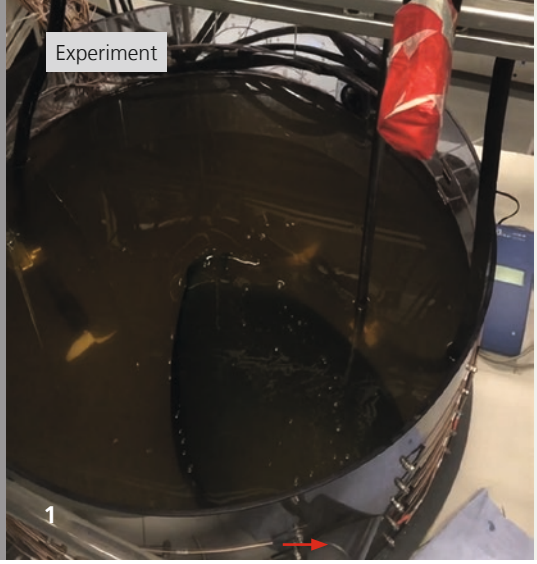

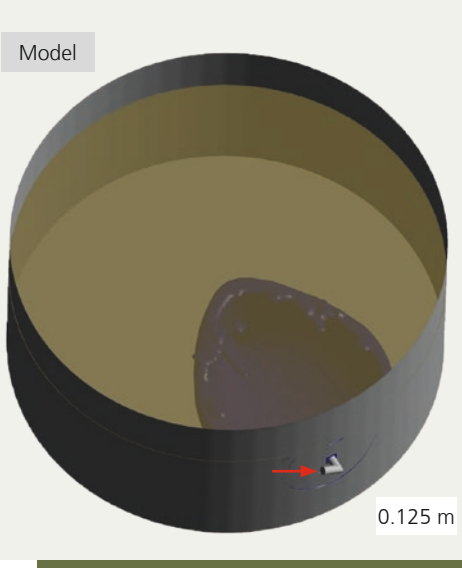

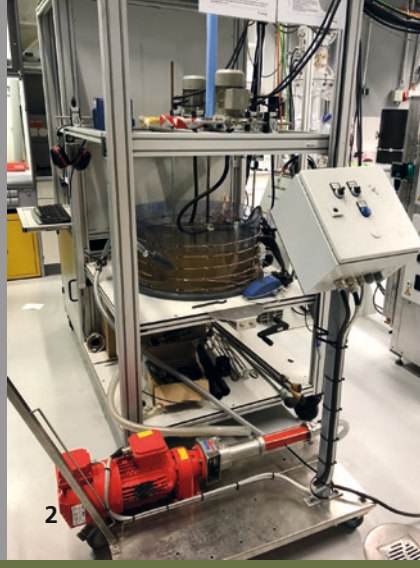

SMART PUMP SYSTEMS FOR MIXING OF BIOGAS REACTORS

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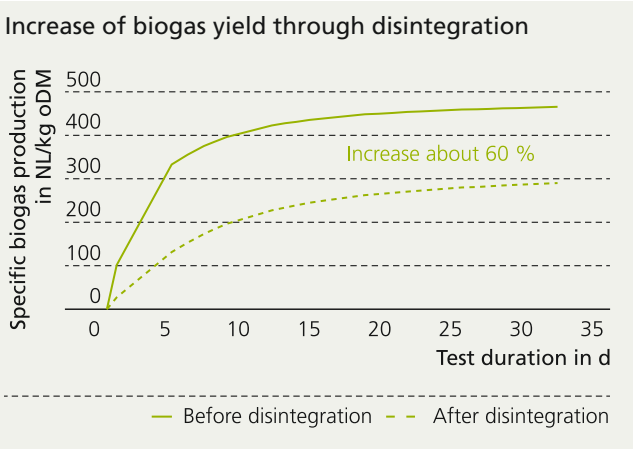
Feeding of fresh substrate and adequate fermenter homogenization are still major challenges for the economic operation of biogas plants, especially when biogenic residues, such as straw and solid manure, are used. This is where the ongoing research project FlexPump comes in. Together with its partners, Vogelsang GmbH & Co. KG and A&U Service- und Vertriebs GmbH, Fraunhofer IKTS is developing a smart pump system for the hydraulic mixing of biogas reactors, testing it under practical conditions. The pump technology was designed to feed and mix the reactor. This is achieved by suspending the feed, for example straw and solid manure, with the fermenter contents and returning this mixture back into the biogas reactor with high hydraulic intensity. This means that an external circulation – as known in systems for sewage sludge digestion – is used for mixing. The prerequisite for this procedure is that the viscosity of the suspensions is adapted to the pump technology. For this reason, disintegration technology was taken into account. The project was able to demonstrate that disintegrated substrates have a significantly reduced viscosity. Batch fermentation tests have confirmed the improved disintegration effect and shown a significant increase in the biogas yield as seen in the graph on the right. The mixing system under development was first evaluated on the pilot-plant scale at IKTS. For this purpose, the large-scale process conditions were scaled down to pilot-plant scale, with a constant entry speed of the pumped medium into the reactor. By means of process-tomographic investigations with electrical resistance tomography (Figure 2), the fluid dynamics of the mixing process could be evaluated and optimized depending on the substrate properties. In addition, computational fluid dynamics (CFD) models are being used (Figure 1).

The results are verified and optimized under practical conditions in a large-scale biogas plant.



Services offered

- Scaling and characterization of flow and mixing processes
- Multiphase computational fluid dynamics (CFD) with non-Newtonian fluids

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1 *Comparison of experiment and model with only pump operation.*
2 *Tomographic test bench.*

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