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Title: Residual gas potential difference between the summer and winter samples

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Introduction

Renewable Energy Sources Act (2017) restricted new biogas plant in Germany, in the case of installations commissioned after 31 December 2016 and digestate facilities constructed after 31 December 2011, the hydraulic retention time (HRT) in the gas-tight system which is connected to a gas consumption device amounts to at least 150 days (BMU 2017). According to the VDI 3475, biogas plant built before 2012 needs to have a HRT of 110 days in heated system or 150 days in gas-tight system. Otherwise, a verification of less than 1.5% residual methane potential of daily produced methane is necessary once a year.

The HRT differs strongly between winter and summer seasons as digestate is not allowed to be sprayed in fields in winter time (1 December – 10 January) (BMU 2017). A longer digestate storage time is needed compared to summer season, which will result in a different residual methane potential in biogas plants.

The goal of this work is to investigate residual methane potential among winter and summer seasons in full scale biogas plants, and investigate their differences if any.

Material and Methods

Residual gas potential test

Residual gas potential test was carried out with the Hohenheimer Biogas Yield Test (HBT), which follows the guidelines of the VDI 4630. The digestion of the homogenized samples took place in 100 ml glass syringes in a motor-driven rotor, which is located in an incubation chamber. Each HBT test was conducted with three replicates at 25 °C and 37°C over a period of 60 days (Mittweg et al. 2012; Ruile et al. 2015).

Full-scale biogas plant and sampling

Sample collection of all full-scale plants was carried out both in winter and summer time. All samples were cooled down to 4°C immediately after the sampling. Residual gas potential test were conducted for each sample. In addition to the residual gas potential, actual plant operation data, such as power generation and consumption amount, substrate input and temperature, were recorded.

All samples were analysed for dry matter (DM), organic dry matter (ODM) for all samples were determined in accordance to DIN EN 12880 and DIN EN 12879. Content of volatile fatty acids (VFA) were determined by capillary gas chromatography (GC) (type CP3800 with a FID-detector, capillary column WCOT Fused Silica, Agilent Technologies Germany GmbH, Böblingen, Germany), as detailed in (Haag et al. 2015) and (Lindner et al. 2016).

Results

The difference of residual gas potential between summer and winter samples is strongly depend on the HRT of each individual biogas plant. However, there is no clear effect found due to low degradation of digestate samples, which is usually stored in an unheated tank in a full-scale biogas plant.

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