PERFORM
PowER platFORM

PERFORM is expected to contribute to technology development to reduce the environmental impact of the chemical industry. The technology developed in PERFORM will reduce CO_2 emissions from the production of chemicals due to the efficient utilization of renewable biobased feedstocks and renewable energy. It will also be essential for a future sustainable society that uses local resources

Organic Electrochemistry: Towards the electrification of the European Chemical Industry in 2030 webinar hosted on June 10.

PERFORM REACHES THE MIDDLE TERM OF THE PROJECT

PERFORM celebrated on January 28 & 29 its month 24 General Assembly meeting in an online version. There, the partners involved in the consortium informed about the progress of their different tasks.

A new milestone was achieved: the **feedstock** was **selected and characterized**. For that process, 7 analytical methods were developed for analysis.

User requirements and specifications for **Perform Pilot platform** and Conceptual Process Diagrams were delivered.

Likewise, the design and sizing of the **reactor** modelling were completed, a preliminary Power Platform demonstration was done, and the system configuration is under the definition.

Finally, progress on the communication, dissemination, and exploitation activities was showcased.

Separated workshops were held to discuss the **downstream processing** and the two reaction lines. Other separated session was also organised to discuss Intellectual Property and Key Exploitable Results, to gather the opinion of the consortium companies.

PERFORM, part of ESEE 2021

From June 14 to 17, PERFORM consortium partners TNO, University of Messina, and VITO

attended the 12th European Symposium on Electrochemical Engineering (ESEE 2021), held online.

During the venue, Deepak Pant, Senior Scientist at VITO, Roman Latsuzbaia, Scientist at TNO & Voltachem, Carlos Sánchez Martínez, Chemical Research Scientist at TNO and Rosalba Passalacqua presented different abstracts and posters in several sessions:

Roman was involved in the sessions: *Fast-tracking electrochemical innovations & matchmaking, and Electrochemical processes applications*, and presented the abstract *Electrochemical process development for production of biobased maleic acid*. For his part, Deepak participated in the session *Progress in electrocatalysis and electrocatalytic materials* and showcased the abstract *Development and upscaling of gas diffusion electrodes for wastewater treatment and electrosynthesis of chemicals.* Likewise, Carlos was also involved in the preparation and presentation of the abstract entitled *Overcoming mass transport limitations in electrochemical reactors with a pulsating flow electrolyser,* together with Roman and other scientist's colleagues. Finally, Rosalba was in charge of the preparation of the poster *NiFe Oxides as Anodic Materials for the Electrocatalytic Oxidation of Glucose to Glucaric Acid.*

The scope of ESEE 2021 focused on the topic Electrochemistry for electrification and energy transition toward a sustainable future with the aim to showcase scientific advances in physical, chemical, and biochemical routes towards a future where electrochemical engineering is part of a sustainable society, closing resource cycles and contributing to zero-pollution mobility and manufacturing.

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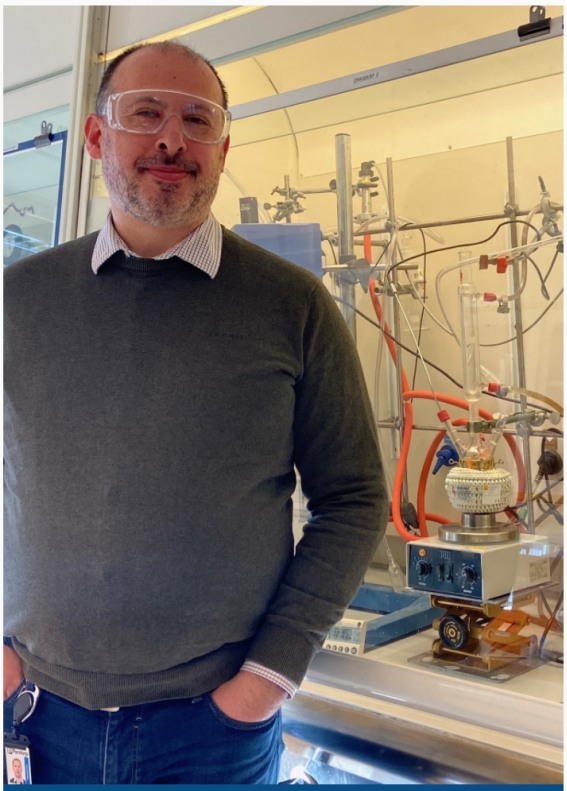


Interview with Konstantin Mpampos, Associate Specialist Chemistry R&D, Innovation at Perstorp AB.

What is PERSTORP's role in PERFORM? Why is it interesting for the company to participate in this project?

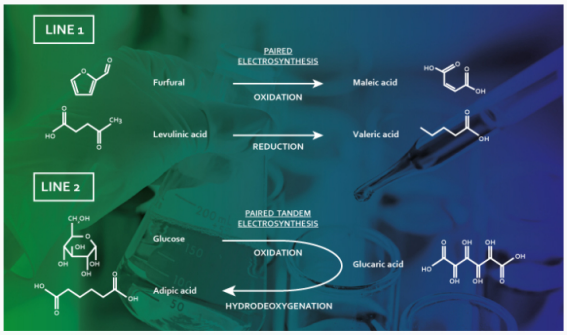
The main role Perstorp has in the PERFORM project is to test the produced material in different formulations from the pilot, in particular the **valeric acid** (VA), as well as to benchmark it against the one produced by other technologies on an industrial scale. VA and its esters are mainly used in perfumes and cosmetics as food additives, due to the fruity flavour of the esters, but also as plasticizers and pharmaceuticals.

Perstorp is at present producing VA on an **industrial scale** and has a long experience of different oxo processes, including a substantial experience on **downstream products based, not only on valeric acid but also on other comparable acids and** products. The company uses VA in esters for synthetic lubricants, as raw material for Active Pharmaceutical Ingredient (API) production, and for making esters for aroma **chemicals**. In example, ProPhorce™ Valerins (glycerol esters of valeric acid) is a new breakthrough product introduced by Perstorp for feed purposes to boost animal performance.

Our company's interest in the PERFORM project, as well as in other projects that aim to use **sustainable feedstock**, together with technologies that facilitate reducing the carbon footprint, is aligned with our sustainability strategy set for the coming years.

Perstorp's ambition is to achieve **finite material-neutral production**. We continuously develop new products and applications based on sustainable raw materials and energy. Green chemicals produced via the **electrochemical route** create valuable assets along the development path and toward fulfillment of the ambition we have as a company. Being one of the world's leading chemical companies focusing on sustainable coating, adhesives, feed and food, and plastic material market segments it is important for us to follow the development and contribute to that.

PERFORM SYSTEM DESIGNED AND REACTOR CONSTRUCTED



With the growing global shift towards more sustainable technologies in science and industry, the **electrochemical production of chemicals** is more relevant than ever, due to its potential to utilize energy and resources efficiently, eliminate the use of toxic solvents and minimize waste.

Within the European Union, in the PERFORM project a multinational consortium, led by TNO, aims to develop highly efficient and **integrated electrochemical systems** which will substantially improve sustainable production of valuable building blocks from **biobased feedstocks.** The project will demonstrate electrochemical production processes of biobased chemicals at a technology readiness level 5-6. Two demonstration lines are under development to establish the potential for selective and efficient production of **biobased chemicals via electrochemical routes.** The first showcase covers electrochemical production of maleic acid from furfural paired with the production of valeric acid from levulinic acid; while the second showcase deals with – adipic acid production from glucose.

Read full article

Interview with Daniel Grau, Biobased Products and Bioenergy Engineer at University of Hohenheim and leader of the Process Assessment for PERFORM.

How is an environmental life cycle assessment performed and why is it relevant for the project?

Society is becoming more aware of the importance of **environmental protection** and the environmental impacts associated with the production and use of products. This sparked interest in the development of methods that take these effects into account and contribute to understanding. The most important technique developed for this purpose is the **four-phased life cycle assessment** (LCA), a method standardized by the International Organization for Standardization (ISO) 14040/44 standards.

The LCA is characterized by a large number of applications. The study can be used to identify opportunities that lead to the improvement of the **environmental performance** of products in the various phases of their life cycle. Furthermore, the LCA can help to inform decision-makers in industrial, governmental, or non-governmental organizations. This can influence decision-making, e. g. in strategic planning, prioritization, and product or process design. The LCA is advantageous for the selection of **relevant indicators** of environmental properties including the associated measurement methods. Besides, the LCA can serve as a marketing tool, e. g., by implementing an environmental label or producing an environmental declaration for a product.

Within technical projects such as the PERFORM project, an LCA can provide decision support along the course of the project to verify and, if necessary, to apply corrections to the process in order to achieve more **positive impact** environmental indicators.

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PERFORM ACHIEVES A NEW MILESTONE: FEEDSTOCKS SELECTED AND CHARACTERISED

The PERFORM consortium works on the electrochemical conversion of glucose from Avantium's **DAWN Technology™** to high-value products.

To make this **glucose feedstock** suited for electrochemical conversion it is crucial to know the composition of the feedstock, understand which components can interfere with the **electrochemical conversion,** and develop protocols and equipment to selectively remove such components from the sugar matrix. Avantium has recently reported the milestone "Feedstocks selected and characterised".

To achieve this milestone **analytical methods** are developed to define the composition of the sugar stream that is produced in the DAWN Technology™ pilot plant. In close collaboration with the partners that work on the electrochemical conversion, we identified which components are to be removed before the electrochemical conversion of glucose. Then starting on a **laboratory scale**, Avantium developed a series of pre-treatment steps that selectively remove these components. After successful demonstrations on a laboratory scale, these pre-treatment steps are **scaled up** and implemented in the DAWN Technology™ **pilot plant.**

Large steps are made in the PERFORM project in the optimisation of the operability of the DAWN Technology™ pilot plant and its performance with regard to the application of its sugar streams. We are able to unravel the precise composition of the **sugar product streams** that are produced. The development of equipment and protocols for pre-treatment steps, both on lab scale and in the pilot plant, allowed us to selectively remove components from the sugar streams. This can broaden the scope of applications of the sugars obtained in the DAWN technology™.

Interview with Sorani Montenegro, R&D specialist at Hysytech

What are the main responsibilities of Hysytech within the project?

The responsibilities that Hysytech has in the PERFORM project are mainly focused on work package 4, where we are dealing with the engineering design, scale-up, process optimisation, manufacturing, and assembly of the final technology readiness level 6 **platform technology for two targeted reactions.** Together with the rest of the consortium partners, Hysytech is responsible for the development of sustainable technology, with high performance and cost-competitive to be able to produce the **targeted valuable building blocks**. To do so, we are working to build a simple and reliable process, highly integrated and optimised. Later, the process needs to be properly designed with process intensification, decreasing CAPEX (Capital Expenditure) and OPEX (Operating Expense), as well as emissions.

In PERFORM, two different showcases industrially relevant will be demonstrated; the first one consists of the **paired electrosynthesis of furfural to maleic acid, and levulinic acid to valeric acid**. The second showcase is the paired tandem electrosynthesis of **glucose to glucaric acid and further glucaric acid to adipic acid.**

READ FULL INTERVIEW

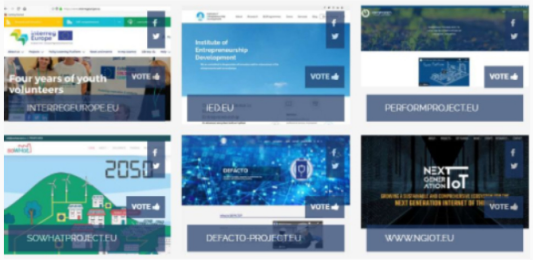
FIRST JOINT NEWSLETTER OF SPIRE 02-2018 PROJECTS AVAILABLE FOR CONSULTATION!

Here you will find the latest advancements and key technologies developed on PERFORM, LIBERATE, DESTINY and SIMPLIFY.

The four projects address the same challenge: Processing of material feedstock using non-conventional energy sources.

Non-conventional energy sources, such as microwave, plasma, ultrasound a have already been applied in process intensification, mainly at lab scale, shond laser, as well as electrochemical and photochemical processes, wing significant improvements in process performance (e.g. improved selectivity, crystal nucleation, reaction speed easing raw material demand) for the benefit of energy efficiency.

The processes powered by non-conventional energy sources are suitable for connection to the electricity grid. They allow variable throughputs to better follow market demand and enable leaner production paradigms (e.g. decreased stock, production on demand). Such technologies are suitable for downscaling and continuous processing, where they can also be coupled with real-time monitoring allowing finer control of the transformations.



The PERFORM website has been nominated for EURID's Web Awards

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