



wet-chemical measurement of H₂S in wet, tary gases

Daniel Schweitzer

Motivation

- Gasification of S-containing biomasses can cause high concentrations of H_2S in produced gases.
- H_2S can damage downstream product gas utilization devices (e.g. engines, catalysts ...)
- detailed knowledge about H_2S concentration necessary
- Use of gas-analyzers (GC, FTIR) often not suitable due to
 - high equipment and maintenance costs
 - special personal and knowledge required
- Wet-chemical methods suitable due to
 - low costs
 - short preparation and set-up time
 - no special equipment and personal necessary

- Several standardized methods for measuring H₂S in product gases exist:
- Absorption of H₂S in CdSO₄ with iodometric titration(EPA Method 11)
- Absorption of H₂S in Zn(CH₃COO)₂ with iodometric titration(EPA Method 16a)
- Absorption of H₂S in Zn(CH₃COO)₂ with subsequent iodometric titration (DIN 51855-4)
- ...

DIN 51855-4 was selected due to

- no toxic chemicals necessary
- sampling and titration can be done separately → high sampling frequency

H₂S measurement method

Basic measurement method:

- H₂S: Reaction with Zinc Acetate_(aq) und formation of zinc sulphide_(s)
- Zinc sulphide precipitate filtered from sample solution and subsequent the amount of zinc sulphide is determined by Iodometric titration
- Method is standardised & described in DIN 51855-4

Problem:

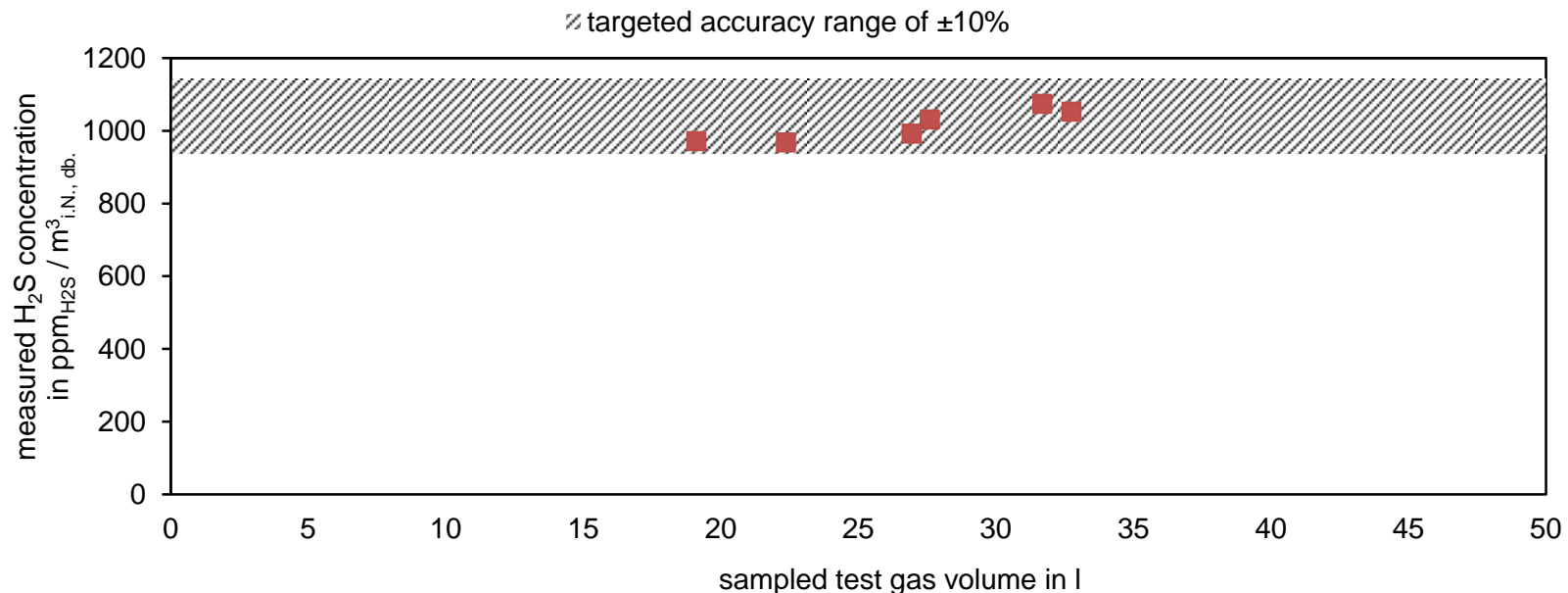
- tar condensation in the Zinc Acetate solution disturbs the Titration
- Use of acidulated Isopropanol for tar removal*

| tar removal solution | absorption solution |
|--|------------------------------|
| ½ Isopropanol and ½ of 30% H ₂ SO ₄ | Zink acetate _(aq) |

* J. Zeisler, M. Kleinhappl: Reliable sampling of impurities in product gas and syngas, *in* ICPS2010

H₂S measurement - Accuracy

- Accuracy:
test measurements with a 1040 ppmv_{H₂S} test gas have show a good accuracy
- addition of gaseous tar species in test gas showed no change in H₂S concentration



Conclusion

- + H₂S measurement in wet, tary gases is possible
- + test measurements showed good accuracy
- + tests at a lab gasifier have shown good results

- Prior to the titration the H₂S concentration has to be estimated

- a more detailed documentation about pollutant measurement techniques in product gases will be published in near future

The work was carried out within the DEBUGGER (Demonstration of efficient Biomass Use for Generation of Green Energy and Recovery of Nutrients) project.

The authors gratefully acknowledge the financial support from EIT and KIC InnoEnergy.

<http://www.kic-innoenergy.com/>

Contact:

Daniel Schweitzer

Institute of Combustion and Power Plant Technology

University of Stuttgart

daniel.schweitzer@ifk.uni-stuttgart.de

<http://www.ifk.uni-stuttgart.de>

