ATBEST

Analysis of Anaerobic Digestion by MIR, UV/VIS online spectroscopy

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QUESTOR CENTRE

Fachhochschule Köln
Cologne University of Applied Sciences

Campus Gummersbach

PEOPLE

MARIE CURIE ACTIONS

About Me

- Graduated Liverpool University 2010 MENG EEE
- Worked at EA Technology for 3.5 years
  - Project management
  - Research
  - Hardware design
  - Programming

Aims

- Development of an MIR online-measurement system.
- Monitoring of critical process parameters in AD.
- Maintain stable AD by substrate inflow
- Optimization of biogas plant operation
- Decrease operating costs.

Tasks

- Develop an online measurement system for VFA and TAC.
  - VFA intermediate product, high levels inhibit biogas production
  - Buffering capacity or Alkalinity, helps withstand shock loads of VFAs
- Test MIR system.
- Data analysis.
- Develop calibration method.
- Field test & comparison.

Existing Work

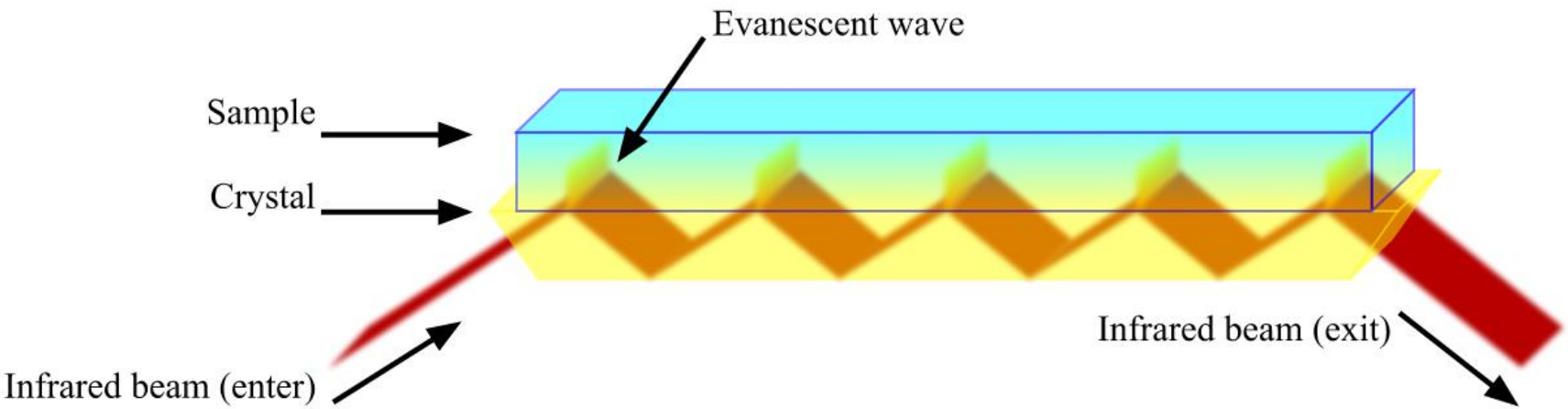
- Wolf (2013) used UV/vis spectroscopy
- VFA 88% accuracy.
- 1mm gap soiling problem
- Substrate diluted.
  - Clear spectrum
  - Helped soiling

Sensor

New Probe

- ATR (Attenuated Total Reflection)
- One measurement surface
- MIR
- Polycrystalline IR Fibres
- MIR improvement over NIR

ATR Probe


Evanescent wave
Sample
Crystal
Infrared beam (enter)
Infrared beam (exit)

ATR Probe

- Sensor fouling
- Wave penetration is micrometers

:metabolon Site

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Biogas Plant

- Two digester systems
- Automated control
- Plan to test sensor in system

AVEA Industrial Plant

- Fermentation and composting plant
- Have previously provided data to CUAS
- May be possible to fit sensors & collect data

Project Plan

- Get NIR probe working (2 months)
- Change to MIR probe, get system working (3 months)
- Perform reference measurements (5-6 months)
- Fit ATR probe to small biogas plant
- Perform measurements (6 months / test)
- If possible fit to Avea plant (6 months)
- Testing of optimisation strategies (3 months / test)
- Machine learning (3 months)
- Relate existing sensor measurements to MIR measurements of VFAs (4 months)
- Final project report (3 months)

Summary

- Use MIR ATR probe for online VFA measurements.
- Test prototype on AD plants.
- Machine learning to interpret data.
- Evaluate/improve existing control methods.

End