



**GreenSolRes** demonstrates the conversion of lignocellulosic biomass to levulinic acid (LVA) and further downstream to  $\gamma$ -valerolactone (GVL), 1-methyl-1,4-butanediol (MeBDO) & 2-methyltetrahydrofuran (2-MTHF). The products can be applied as solvents in the pharmaceutical sector or as building blocks for the formulation of bio-based adhesives.

The project started on 1<sup>st</sup> September 2016 and has duration of 60 months.

**Further information:** [www.greensolres.eu](http://www.greensolres.eu)

## Consortium

GFBiochemicals Europe, Geleen (Coordinator)

Henkel AG & Co. KGaA, Düsseldorf

RWTH University, Aachen

Leibniz Institute for Catalysis, Rostock

SYNCOM GmbH, Ganderkesee

Hybrid Catalysis B.V., Eindhoven

VITO Flemish Institute for Technological Research, Mol



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## Latest on levulinic acid production

A key objective of the project is the demonstration of the LVA production from lignocellulosic biomass. This will now be realised at the new Biorefinery Center of the Aachen University. The Center for Next Generation Processes and Products NGP<sup>2</sup> undertakes the demonstration of LVA production and further on its upgrading to bio-based chemicals. The work towards retrofitting of equipment will be performed in the first quarter of 2019 followed by operation and production of first samples of LVA during the fourth quarter of 2019. The work programme has been restructured as a consequence of GFB Italy leaving the project. The project duration has been extended by 12 months.

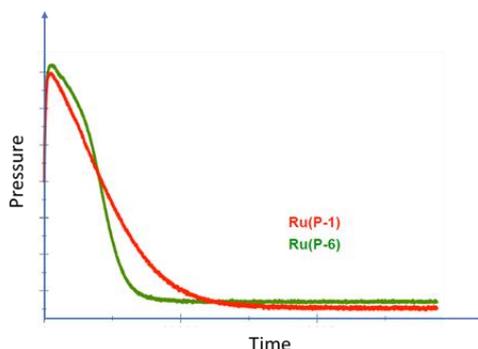


NGP<sup>2</sup> building at RWTH Aachen©

## On the catalyst front

The tailor-made Ruthenium based catalyst for hydrogenation of levulinic acid has been substantially improved since its first synthesis (Milestone 1) and new patents have been filed. Research work on optimisation is directed towards increasing the catalytic activity and improving the economics for industrial scale hydrogenation. Other project activities will benchmark catalyst performance with the state of the art. Preliminary results indicate that the newly developed catalyst system is superior for the two step conversion of levulinic acid to diols.

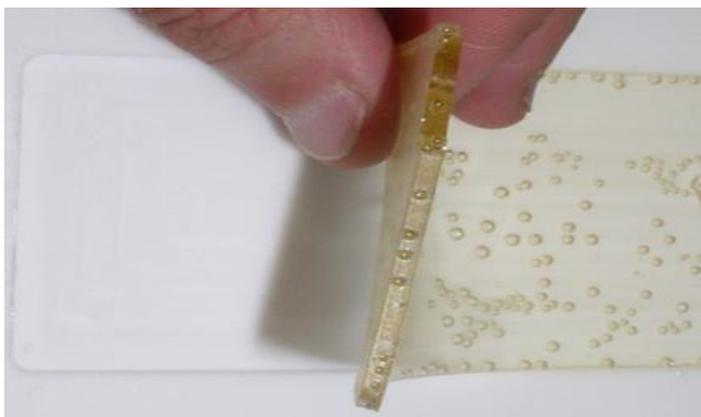
Commercially available laboratory grade MeBDO is expensive and scarce. To solve this problem LIKAT successfully synthesized MeBDO via GVL using their recently developed hydrogenation catalyst. A significant amount of samples needed for formation of novel polymers has been produced.



Left: Improved activity of novel Ru complex in green compared to previous complex in red. Right: Reactor set-up for catalyst testing at HYBRID©

## Step forward towards bio-based adhesives

In the past few months, LIKAT and HENKEL collaborated on polymer development and application testing. Various bio-based polyesters (PES) have been prepared from the platform chemical MeBDO in the desired molecular weight range and tested in adhesive formulations. The analysis shows promising effects and may lead to novel bio-based materials with superior performance and properties.



A film of bio-based polymer prepared for laboratory analysis

## Safety first

Health, safety and environmental matters relating to the production, distribution and use of new bio-based chemicals are important especially as the expectations are to produce materials which are less toxic and have improved environmental performance. In GreenSolRes the chemicals will be benchmarked against the equivalent fossil-based derivatives. Within the scope of this work, literature review on physical-chemical properties, toxicity and ecotoxicity of the chemicals has been finished. Some toxicity predictions were made with computer models by comparing structural analogues. The data gaps are identified and a testing strategy for data completion has been designed. The results are expected to be available as of early 2019.

## Consortium meetings



The GreenSolRes Team

BBI and the GreenSolRes consortium held a review meeting in Brussels on 24<sup>th</sup> May, 2018. Progress and achievements of the first reporting period (RP1) were presented and discussed.

The next joint plenary and steering committee meeting will take place at Geleen from 20<sup>th</sup> to 21<sup>st</sup> February 2019.

## GreenSolRes at BioSC Symposium 2018

RWTH presented a GreenSolRes poster to the scientific and industrial community at the 3<sup>rd</sup> International BioSC Symposium "Towards an Integrated Bioeconomy" held on 12<sup>th</sup> – 13<sup>th</sup> November 2018 in Bonn and chaired the session III: Green Value Chains - Processes and Products from Biomass.

## Upcoming events

- [Third International Conference on Catalysis and Chemical Engineering](#) at Houston TX, United States from 25<sup>th</sup> to 27<sup>th</sup> February 2019
- [New approaches to mitigating catalyst deactivation](#) at London, United Kingdom on 5<sup>th</sup> March 2019
- [Fourth Green & Sustainable Chemistry Conference at Dresden](#), Germany from 5<sup>th</sup> to 8<sup>th</sup> May 2019
- [Sixth International Symposium Frontiers in Polymer Science](#) at Budapest, Hungary from 5<sup>th</sup> to 8<sup>th</sup> May 2019
- [International Symposium on Green Chemistry \(ISGC\)](#) at La Rochelle, France from 13<sup>th</sup> to 17<sup>th</sup> May 2019



*Wishing you a joyful and  
bright holiday season.  
Merry Christmas and a  
happy new year 2019!*

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