Renewable jet fuel range hydrocarbons from biomass residues derived lignin (Lignin2jetfuel)

Publieke samenvatting / Public summary

Aanleiding

The International Civil Aviation Organization (ICAO) recently introduced global market-based measures to reduce the aviation CO2 emissions from 2020 onwards. These measures aim to counterbalance any annual increase in the CO2 emissions from international aviation through the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA).The European Union (EU) aviation industry that is regulated by EU Emission Trading Scheme (ETS) also aims to further reduce the CO2 emissions in the coming decades, and under the renewable energy directive (RED), Member States are setting SAF-(sustainable aviation fuel) mandates. Under the agreement, the global aviation emission target is a 50% CO2 reduction by 2050 compared to 2005. The aviation sector will depend on liquid fuels for many decades. To achieve the emission reduction target, therefor SAF from biomass is considered as an excellent candidate as long as a minimum of 70% greenhouse gas savings is realized. Fundamental research and process development are required to achieve the required quality SAF from various residual non-food biomass resources.

Doelstelling

This project aims to develop a proof of concept (TRL 3-4) scalable technology to produce jet fuel components; oxygen free- alkyl aromatics and cycloalkanes from 2 nd generation lignocellulose derived lignin. A further aim is to create new value chains and to demonstrate the attractiveness of the new to be developed sustainable technology-via

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techno-economic and life cycle analysis. • To this date, efforts to produce jet fuel components from bio-renewable sources succeeded in producing n- and iso- paraffins, without any alkyl aromatics or cyclo-paraffins. Such cycloalkanes or alkyl aromatics and minor oxygen containing (phenolic) additives are required for compatibility with gaskets in the jet engines. Consequently, the bio-based paraffinic jet fuel components needed to be blended with petroleum based alkyl aromatic/cycloalkane components at the risk of enhanced CO2 emission. Thus, our proposal may offer a biobased and sustainable solution for the necessary aromatic/cycloalkanes and a possibility to produce a 100% bio-based jet-fuel with a more favorable reduced CO2 footprint.

Korte omschrijving

Sekab and Renewi will supply purified biomass. Vertoro will fractionate the biomass into carbohydrate and lignin oligomers. WFBR and TU/e will perform depolymerization of lignin oligomers and subsequent C-alkylation to produce monomeric alkyl-phenolic components.
Depolymerization/alkylation of lignin stream will be further upscaled at WFBR/Vertoro. KPRT(Q8) will perform catalytic hydrotreatment of alkylated phenolic monomers. Product stream will be assed for suitability as jet fuel components by KPRT (Q8) and TU/e. Additionally LCA/TEA analysis will be performed at WFBR to compare the developed technology to the existing technology.

Resultaat

The project will result in a proof of concept (TRL 3-4) to produce high value SAF components from cheap lignocellulosic biomass derived lignin. Focus will be to produce lignin derived alkylated and cycloalkane components which are promising for use as jet fuel components. As a side product oxygen containing aromatics may result via the thermal and chemo-catalytic conversion methods; these can have a valuable outlet as octane booster in gasoline. Efficient depolymerization of lignin into highly selective (>90%) alkylated-aromatic monomers will be achieved in one pot using heterogeneous

catalysts. Next, efficient and selective catalytic hydrotreatment process will be developed to remove oxygen. Based on initial process development and conversion efficiency we expect an overall yield from lignin to jet fuel components at a minimum of 35% w/w. Finally, a pre processing approach to convert waste based lignocellulosic material into on-spec feedstock will be developed.

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.
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