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Press Release

ILIMITED Horizon Europe project:

Building the future of sustainable methanol production: ILIMITED highlights key project achievements

Advancing research for sustainable CO_2 valorisation

The Horizon Europe project highlights key scientific advances, international collaboration and innovation activities supporting sustainable CO_2 valorisation and methanol production.

As Europe accelerates its transition towards climate neutrality, innovative solutions for carbon capture and utilisation are becoming increasingly important. One promising approach is the conversion of captured carbon dioxide (CO_2) into methanol, a versatile chemical building block, energy carrier and renewable fuel with the potential to support a circular carbon economy.

The Horizon Europe project **Ionic LIquid sorbent Methanol synthesis In order To Enable over 80% yielD (ILIMITED)** is contributing to this ambition by developing innovative ionic-liquid-based solutions to improve the efficiency of CO_2-to-methanol conversion. Bringing together expertise in catalysis, process engineering, materials science, modelling and sustainability assessment, the project is advancing new process intensification strategies that could help unlock higher methanol yields and more efficient use of captured carbon.

Accelerating the discovery of novel Ionic Liquids

Since its launch, ILIMITED has established a strong scientific foundation for developing next-generation technologies that enable more efficient and sustainable methanol production. One of the project's main objectives is to develop ionic liquids (IL) capable of selectively removing methanol and water during the reaction process. This approach can shift the reaction equilibrium towards higher methanol yields and improve overall process efficiency. To identify suitable candidates, researchers developed an advanced computational workflow that combines molecular modelling, thermodynamic calculations and machine-learning tools. Through large-scale virtual screening, approximately 19 million IL structures were evaluated for their suitability in methanol synthesis applications. This screening process enabled researchers to narrow down a vast chemical space to a small number of highly promising candidates, which are now entering the experimental validation phase.

An important milestone has been the publication of the project's first peer-reviewed scientific paper, which contributes new knowledge to the field of IL screening and supports the identification of materials with potential for future industrial application. This publication represents a significant step in translating project research into openly accessible scientific knowledge.

Understanding long-term stability under industrial conditions

For innovative solvents to become industrially viable, their long-term thermal and chemical stability must be demonstrated under realistic operating conditions. Researchers from the consortium have therefore focused on developing practical methodologies for assessing the durability of ILs exposed to

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elevated temperatures and reactive chemical environments. This work provides valuable insights into how these materials behave during prolonged operation and helps identify the most promising candidates for future industrial deployment. The results are contributing to a deeper understanding of the factors governing IL stability and are supporting the selection of materials capable of operating under demanding process conditions.

Advancing process intensification for sustainable methanol production

Another important focus of the project is designing innovative adsorption and separation solutions that enhance methanol synthesis performance. Within ILIMITED, researchers are investigating how selective adsorbents and process-intensification concepts can facilitate the in-situ removal of reaction products. Such approaches have the potential to overcome the thermodynamic limitations that currently restrict methanol yields and require extensive process recycling. By integrating advanced materials with novel reactor and separation concepts, the project aims to establish more efficient pathways for converting captured CO_2 into valuable chemicals and fuels.

Sharing knowledge across Europe and beyond

Dissemination and knowledge exchange are central elements of the ILIMITED project. Consortium partners have actively shared project progress and research developments with the international scientific community through participation in leading conferences and scientific events across Europe and beyond, including: EUROPACAT2025 (Norway), ICCT 2025 (Portugal), COIL-10 (Australia), EcoMac2026 (Greece), ISCRE2026 (Korea), WSERENRE2026 (Switzerland), EUCHEMSIL 2026 (UK), JEEP 2026 (Portugal) and MELPRO 2026 (Czech Republic).

These activities have enabled the consortium valuable exchanges with researchers, industry representatives and innovation stakeholders while increasing the visibility of project results and fostering new opportunities for collaboration.

Building synergies with sister projects

Beyond its own research activities, ILIMITED actively collaborates with sister projects funded under the same Horizon Europe call, recognising that complex climate and energy challenges require coordinated, multidisciplinary solutions. A notable example is the **joint special session "From Research to Application: Cross-Sector Energy Technologies for the Climate Transition",** organised together with the sister projects **PeCATHS** and **NOVETROL** at the TBMCE 2026 conference in Slovenia. The session also featured contributions from the **CarbNETs** project, further enriching discussions on industrial decarbonisation and carbon management technologies.

The session brought together experts working on sustainable hydrogen storage, CO_2 valorisation, life-cycle sustainability assessment and industrial decarbonisation. By connecting complementary research initiatives, the participating projects demonstrated the importance of cross-sector collaboration in accelerating Europe's transition towards a climate-neutral, circular economy.

"*Captured CO_2 should not be seen as waste, but as a valuable resource. Through ILIMITED, we are exploring innovative ways to convert CO_2 into useful products while improving process efficiency and sustainability. By combining advanced ionic liquids, digital tools and multidisciplinary expertise, the project is creating new opportunities for more sustainable methanol production and supporting Europe's transition towards a climate-neutral future*." Dr Anže Prašnikar, ILIMITED Project Coordinator, National Institute of Chemistry.

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Looking ahead

In the coming months, research and development activities will continue, focusing on the experimental validation of the most promising ILs identified through computational screening, further optimisation of adsorption and separation processes, and strengthened collaboration across the project's multidisciplinary research areas. The consortium will also expand cooperation with scientific, industrial and policy stakeholders through conferences, scientific publications and joint dissemination initiatives. These efforts will help maximise the impact of the project results and support the uptake of innovative carbon utilisation technologies.

By combining advanced materials research, digital innovation and European collaboration, ILIMITED is helping to pave the way towards more efficient carbon utilisation pathways and a more sustainable chemical industry.

About ILIMITED

Ionic LIquid sorbent Methanol synthesis In order To Enable over 80% yielD (ILIMITED) is a Horizon Europe research and innovation project developing advanced ionic-liquid-based solutions for process intensification in CO_2-to-methanol conversion. By combining computational modelling, artificial intelligence, material development and experimental validation, the project aims to increase process efficiency and contribute to the transition towards a climate-neutral and circular carbon economy. The ILIMITED project is coordinated by **National Institute of Chemistry (Slovenia)** and funded under Horizon Europe Grant Agreement n°101192964.

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For more information, visit ILIMITED:
Website: https://ilimited-project.eu/
CORDIS: https://cordis.europa.eu/project/id/101192964
ZENODO: https://zenodo.org/communities/ilimited
LinkedIn: https://www.linkedin.com/company/ilimited

Contact

Project coordinator:
KEMIJSKI INSTITUT / NATIONAL INSTITUTE OF CHEMISTRY anze.prasnikar@ki.si

Project consortium:
ARISTOTELIO PANEPISTIMIO THESSALONIKIS amargel@chem.auth.gr
GLOBAL OMNIUM MEDIOAMBIENTE, S.L. fesena@globalomnium.com
ICODOS GMBH florian.summ@icodos.com
RINA CONSULTING SPA gaia.masoero@rina.org
UNIVERSIDADE DE AVEIRO jcoutinho@ua.pt
ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE philippe.schwaller@epfl.ch

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