

Measuring and quantifying greenhouse gas emissions from energy and waste treatment plants

Background

To mitigate global climate changes, international circles have strong focus on reducing the emission of greenhouse gasses to the atmosphere. For that reason, the future society will be based more on biomass focusing on circular economy according to which organic residual streams are exploited for energy purposes, for example by means of biogas and / or extraction of materials in the form of for instance fertilizers and humus. Energy and resource utilisation by means of biomass and organic residual currents may cause large emissions of greenhouse gasses to the atmosphere, such as methane and dinitrogen oxide. The emission can occur from different spot spills on large technical recycling and treatment plants, from open reservoirs or from areas holding stocks of organic materials. The extent of these emissions has not been studied in detail, partly due to their diffusive and dynamic nature, and partly because of the lack of suitable methods of measurement.

Purpose

The overall purpose of the research project is to test, develop and demonstrate the applicability of the trace element dispersion method for quantifying diffuse greenhouse gas emissions from biogas plants. The Technical University of Denmark's (DTU) Department of Environmental Engineering has built a mobile platform for analyses and used it for quantifying the methane emission from landfills. The method is called the trace element dispersion method and is based on the take-up of trace elements of the source and parallel down current wind vane measurements of tracer gas and methane. DTU's Department of Environmental Engineering has documented the suitability of the method for quantifying methane emission from landfills, but the measurement method has probably a far bigger scope of application, which goes beyond the landfill area. There is, however, a need for documenting and validating the measurement method when applying the method on other sources with diffuse emissions, such as for example biogas plants.

Project activities

The research undertaken comprises measurement of emissions from selected biogas plants in Denmark – including biogas plants treating, respectively, sewage sludge, liquid manure and / or organic waste. The research team will quantify the methane emission using the trace element dispersion method with the purpose of documenting that the emission can be determined at a precision rate of more than 15% when carrying out the measurements under optimum conditions. For the purpose of validating and documenting the method, the measurement campaigns will include a secondary tracer gas with a controlled and known emission, which will function as an internal standard aiming at determining the retrieval percentage. In addition, the precision of the method and its sensitivity will be studied by making a test, during which the research team will study the impact of different factors (among others tracer gas configuration and measurement distance) on the measured emission.

Relevance and organisation

A measurement method for quantifying the methane emission from biogas plants will be of interest to biogas plants and authorities. The development of measuring methods provides the basis for gaining better knowledge of the emission from biogas plants - knowledge, which in a long-term perspective could be used for reliable reporting on emissions to authorities, validation of emission models, optimization of treatment technologies and / or process lines, environmental assessments etc. The project will be carried out by DTU's Department of

Environmental Engineering under the guidance of Professor Charlotte Scheutz. The project partners from COWI will participate in the project

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