iCULTURE combines bacterial engineering with AI to valorise seaweed sidestreams, supporting sustainable resource use

Trondheim 09/11/2026 – The Horizon Europe project iCULTURE is developing a **biotechnology platform that uses bacterial cultures to transform sugars from seaweed-processing sidestreams into high-value bioactives**. Combining bacterial engineering with AI-supported monitoring and control, the project aims to create value from residual materials, supporting responsible use of marine resources.

Seaweed-processing residues contain complex, variable sugar mixtures that conventional production bacterial strains cannot fully utilise. Addressing this challenge requires engineered bacteria able to use these sugars, together with tools to monitor and regulate fermentation. "*After almost three years of collaborative research, we have established and tested many of the building blocks of the bioprocess: from bacteria that utilise different sugars to digital tools for monitoring, prediction and fermentation control. We are now refining their integration and advancing testing with industrial sidestreams to optimise process performance and bioactive production,*" says Prof. Nadav Bar, iCULTURE project coordinator.
The project has expanded the range of sugars that engineered bacteria can consume and developed modules for producing target bioactives. Small-scale experiments have tested co-cultures on purified sugars and seaweed hydrolysates and demonstrated fluorescent labelling for distinguishing strains within a mixture. These experiments have also informed further strain development to improve compatibility within co-cultures. In parallel, researchers have demonstrated automatic biomass control in monoculture continuous cultivation with fast sugar measurements, automated flow-cytometry analysis and AI predictive models. Testing on industrial sidestreams is now underway in monoculture, preparing the ground for a **20-litre demonstration of bioactive production from seaweed-processing residues**. The demonstration is planned at **NORFERMA**, a spin-off company based in Trondheim, founded as an outgrowth of research at the Norwegian University of Science and Technology and EU-backed initiatives including iCULTURE. In parallel, life-cycle assessment will examine environmental performance and identify opportunities to improve the overall process.

Alongside biotechnology development, iCULTURE is **building evidence for responsible resource management**. The project developed models to monitor marine-forest biomass, climate-related changes and population recovery, to inform decisions on where and how seaweed resources can be used sustainably. A first stakeholder workshop, that took place in March 2026, brought research, industry and policy perspectives into dialogue to inform the resource management models and the development of policy recommendations. Its findings are available in the **workshop report**. "*Through this dialogue, we are connecting our modelling work with the practical needs of those who manage and use seaweed resources. This helps us develop recommendations that support responsible use while protecting marine ecosystems,*" adds Prof. Bar. A second workshop is planned for spring 2027, to discuss the emerging modelling results and their implications for resource management, including future biomass availability, population recovery and opportunities for industrial use of invasive species.

Beyond research and multi-stakeholder dialogues, iCULTURE fosters training and public engagement. The **iCULTURE Summer School**, held in May 2026, brought together an international community of more than 80 university students, creating opportunities for learning and exchange across disciplines. The project also developed outreach formats and tools ready to bring algae science closer to the public. Across three editions of European Researchers' Night over three years, these activities have engaged more than 16500 participants. A **quiz package** and **art-science exhibition cards** can be freely used by educators, researchers and organisations to bring algae into classrooms, exhibitions and community settings.

More information and collaboration opportunities are available on the website and the dedicated social media platforms (Twitter, LinkedIn, Instagram).

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