Research. Transfer. Sustainabilty.

Efficient synthesis of methanol from biogas

GREEN-BEE – Market- and product-oriented further development of the concept for synthesizing methanol from sewage gas

Defossilization of the energy intensive sectors facilitates a rapid rise of demand for regenerative chemical feedstock and fuel substitutes. The utilization of biomass plays a key role in the provision of those substitutes. Thus, FiW is researching biomass based thermochemical processes to meet the demands for biological or regenerative substitutes. In the BMWK-funded GREEN-BEE project, a process was developed and piloted that enables the efficient use of biogas for the synthesis of methanol, one of the key molecules in the defossilization of energy-intensive sectors.

The development of the process piloted in GREEN-BEE builds on many years of experience in the field of biogas-based methanol synthesis. As early as 2012, FiW began developing synthesis processes that enable the direct use of biogas as part of a state-funded research project. The work culminated in the "WaStrak II" project, where the process approach was piloted for the first time. Between 2020 and 2023, numerous optimizations were made to the originally developed process, which now enable the cost-efficient synthesis of methanol from biogas or sewage gas.

For this the biogas reforming process was first adapted in collaboration with OWI Science for Fuels gGmbH. Instead of the previously used steam reformer, autothermal reforming with the integration of oxygen is now applied. This significantly reduces the heat input into the system, which considerably increases energy and cost efficiency. In addition to the operational optimization of the synthesis parameters for methanol synthesis, a new type of methanol catalyst was also tested in GREEN-BEE, which in turn promises an increase in CO_2 conversion to methanol.

Interior view of the GREEN-BEE test facility at the Emschermündung wastewater treatment plant.

The system integration of hydrogen for synthesis gas additivation also offers optimal synergy effects with oxygen utilization in autothermal biogas reforming. This enables the efficient integration of an electrolyzer into the process. This means that the process concept also offers the possibility of acting as an electricity sink, thus representing a valid approach to sector coupling of several different sectors.

Overall, it has been possible to achieve a level of development of the overall process that allows the concept to be transferred to industrial production scale. The process concept offers the possibility of partially defossilizing value chains that are heavily dependent on methanol through the decentralized supply of biomethanol.

It also offers a supplementary value chain for the biogas sector: While many biogas plant operators currently rely on the conversion of the valuable biological product into electricity, the synthesis of renewable platform chemicals can be an important complementary option to the complex EEG tendering process. The process can therefore be used by industrial operators of their own biogas plants, but also represents an option for stand-alone operators of biogas plants and plant operators from the agricultural and water management sectors.

Project overview

PROJECT TITLE

GREEN-BEE – Market- and product-oriented further development of the concept for synthesizing methanol from sewage gas

PROJECT PERIOD

06/2020 – 06/2023

PROJECT PARTNERS

OWI Science for Fuels gGmbH

FUNDING

SPONSORED BY THE

Federal Ministry
for Economic Affairs
and Climate Action

SUPERVISED BY

EURONORM GmbH

CONTACT

Forschungsinstitut für Wasserwirtschaft und Klimazukunft
an der RWTH Aachen e. V.
Kackertstraße 15 – 17 / 52072 Aachen

Carl Fritsch, M.Sc.
T +49 241 80 2 39 55 / fritsch@fiw.rwth-aachen.de

Dr.-Ing. Kristoffer Ooms
T +49 241 80 2 68 22 / ooms@fiw.rwth-aachen.de

www.fiw.rwth-aachen.de

As a member of the JRF research community, FiW is funded by the state of North Rhine-Westphalia.
The FiW is a member of the Zuse-Gemeinschaft.

STATUS

Oktober 2023