

Levulinic acid valorisation via Electrochemistry

Publieke samenvatting / Public summary

Aanleiding

The Paris Climate Agreement's objective is to restrict the global temperature increase to well below 2°C. Moreover, the Dutch climate change legislations' (Klimaat wet) target is to reduce CO₂ emissions by 49% by 2030 and 95% by 2050, compared to 1990 levels. Within the chemical industry the largest abatement potential for CO₂ reduction is the shift from fossil-based towards bio-based feedstock. Since the chemical industry is becoming the biggest driver for the increased global oil consumption and given the (inter)national climate protection targets, it is actively exploring processes based on renewable feedstock to significantly reduce its CO₂ emissions. Levulinic acid (or the ester thereof) is a bio-based chemical which can be prepared from biomass and has high potential usage within the chemical industry and is currently being developed by Dutch-based GFBiochemicals. However derived dedicated and drop-in chemicals thereof are slowly emerging. LEVEL utilizes cheap renewable energy to drive chemical transformation (Power-2-X) and exploit the features of electrochemistry to produce unique chemical compounds and use less conversion steps compared to its chemical equivalent.

Doelstelling

LEVulinic acid Valorisation via ELectionrochemistry (LEVEL) entails the production of bio-based drop-in & dedicated chemicals and ultimately (valerate) biofuels, thus aiming to accelerate the market up-take of bio-based levulinic acid. Therefore, via development of new technological conversion technologies and products, LEVEL contributes to the

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biobased economy in the Netherlands. To identify and develop new high tech applications, polymer materials are synthesised based on the Kolbe electrolysis derived product of levulinic acid, and subsequently characterised. The LEVEL project also involves development of an efficient electrochemical process for the production of valeric acid, which is based upon recent findings of Wageningen Food and Biobased Research (WFBR), where superior selectivity (>99%) towards valeric acid was obtained. Valeric acid is currently produced by Perstorp in Sweden and used amongst others in its Dutch site as animal nutrition compound.

Korte omschrijving

WFBR will use an electrosynthetic approach to produce a chemical building block from levulinic acid, which will be used by Perstorp and WFBR to synthesize new polymeric materials, which will be characterised based on their functional properties. Furthermore, WFBR will further develop the electrochemical conversion process to valeric acid in order to optimise the electron utilization efficiency, space time yield and minimize energy usage. An efficient down-stream processing strategy will be developed by GFBiochemicals and Perstorp and subsequently integrated it into an electrochemical process. GFBiochemicals and Perstorp will determine the techno-economic potential and market applications of the derived products and electrochemical process.

Resultaat

New bio-based polymeric materials based on levulinic acid are synthesized and potential market applications are identified. For the production of bio-based valeric acid an electrochemical process is designed and optimised together with the identification of new market applications. New valorisation routes of bio-based levulinic acid will strengthen the Dutch bio-based economy and aid CO₂ reduction within the chemical industry. The results from the techno-economic and market evaluation will be used for future research directions in order to come to a cost competitive process and

products. The obtained results will be used to outline an exploitation plan.

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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