

Online Tar-Analysis by means of Fluorescence and Absorption Measurements

Christoph Baumhagl



Work was performed at the Institute of Thermal Engineering,
Graz University of Technology
...but is ongoing at the University of Erlangen



Objectives for the development of our tar analysis:

- Online measurement
- Economic
- Easy to use (plug and play)
- For quantitativ analysis
- Medium precision

>>>

Fluorescence spectroscopy and absorption measurements using cheap light sources and detectors > LED's and Photodiodes

Objectives

Basics

Analytics

Results

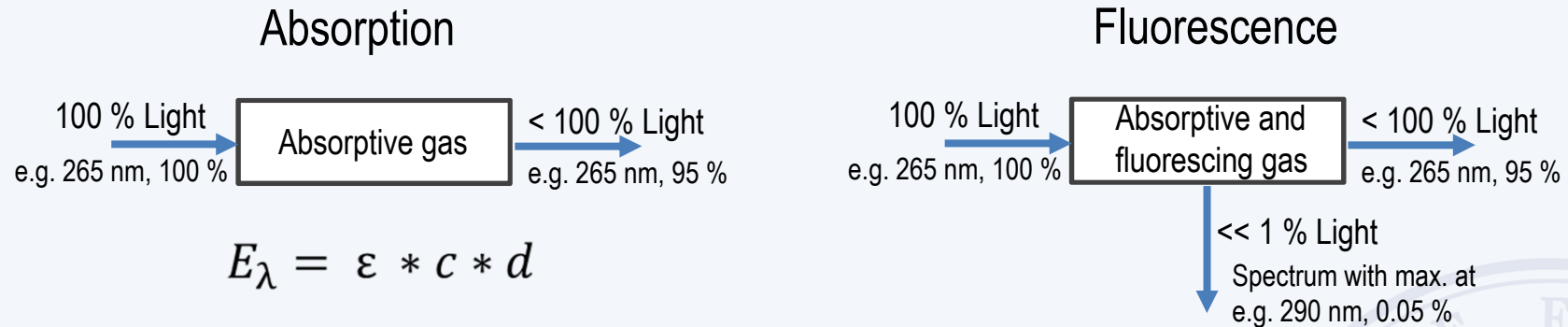
Summary

Department of Chemical and Biological Engineering (CBI)

Chair for Energy Process Engineering

Prof. Dr.-Ing. Jürgen Karl

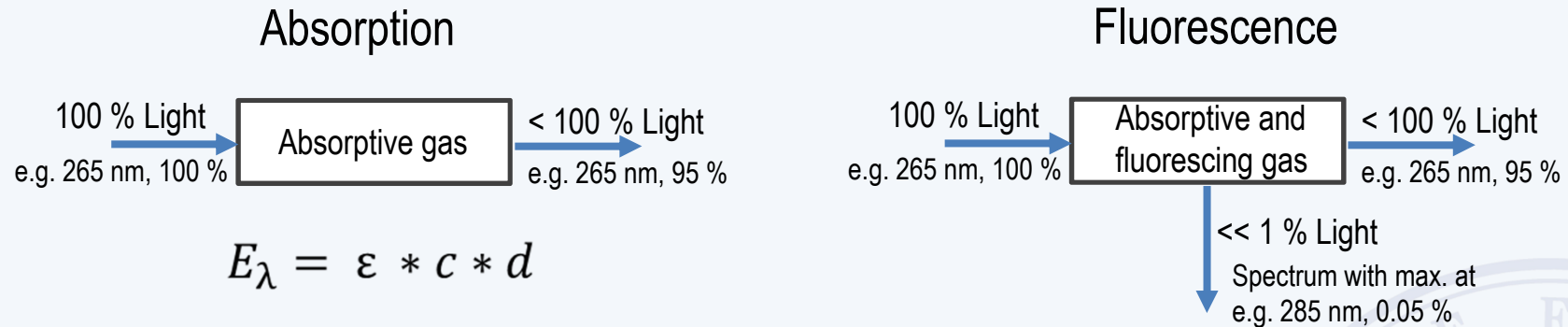
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Why Fluorescence or Absorption Measurements?

Especially higher hydrocarbons (tars) have their main absorption and fluorescence bands in a range where other biogenous synthesis gas components do not effect
 Signal is corresponding with the tar content in the gas

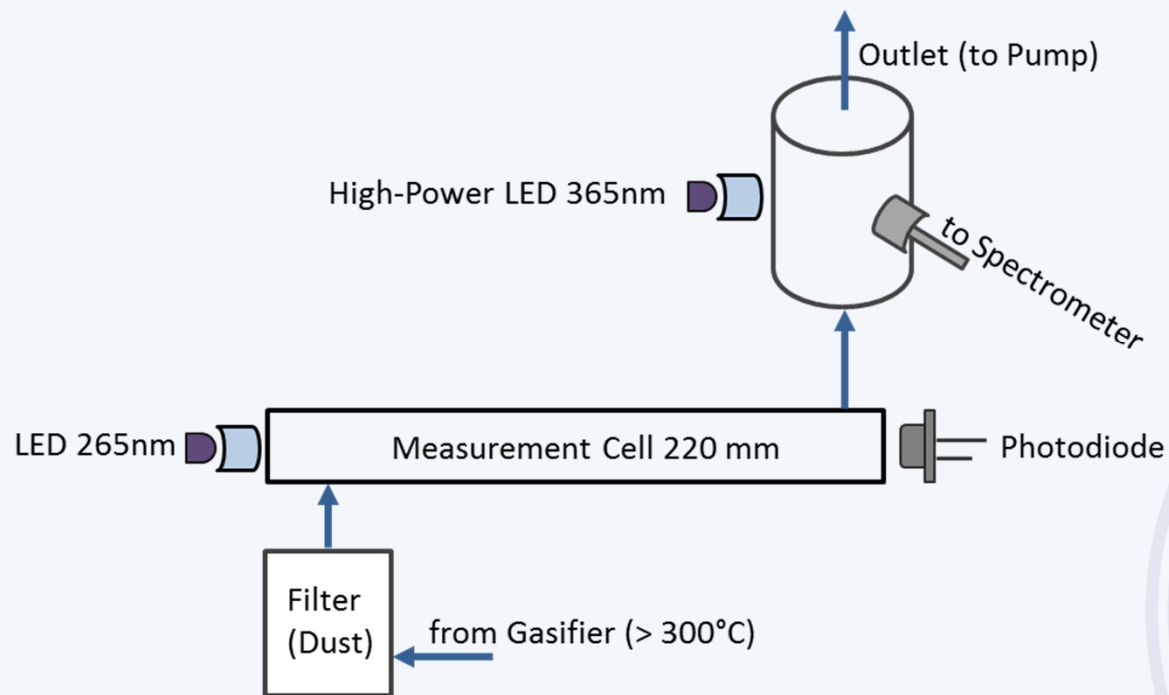
>> UV range from 255 nm to 380 nm (depending on species)



Main differences absorption and fluorescence measurements:

- Absorption could be influenced (minor) by dust, H₂S, scattered light, etc.
- Fluorescence signals could also provide information about the species
- Absorption provides high signal differences > easily detectable with cheap photodiodes

Combined absorption and fluorescence measurement system



Whole setup heated at 350°C to prevent condensation
 Signal processing with an analogue data logger and Lab View

Objectives

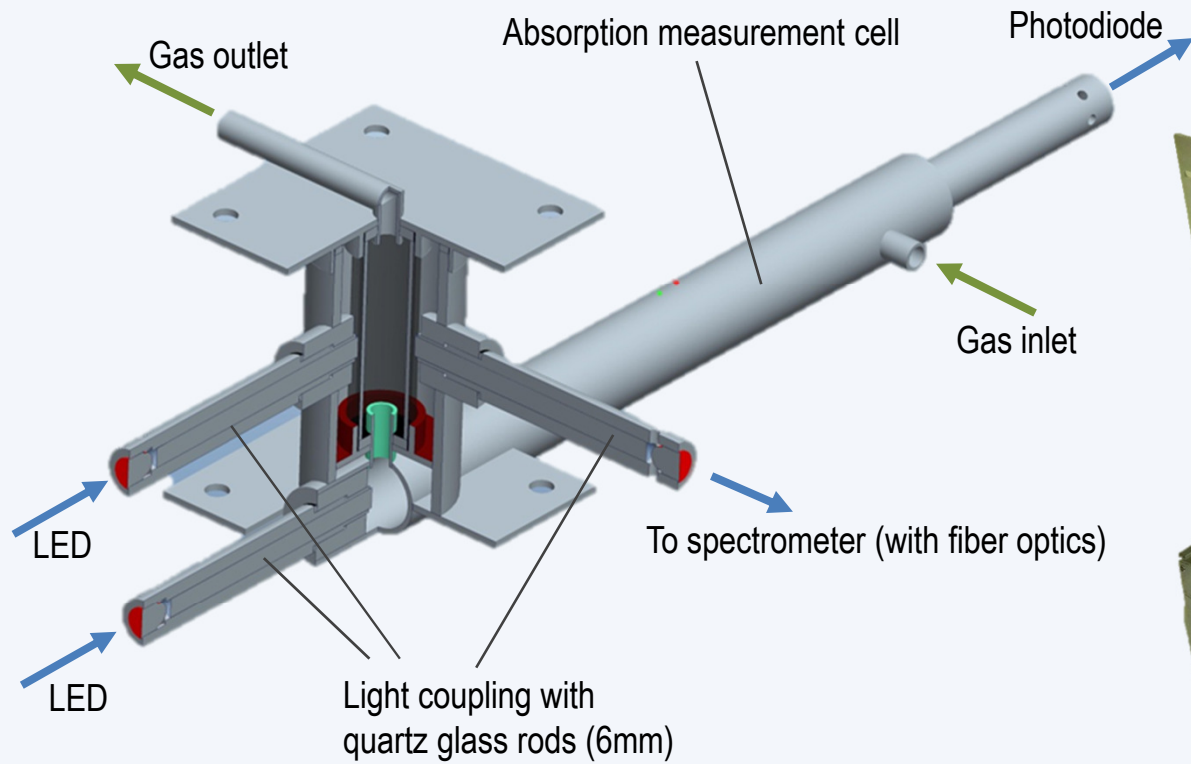
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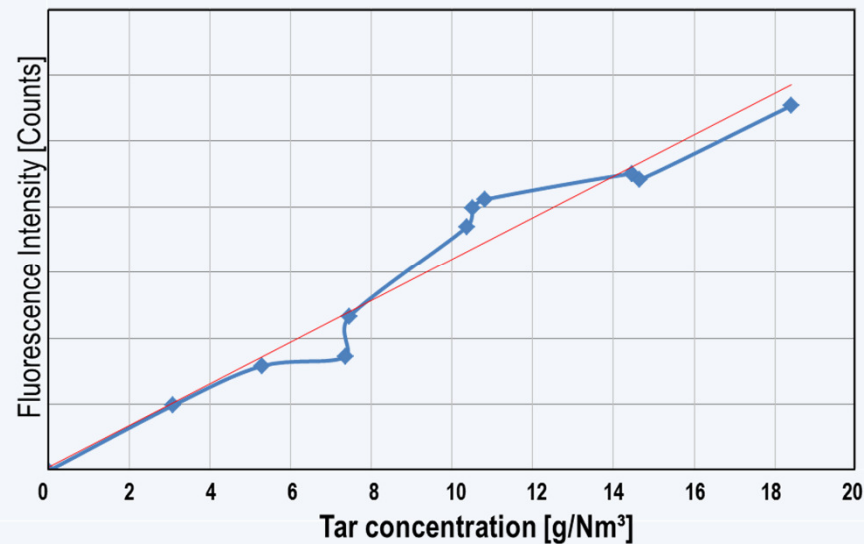
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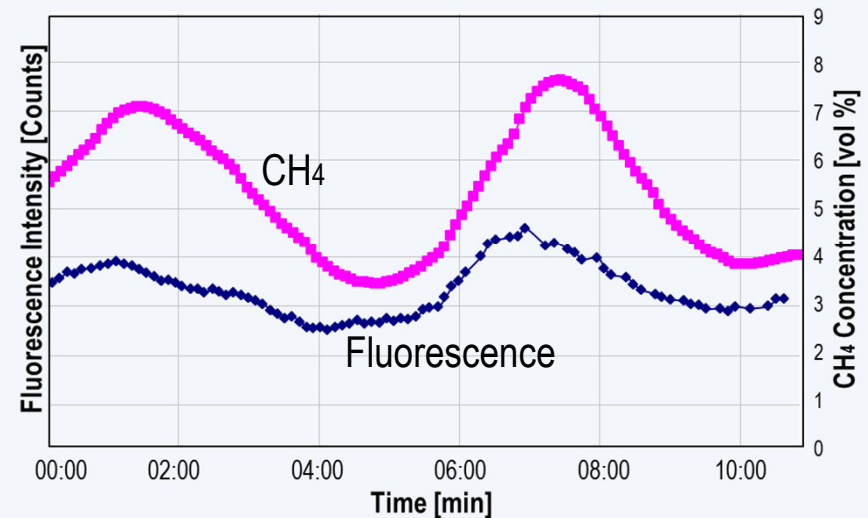
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Results: Fluorescence measurements

Fluorescence intensity at operating points with different tar concentrations
 (from an allothermal biomass lab gasifier)



Fluorescence intensity corresponding to the methane concentration



Objectives

Basics

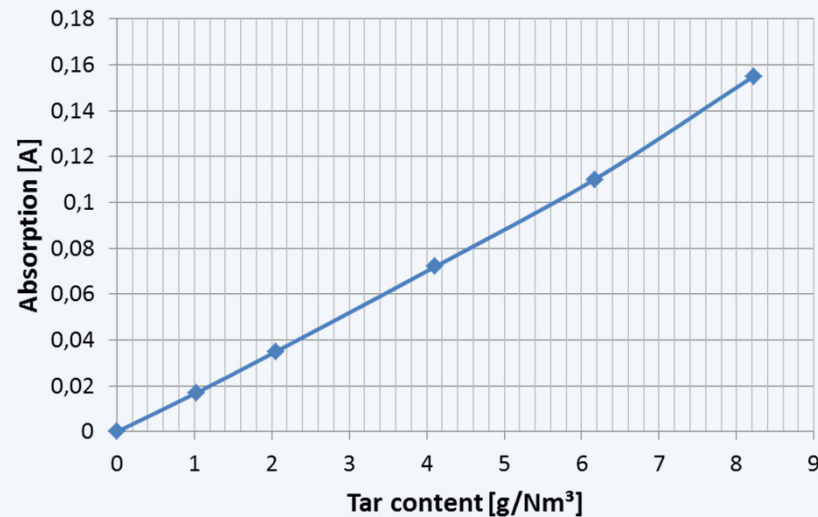
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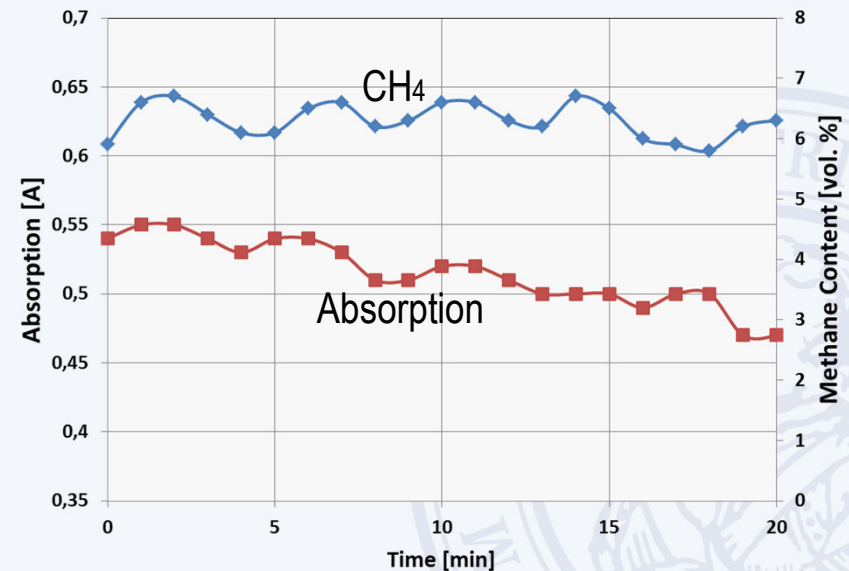
Summary

Results: Absorption measurements

Measured Absorption with Toluene (in nitrogen)



Absorption corresponding to the methane concentration (real biomass synthesis gas)



Calibration is ongoing ...

Objectives

Basics

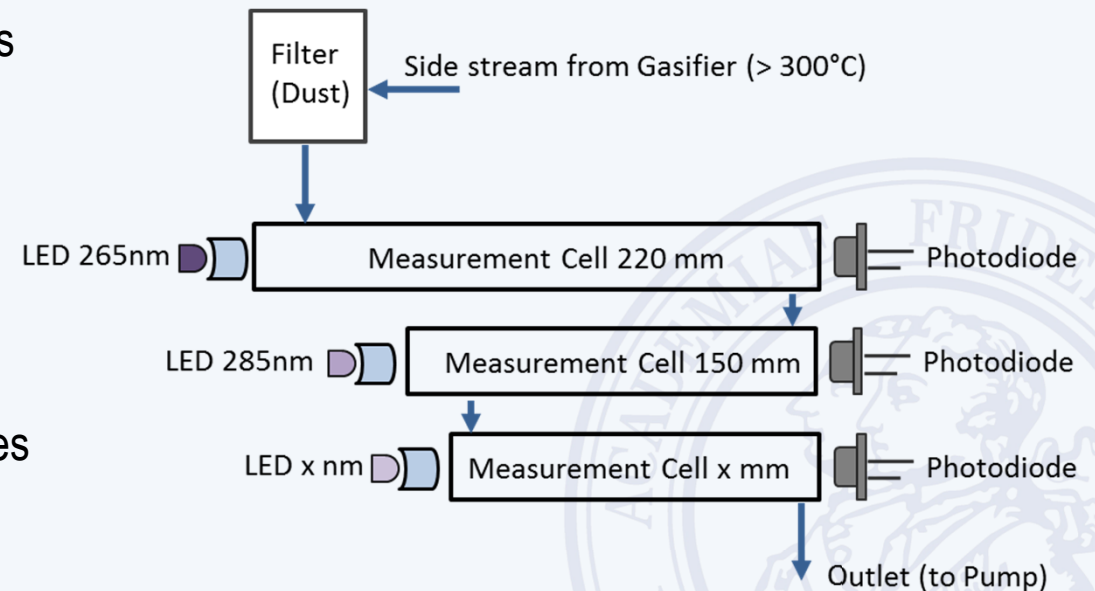
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Summary and Outlook

- The concept of measuring the tar content by means of absorption and fluorescence measurements using cheap light sources and detectors is working
- Absorption has lower requirements on detectors and light sources > cheaper
- Inaccuracies by usage of only one light source
- With combination of different light sources higher accuracies and also a qualitative analysis could be possible



Thank you

Absorption



Pro:

High signal differences

> Low power light sources and low power detector

>> Cheap

?

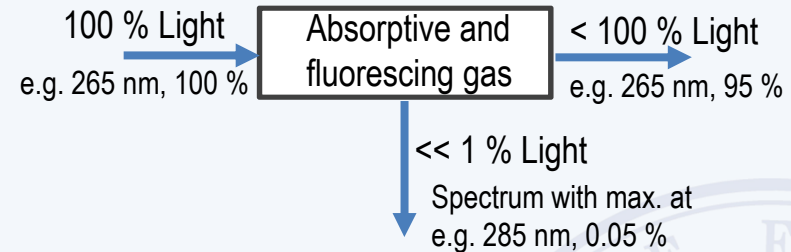
Contra:

Influence of dust and H₂S

Influence of scattered light

?

Fluorescence



Pro:

Spectrum

> No influence of scattered light

> Eventually determination of species (groups) possible

?

Contra:

Low signal power

> High power light sources or high sensitive detectors

?

Was?

Warum?

Was tun?

Ausblick

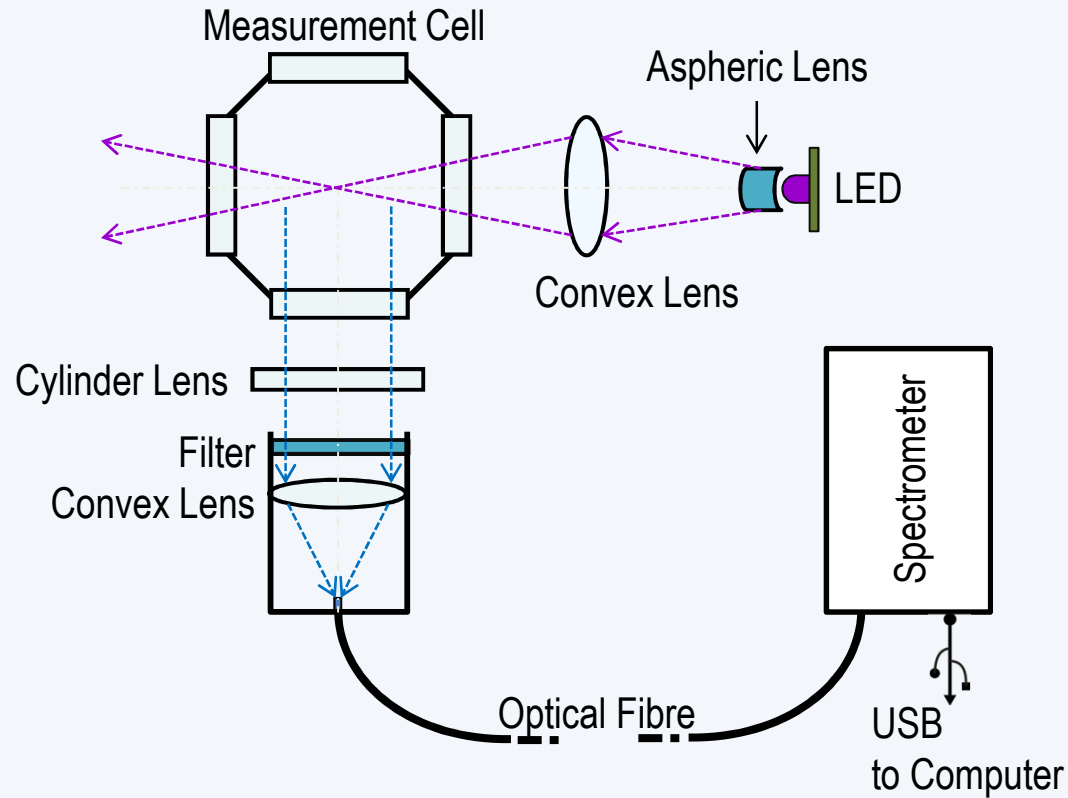
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Fluorescence Spectroscopy



Was?

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