

Gasoline additives from sugar

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Pilot plants for the chemical conversion and processing of fuels and fuel additives: High-pressure flow tube reactor. Credit: Fraunhofer-Gesellschaft

Fuel additives such as isooctane have so far been produced from mineral oil. Commissioned by the French-German company Global Bioenergies, the Fraunhofer Center for Chemical-Biotechnological Processes CBP in Leuna will soon be producing biobased additives for gasoline. The source is bioisobutene, which is obtained biotechnically from sugar.

In order to prevent the air-fuel mixture in the gasoline engine from self-igniting prematurely, additives are included with the fuel to increase the knock resistance. In a project funded by the German Federal Ministry of Education and Research (BMBF) the French-German company Global Bioenergies now aims to produce two such additives, isooctane and ETBE (ethyl-tert-butyl ether), for the first time from purely renewable resources. The Fraunhofer Center for Chemical-Biotechnological Processes CBP in Leuna will develop and validate the processes for Global Bioenergies using the equipment available at CBP through to industrial scale.

The raw material for the biobased fuel additives is

biobased isobutene, a hydrocarbon, from which plastics and elastomers can also be synthesized. From autumn 2016 it will be produced in a pre-industrial pilot plant, which Global Bioenergies have installed at Fraunhofer CBP over the past few months. The plant is the first worldwide to produce isobutene in a purely biotechnical process from sugars, which can be obtained from different renewable sources such as agricultural biomass and forestry residues. In a 5.000-liter fermenter bacteria convert such sugar into the gaseous hydrocarbon.

Chemical conversion of isobutene to isooctane

In fact, isooctane has been synthesized from isobutene for years in the chemical industry. "The challenge is now to find out how the established chemical processes can be transferred to the biobased source material," says Dr. Daniela Pufky-Heinrich, who is heading the project at Fraunhofer CBP. "Substances could enter the product, for example via the plant-based raw material and the biotechnical production process; these substances could act as a catalyst poison or interfere with the combustion process in the engine," the chemist points out. That is why it is important to design all the separate steps in the process with a view to a cost-effective overall process, from the [sugar](#) by way of the biobased isobutene through to the fuel additive. "This means that we have to investigate every single parameter and, if necessary, modify each one, for example our purification strategy for the intermediates and the end product," says Pufky-Heinrich.

Then it is a question of scaling up the optimized overall process from the lab via the technical testing stage to the pilot scale. "Parallel to this, we will supply sample quantities of approx. 100 kilograms for application testing in the automotive and fuel industry," says Pufky-Heinrich.

The Fraunhofer researchers also intend to examine various procedures for the chemical production of ETBE, which is synthesized from biobased

isobutene and ethanol. This [gasoline](#) additive is first produced from batches of the biotechnological isobutene production from the Global Bioenergies pilot plant in Pomacle, France.

The hydrothermal reactor units available in the Chemical Process Group at Fraunhofer CBP will be used for the chemical conversion; the thermal treatment units are used for the subsequent purification.

Provided by Fraunhofer-Gesellschaft

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