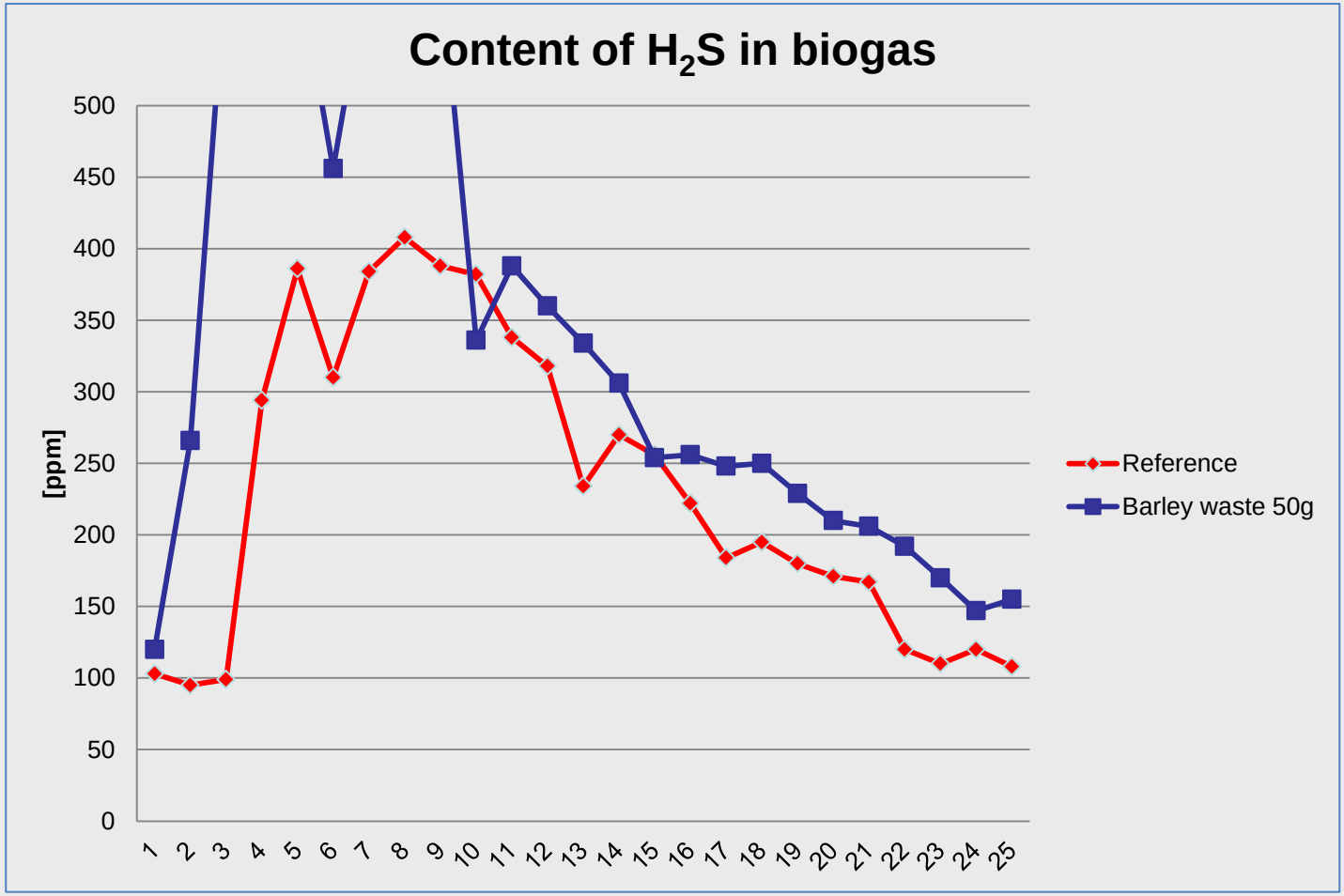
- In small lab reactors
- Spring barley waste





Test of cereal waste

- In experimental reactor with barley waste was monitored higher content of H_2S in developed biogas – protein rich material



Conclusion

- Results of tested materials showed specific influence of each material on the dynamic of anaerobic fermentation and quality and quantity of biogas
- Materials rich on fats (G-phase), proteins (barley waste) can by optimal dosage improve biogas amount, beware of overfeeding
- Primary inhibitors (formaldehyde)in low concentration doesn´t affect dynamic of anaerobic fermentation

Thank you for your atention!