Bioliq® pilot plant at KIT close to completion

The completion of the bioliq® pilot plant on the northern campus of the Karlsruhe Institute of Technology (KIT) is now a certainty. Following the commitment by the German and Baden-Württemberg governments to provide 11 million euros in financing, the KIT has now also signed contracts with companies that will work with KIT in the implementation of the two final processing stages. These two stages involve the production of second-generation environmentally friendly biofuel from biogenic synthesis gas.

Production of bioliqSynCrude® in the pilot plant located on the northern part of the KIT campus: the plant will now be complemented with processes that enable synthetic fuel to be produced.

"We will only be able to demonstrate the entire process from the initial bales of straw to pumping stations when we have implemented the final processing stages. We will then be able to fully assess the entire process in all its details," said Nicolaus Dahmen, project leader of the construction process. Synthetic fuels, also known as 'btl' (biomass to liquid) fuels can be produced from straw and other biogenic waste. The use of biological waste material has the advantage over first-generation biofuels in that it is not used for food or feed production, and it does not require additional agricultural areas.

The first stages of the bioliq® pilot plant project were carried out in cooperation with the company Lurgi GmbH.

Stage 1: densification of energy through flash pyrolysis

The first stage of the bioliq® process generates an energy-rich intermediary product (bioslurry). Biomass such as straw and other biogenic waste is converted into bioslurry at a number of decentralised plants. Flash pyrolysis converts the biological waste material into an intermediary product consisting of coke and oil that resembles petrol. This substance, known as bioliqSynCrude®, contains around 90% of the energy stored in the biomass used and has an energy density that is around ten times higher than that of the original waste residues. The pilot plant that is used to produce bioliqSynCrude® was set up on the KIT campus in 2007. bioliqSynCrude® can be transported over large distances relatively economically and can be further processed in large-scale plants that resemble car fuel production plants.

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Stage 2: Production of synthesis gas through entrained-flow gasification

The energy-rich suspension will be converted into synthesis gas, a chemically reactive mixture of carbon monoxide (CO) and hydrogen (H2), in large-scale plants using an entrained-flow gasifier. This gasifier is currently being constructed on the KIT campus. The liquid bioliqSynCrude® bioslurry is mixed with oxygen at high pressure (up to 80 bar). At temperatures in excess of 1200°C, the slurry is converted into smaller chemical constituents, which can be turned into designer fuels in subsequent steps.

Stage 3: Conversion into designer fuels

The chemical constituents are converted into designer fuels in the third stage of the bioliq® process, which is just being implemented on the KIT campus in cooperation with two industrial partners, MUT Advanced Heating GmbH based in Jena (for the hot-gas purification) and Chemieanlagenbau Chemnitz GmbH, an international process engineering company (for the synthesis part of the bioliq® plant). These two industrial partners will not only deliver and put in place parts of the plant, but will also work with KIT in the operation and further development of the plant. "We are entering the important phase of implementation of the pilot plant with a projected production of 100 l designer fuel per hour," said Dr. Peter Fritz, Vice President Research and Innovation at KIT: "This is the essential step towards industrial development, after many years of upstream research conducted in the laboratory."

Undesired substances such as small particles, chlorinated substances and nitrogen components are removed from the synthesis gas at high temperatures. The KIT scientists have developed a new

technique, in which the gas is purified at 500°C. In contrast to conventional processes, which require temperatures far below the freezing point of water, the innovative process leads to around 10 per cent of energy savings.

Many steps are required to produce fuel, including several chemical intermediary steps. The bioliq® pilot plant combines some of these steps into a single process stage. In analogy to processes used to produce fuel from natural gas, dimethyl ether is turned into Otto fuel, which can subsequently be further developed, and used, for example for direct fuel injection.

The Karlsruhe Institute of Technology (KIT) is a public corporation and state institution of Baden-Württemberg. It fulfils the missions of university and national research centre of the Helmholtz Association. KIT works within the knowledge triangle of research, teaching and innovation.

Press release

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