

Executive Summary

OBJECTIVE

The objective of AD-WISE is the development of an on-line system to optimise the anaerobic digestion process in biogas plants, to simultaneously maximize biogas production and maintain process stability.

PROBLEM TO BE SOLVED

One of the main research lines in anaerobic digestion in recent years is focused on the optimisation and control of biogas plants. Due to the special characteristics of these plants, the only parameters controlled on-line are temperature, methane concentration in biogas and sometimes the pH. This information is not enough to control the process, since these parameters do not predict a process malfunction. In this context, many plant operators are forced to manage the process in a conservative way, thus under-utilising the potential of energy production of the plant due to the acidification risk if the plant is operated at its limit without adequate control parameters.

Among all proposed control parameters, the most reliable is the volatile fatty acids profile (VFAP) that consists of acids such as: acetic, propionic, butyric, etc. This parameter allows checking not only the state of the process but also predicting and avoiding a process malfunction (acidification), which is not possible to do with other parameters such as pH or biogas composition. Nevertheless, it is not currently possible to perform real-time on-line measurements of this parameter. It is necessary to take a sample and send it to an external laboratory for analysis of its volatile fatty acids (VFA) by gas chromatography (a precise but expensive technique that requires specialized equipment and staff). It usually takes 1-2 weeks between the sampling and the results and therefore the measurement loses its value as a control parameter and becomes merely informative.

EXPECTED RESULTS

The result of AD-WISE will be on-line equipment capable of real-time measurement of the VFA profile, based on optical techniques, and the integration of these measurements into the control system of the biogas plant to optimise the process (maximise biogas production while simultaneously maintaining the stability of the process). The resulting equipment will be low-cost and easy to use, and will allow real-time measurements of VFAP and using them automatically to control and regulate the process.

WORKPLAN

The research project includes an initial laboratory stage. At this point, the measurement equipment and the mathematical models to obtain VFAP measurements and their interpretation are being developed. With these results, a prototype of the equipment will be built and tested in the AINIA's pilot plants and in the agroindustrial biogas plant of Farm San Ramón (Spain).

PARTNERSHIP

In addition to the AINIA Technology Centre (Spain), that is the project leader, the project has four European partners: the Fraunhofer Institute (Germany), Farm San Ramón (Spain), Interspectrum (Estonia) and The National Microelectronics Applications Centre (Ireland).

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