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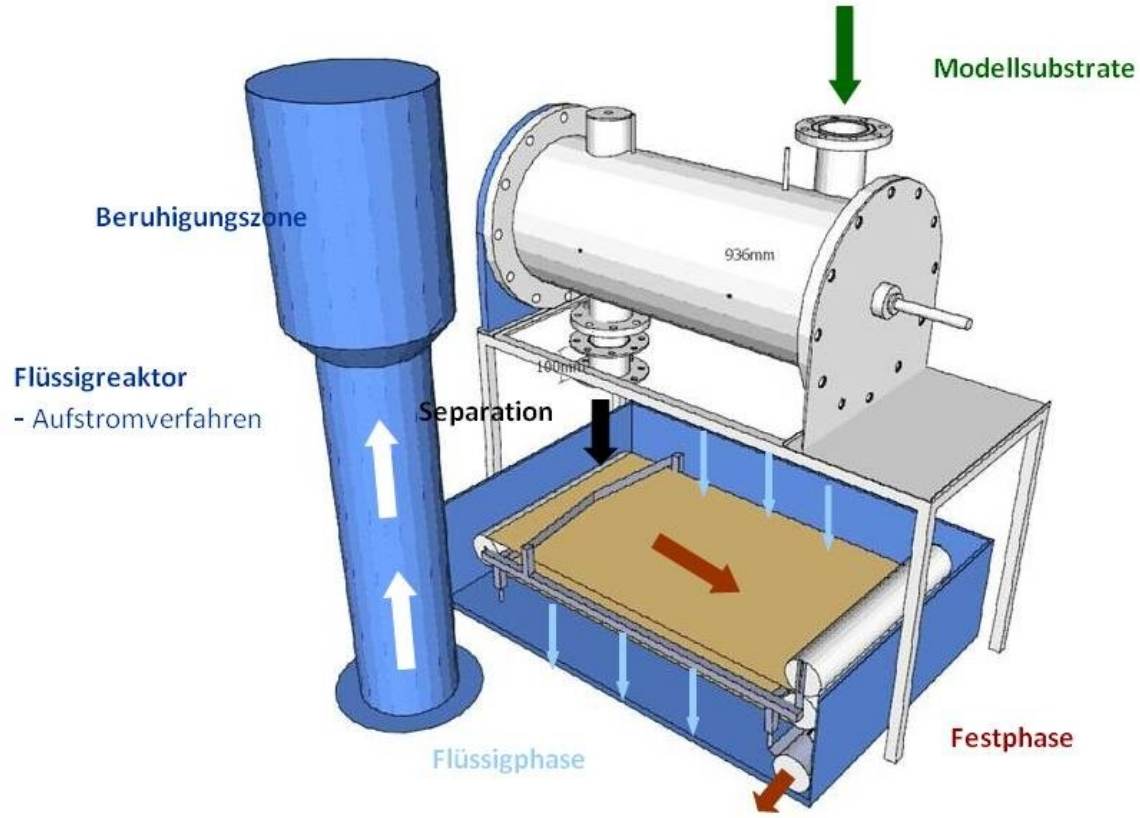
https://www.biooekonomie-bw.de/en/articles/news/university-of-hohenheim-and-avat-innovative-method-for-the-production-of-biogas

University of Hohenheim and AVAT: innovative method for the production of biogas

Partners from industry and research have joined forces to develop an innovative method for the production of biogas. In contrast to standard methods, the chemical degradation processes will in future take place in different tanks rather than in just one. The developers hope that the separation of the processes will expedite the degradation processes, improve the quality of the individual degradation products, and enable their broad applications. Scientists of the University of Hohenheim are working on the construction of a three-part technical module that Tübingen-based AVAT Automation GmbH complements with a sophisticated measurement and control system.



Schematic representation of a pilot plant that is used for the spatially separated production of biogas.
© Lemmer

Three chemical steps are required to convert biomass into methane: primary and secondary fermentation and methanogenesis. Dr. Andreas Lemmer from the State Institute of Agricultural Engineering and Bioenergy explains: "First, biomass is converted into long-chain organic acids, which are then converted into acetic acid, hydrogen, and carbon dioxide before microorganisms use the latter three compounds to produce methane. These are the same chemical processes as those taking place in a biogas plant fermenter. However, different processes also have different requirements on the conditions: For methanogenesis to take place effectively, the pH value in the fermenter must not be lower than 6.8 and the temperature must not be higher than 40°C. However, Lemmer explains that it is possible to considerably expedite the primary fermentation when the pH value is lowered and the temperature increased. Moreover, more effective fermentation conditions also allow the separation and early removal of energetically inefficient carbon dioxide.

Module consisting of three parts: fermenter, bioleaching and methane reactor

This is why the FABES project, which is a BMBF-funded project involving academic and industrial partners, has the goal to spatially separate the primary fermentation process from methanogenesis. The researchers from Hohenheim focus on constructing a module comprising three parts: a fermenter for primary fermentation, a tank for bioleaching, i.e. the separation of acids from non-degraded structural substances, and a reactor for the production of methane. The Tübingen-based company AVAT is in charge of establishing the fully automatic operation of the research plant.

Measuring and controlling: automation and process control systems made by AVAT

As a specialist in automation and process control engineering, AVAT is working on the measurement and process control systems of the module as well as on a graphical interface that will enable the viewing of a dynamic image of the plant. Three engineers are working on finding effective ways to feed to and remove biomass from the fermenter in a pH-dependent way, on sensors that are able to continuously register the measured values, and on the simultaneous and automatic removal of samples. It is the engineers' objective to enable users to interfere with and control the processes based on reference parameters. "The FABES project needs to be able to transfer the scientific preparations into technical applications," explains Hartmut Schäffer of AVAT who is in charge of managing the project, going on to add that "the success of the project will depend on whether the degree of efficiency of a biogas plant can be increased by using the innovative method."

However, before the time when they will need to assess the success of the FABES project, AVAT and the University of Hohenheim can already report about their excellent cooperation. For Heinz Hagenlocher of AVAT Automation GmbH, the cooperation with the University of Hohenheim represented "a challenging entrance into the biogas business". When Hagenlocher studied the biogas plant market some time ago, he came across a public call announcing the construction of a research biogas plant on the Unterer Lindenhof premises in Eningen unter Achalm and decided to apply. AVAT's successful application enabled Hagenlocher's Energy Automation Solutions (EAS) business division to equip the research biogas plant with process automation and process control systems. From the company's point of view, the entrance of the biogas business is a logical step in its development, since AVAT has long-standing experience in the development of plants that are used

Doctoral student Friederike Hahn and Dr. Andreas Lemmer are testing new methods for the production of biogas. The two researchers are standing behind a fermenter prototype that is being used for primary fermentation.
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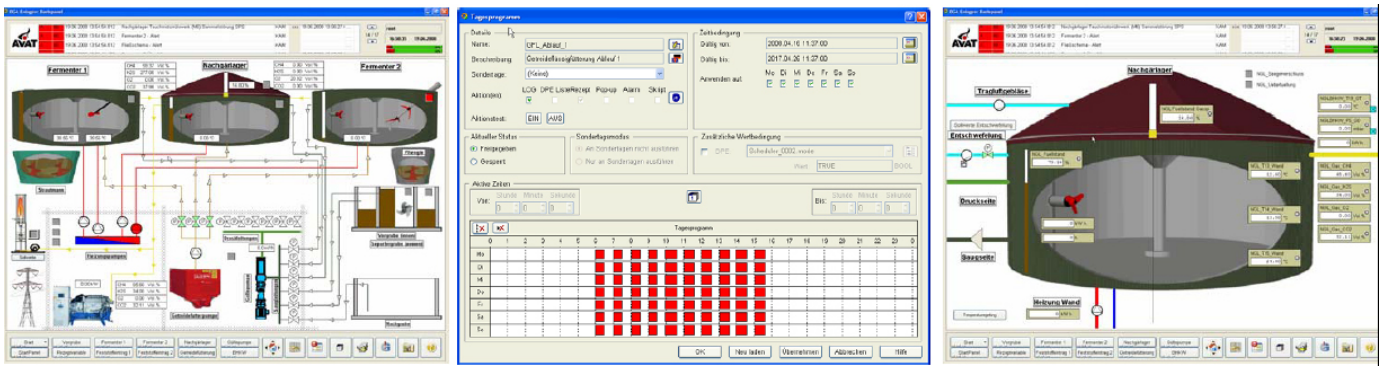
for decentralised energy production, in particular block heat and power plants that produce energy and heat according to the principle of the combined production of heat and power from biogas.

Requirements on the FABES module – flexibility in size and application



In addition to providing automation and process control solutions for the FABES module, AVAT also provides software for the visualisation of the operating sequences, such as those used by the research biogas plant erected on the Unterer Lindenhof premises in Eningen unter Achalm.
© AVAT Automation

The term FABES is coined from the initial letters of the cooperative project, which focuses on achieving the targeted fermentative disintegration of biomass for the combined production of energy and materials. “It is our goal to develop a module of flexible size that can also be used for a broad range of applications,” said Lemmer explaining that the module will have to be able to use any organic material and be used at any site where such organic materials occur. Moreover, the spatial separation of the processing steps follows the idea of biorefineries, which refers to the combined energetic and material use of the degradation products. Lemmer names the thermal use of the fibre substances and the chemical use of organic acids as examples.

The cooperation partners will have three years to pursue their goals during which they will be funded under the “BioEnergie 2021” funding initiative of the German Federal Ministry of Education and Research (BMBF), which is coordinated by the BMBF’s Project Management Organisation Jülich (PtJ). Lemmer believes that science is on an excellent path towards producing biogas at the same quality as natural gas and he, moreover, sees this possibility as a personal highlight in his professional career.

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