


Deutsches Biomasseforschungszentrum
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DBFZ

Operational and seasonal methane emissions from open digestate storage tanks

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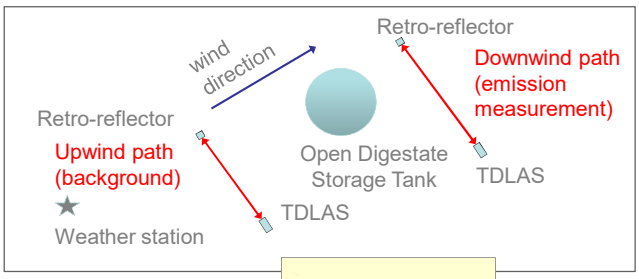
1. Objectives or why we measure methane emission rates:

- Methane is a high potential **greenhouse gas (GHG)** (28 times higher than CO_2 [1]) → important to estimate methane emissions in biogas production process
- Give an **GHG balance** of certain emission sources (here: open digestate storage tanks) at biogas plants
- Understanding **operation and seasonal** emissions of certain components
- Important for **emission reduction** measures
- Measurement of Emission Rate at open digestate storage tanks of four different biogas plants in framework of project **BetEmBGA** (funded by FNR) with two different methods: TDLAS+IDM [2] and closed chamber method [3]

Fig. 1: TDLAS measurement setup for the determination of the emission rate from an open digestate storage tank (© Carsten Tilch, DBFZ).

2. Measurement method for emission rate from open digestate storage tanks:

a) Tunable Diode Laser Absorption Spectrometer (TDLAS) + Inverse Dispersion Modelling (IDM)

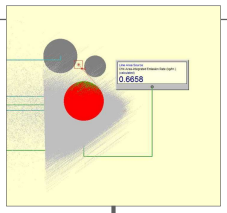


Strengths:

- measurement on **whole** open digestate storage
- **no influence** on digestate (contactless)
- **Long-term** measurements possible

Constraints:

- Dependent on **weather conditions**
- **Other sources** are measured as well (dependent on wind direction)
- Depend on **topography**, **accessibility** on the plant and difficulties when open digestate storage is higher than measurement path

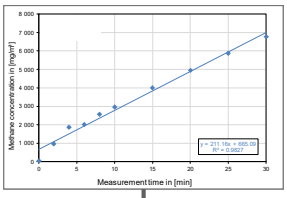


Inverse dispersion modelling (using windtrax [2])

b) Closed Chamber Method

Fig. 2: Closed chamber measurement of methane emission rate at the surface of an open digestate storage tank (© Torsten Reinelt, DBFZ).

Slope of methane concentration vs. time



Methane Emission Rate

Strengths:

- Measurement **directly** on surface of open digestate storage
- Mainly **independent** on **weather conditions**

Constraints:

- Measuring of emissions from only a small part of the surface → **extrapolation**
- Possible **influence** on surface and, hence, emissions
- Measurements at a certain **instant**

3. Results and Discussion

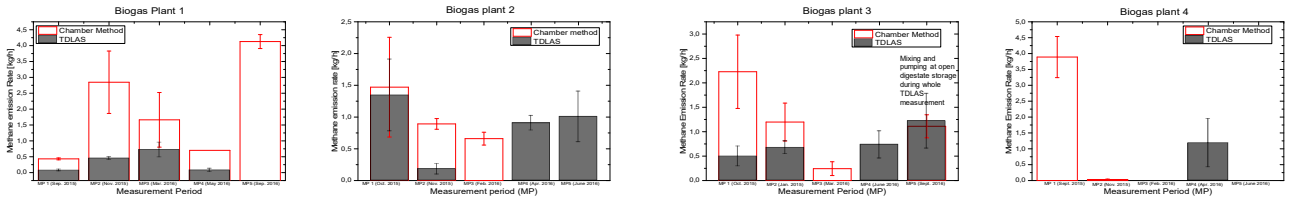


Fig. 3: Preliminary data evaluation of emission rate from open digestate storage tanks with chamber method and TDLAS+IDM.

- Measurements at open digestate storage tanks of **four different biogas plants**
- Determined emission rate with **chamber method always higher** (approx. double) than with TDLAS
- No **consistent seasonal pattern** of the emission rate from open digestate storage tanks of the four different plants
- Higher emissions during **mixing and pumping** process

References:

[1] IPCC. 2013. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.
[2] Flesch, T.K., Wilson, J., Harper, L., Crenna, B. 2005a. Estimating gas emissions from a farm with an inverse-dispersion technique. *Atmospheric Environment*, **39**(27), 4863-4874.
[3] Liebetrau, J., Reinelt, T., Clemens, J., Hafermann, C., Friehe J., Weiland, P. 2013. Analysis of greenhouse gas emissons from 10 biogas plants within the agricultural sector. *Water science and technology*, **67**(6), 1370—1379.

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