

An electrochemically produced oxidiser for modular, onsite generation of HYdrogen PERoxide

HYPER is a new project funded by Horizon Europe, the EU Framework Programme for Research and Innovation, starting on 1st January 2023 and lasting for four years, with a budget of approximately €7 million.

HYPER's world class consortium aims to transform hydrogen peroxide (H_2O_2) production from a large-scale, energy intensive chemical process to a small-scale on-site production, through electrifying the chemical production of H_2O_2 .

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1. Getting started - Project Coordinator Perspective

“The HYPER consortium has hit the ground running, demonstrating at the 6 Month meeting that all the necessary groundwork for a successful project is in place. The required administrative, reporting and dissemination and communication tools are established. Our branding has been designed, and the website is operative. Kit for the experimental work has been received and is ready for data collection.”

“While the anodic (oxidation) reaction of HYPER's electrochemical conversion technology is clear (sulfate to persulfate), the cathodic (reduction) reaction needs to be chosen and tailored to the end-user needs to the extent possible. The end-users have provided our electrochemical researchers with a lot of suggestions for cathodic reactions that can improve their processes. Work on the best fits with the anodic reaction conditions

is starting. The meeting also held space for creative discussions on the vision for the HYPER technology, a necessary step for the techno-economic and life cycle assessment studies.”

“Despite that the HYPER proposal was written exclusively on-line, I have been impressed with the passion and teamwork the partners have shown during the first two Consortium meetings. The partners are fully engaged and committed to successful development of the HYPER technology. During the meeting the dynamic team enthusiastically discussed and conversed about all the possibilities of this project. The next meeting will definitely factor in more buffer time for these fruitful conversations”.

Richard Heyn, Project Coordinator, SINTEF

2. Project meetings

The HYPER consortium has already met twice since the project started on 1st Jan 2023, the first time in Oslo, at the SINTEF offices, for the kick-off meeting 31st Jan – 1st Feb 2023, and again 6 months later in France at the INERIS campus, 14th – 15th June.



At the 6-month meeting the team met in France and shared their initial progress on the project. CONDIAS, Work Package (WP) 2 leaders, are already underway with raw material procurement, finalisation of the combined cutting mask, and planning of coating parameters. Whereas SINTEF in WP2 gave an update on the industrial partner interviews about waste recycling, hazardous chemical mitigation and required compounds, and how the feedback has been converted into suggestions. Other WP2 updates included EUTs summary about the proposed cell and planned stability trails, as well as a presentation from

The Kick-off meeting was the first time that all the project partners had come together in person. The team used this opportunity to present about their roles on the project and engage in some team building activities, such as creating mood-boards that represented the project.

NIC about possible analytical methods for persulfate and H₂O₂ determination. WP5 reported on its start of the conceptual design of processes at commercial scale such as, collection and processing of basic data and background information, as well as defining system and boundary scenarios. Aside from WP2 and WP5 the other technical WPs should officially start research later in the project, however, two eager partners have started research ahead of time; Task 5.4 - safety assessment and risk mitigation, and coating formulations of H₂O₂ in WP4, are both making headway earlier than planned.



3. More about the Project

The HYPER project proposes to research and create a new technology that will transform the production of hydrogen peroxide (H₂O₂), and help to make many industries, such as pulp and paper, textiles, electronics, resins, coatings, disinfection, and water treatment, more sustainable.

Currently the production of H₂O₂ is a large-volume, energy intensive process, involving potentially dangerous chemical interactions.

The HYPER process is aiming to turn this into a smaller-scale, robust, modular, sustainable, electrochemical process, which in turn will provide significant environmental and economic benefits.

Remarkably, the project contributes to the achievement of four of the United Nations Sustainable Goals;

- number 8 – Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all,
- number 9 – Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation,
- number 12 – Responsible consumption and production by adopting waste as an input source in a circular economy paradigm, and
- number 13 – Take urgent action to combat climate change and its impacts.

Beyond the SDGs, HYPER strongly addresses the EU Green Deal challenges by transforming the EU's economy for a sustainable future, decreasing GHG emissions and greening the chemical industry.

HYPER's world class consortium brings expertise to the entire value chain and with a strong industrial commitment to maximise exploitation through practical implementation.



4. The HYPER Approach

HYPER will address new sustainable routes towards chemical key substances through the utilisation of renewable energy sources (RES) – a crucial step for the sustainable transformation of classical chemical processes. Following on are some of the main challenges that the project team has identified and explained what approach they plan take in solving the problem.

1. RESEARCH CHALLENGE:

Optimisation of the system components and process for maximal performance and stable RES integration at TRL4-5. HYPER APPROACH AND SOLUTION:

An implemented mini-plant will include all relevant parts of the process to demonstrate its feasibility. While individual process parts are usually tested step by step, only a full integration can provide the necessary insights into realistic operation conditions to ensure that the developments will be suitable for successfully reaching higher TRL.

2. RESEARCH CHALLENGE:

Scale up the optimised system to TRL6. HYPER APPROACH AND SOLUTION: The system will have a modular design so that it can be easily adapted or expanded to meet current needs.

3. RESEARCH CHALLENGE:

Validate the process in three industrial value chains.

HYPER APPROACH AND SOLUTION:

Simplified in situ generation of H_2O_2 will be studied to produce the needed volumes

of H_2O_2 as a satellite unit of the bleaching device/s, to check the possibility of creating sufficient volumes of active oxygen in bleaching devices (with reduction/elimination of chemical H_2O_2 stabilisers), and the onsite production of the chemical (as an oxidant).

4. RESEARCH CHALLENGE:

Process design and safety, and climate change & environmental impact.

HYPER APPROACH AND SOLUTION:

Design and implement an online coordination algorithm, which will coordinate the electrochemical production process with electric power system (grid) balancing mechanisms (ancillary services, balancing market).

5. Digital twin development

To achieve the research goal, the project will develop a digital twin, to simulate the dynamic operation with variations in the availability of renewable power. The project team will also analyse how the full-sized system would be able to function as a grid balancing service, utilizing renewable electricity when it is both abundant and cheap.

‘Data from the digital twin will be part of the identification of routes for improved commercial viability, ensuring efficient integration of renewable sources to drive the conversion process in a reliable manner’ explains Richard H. Heyn.



6. Upcoming Events

HYPER will be presented at the Processes4Planet projects forum on the 20th of September 2023. The objective of the Processes4Planet projects forum is to advertise and make known the current Processes4Planet projects, a total of 27 so far in 2021-2022.

The Projects Forum seeks to pave the way for the creation or enhancement of synergies and actionable pathways for projects to maximize the impact created through the P4Planet

Partnership and to contribute to its 3 ambitions of circularity, neutrality and competitiveness.

The projects forum is a public event for project teams, consortia members, institutional stakeholders, and others. Further info about registration can be found [here](#).



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