Energy
National Research Programmes 70 and 71

Project

Refinement of carboxylic acids

Organic acids could be turned into aircraft fuel

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How can we make aviation more climate-friendly? One possible answer is liquid fuels produced from biomass.



Air traffic is dependent on liquid fuels. *Source:* Shutterstock

At a glance

- Aviation is currently dependent on fossil liquid fuels.
- However, these fuels can also be produced from organic acids, that have been obtained from biomass.
- Researchers at EPFL have shown that catalytic conversion is possible - but the process is still complex and expensive.

Fossil fuels play an important role in our energy supply. However, when they are used, carbon dioxide (CO_2) is released, which has a huge impact on the environment. Therefore, we need alternatives.

In order to produce electricity, we already use CO_2-neutral energy sources. These are, in addition to hydropower, wind or solar energy. According to the Energy Strategy 2050, these sources should start to play a more important role in Switzerland.

Aviation, which depends on carbon-based liquid fuels such as kerosene, represents a major challenge.

Climate-friendly fuel supply

One possible alternative could be a fuel derived from biomass. Biomass is plant material that has not been altered by geological processes - unlike oil, coal or natural gas. When used, biomass releases only as much CO_2 as it previously captured during plant growth.

In one research project, a team from EPFL has investigated how a liquid fuel for air transport could be produced from organic acids. The production of these organic acids from wood were subject of another sub-project.

EPFL researchers have also looked into wood biomass, as this has the potential to serve as an alternative carbon source for the production of carbon-based chemicals.

For the project, the team used catalytic processes to transform wood-based carboxylic acids to aircraft fuels and alpha-olefins. Olefins are among the most important basic materials in the chemical production of plastics and chemical intermediates.

During this process, the researchers discovered an abrupt change in selectivity. Selectivity is when one of several possible reaction products is preferentially formed in one reaction.

In this case, a sudden change in the selectivity – from olefins to mainly alkanes – was observed during the full conversion of the carboxylic acids. The knowledge of this phenomenon, which has not been observed before, can be used to control, for example, the proportion of alpha-olefins produced.

Technology still in its infancy

The project shows that organic acids produced from wood can be upgraded to aircraft fuels and base chemicals. However, the process is still in its infancy – it still has a long way to go before it is used in industry.

Cost estimates show that aircraft fuels produced with this technology would be more expensive than fossil fuels on the market. However, so far this has been investigated only in the laboratory and has not been optimised for industrial application.

In any case, the technology must be tested on a larger scale to see if it can bear up against industrial conditions. What works in the laboratory does not necessarily work in the factory.

The recommendation by researchers is for government support for alternative chemicals and aircraft fuels. This is because they are in competition with the petrochemical industry, whose processes are already highly optimized and are also supported by the state.

Such support could also provide further incentives for the aviation industry to continue to participate in research. Such participation is indispensable, as aircraft fuel must be tested and checked for suitability under the most realistic conditions possible.

Produkte aus diesem Projekt

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