Einblicke in die Forschungsarbeit

FORSCHUNGSPROJEKT

„Anaerobic Digestion (biogas production)“

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Elitestudiengang Advanced Materials and Processes

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Anaerobic Digestion (biogas production)

Stanislava Mlinar is a graduate of the Elite Master's Programme Advanced Materials and Processes (MAP) at the Friedrich-Alexander-Universität Erlangen-Nürnberg. Stanislava conducted her Master's Thesis at the Fraunhofer Institute for Interfacial Engineering and Biotechnology. Currently, Stanislava works on her PhD at the MAP chair for process biotechnology at the University of Bayreuth. There she continues her research work in the field of anaerobic digestion.

Improvement of mathematical models

Stanislava Mlinar has done her master's thesis in the field of anaerobic digestion (biogas production). Anaerobic digestion is a natural process in which different microbial species convert organic structures through a variety of intermediates into biogas, a mixture of carbon-dioxide and methane1. There are about 10.000 biogas plants in Germany. However, many of them are not optimally operated2. The project MOST3 has been established with the aim to develop a reliable, easy-to-use process measurement and control technology for biogas production. It has been conducted in collaboration with a few companies, research institutes and universities from Germany and Austria. The aims of the project were to analyze all aspects of the process and to test equipment which could potentially be used in biogas plants for detection of limit process parameters, thus helping to avoid a process breakdown. The obtained results were used to improve and sharpen mathematical models for anaerobic digestion, which could predict the changes during the process, depending on the used substrate and process parameters.

Influencing the Chemical Process

Stanislava has contributed to the project MOST by running the process of anaerobic digestion in three reactors on a pilot scale, each with a volume of 50 litres. There, three different temperatures were used. In that way, it has been shown how the process temperature influences the process thermodynamics and therefore the process stability. Two substrates were used, a carbohydrate (starch) and a protein (gluten), both being a structural component of agricultural waste, which is a common substrate used in biogas plants. By increasing the concentration of the substrates in consecutive batches, it was also possible to determine the substrate concentration which could potentially cause a process instability. Since the degradation of the substrates was intensively monitored, a detailed knowledge on the chemical and biological changes during the process under different conditions was achieved.

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[1] Rosenwinkel, K.H.; Kroiss, H.; Dichtl, N.; Seyfried, C.F.; Weiland, P. *Anaerobtechnik: Abwasser-, Schlamm- und Reststoffbehandlung, Biogasgewinnung;* Springer Vieweg: Berlin, 2015; pp 20-43.

[2] BioProFi: *Förderbekanntmachung BioProFi - Bioenergie - Prozessorientierte Forschung und Innovation, Modellbasierte Prozesssteuerung von Biogasanlagen*, Federal Ministry of Education and Research: Jülich, 2014.

[3] MOST: Modellbasierte Prozesssteuerung von Biogasanlagen – Eng.: Model-based process control of biogas plants (https://www.fona.de/mediathek/pdf/Sammelmappe_Verbundsteckbriefe_Bio_Profi.pdf)

More information

https://www.igb.fraunhofer.de/en.html

https://www.map.tf.fau.de

http://www.bioprozesstechnik.uni-bayreuth.de/en/team/index.html