Fraunhofer FEP

PRESS RELEASE

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Microalgae convert CO_2 into useful basic chemicals

Researchers in Saxony are developing biotechnological cell factories that do not require agricultural land or fossil raw materials. Chemnitz University of Technology, Leipzig University, and Fraunhofer FEP are using microalgae to produce the important basic chemical glycolate from carbon dioxide and sunlight - a building block for medicines, preservatives, and polymers that is currently produced from partially toxic fossil raw materials.

Diese Maßnahme wird mitfinanziert durch Steuermittel auf der Grundlage des vom Sächsischen Landtag beschlossenen Haushaltes.

The interdisciplinary cooperation project PhotoKon could make a significant contribution to the regional bioeconomy by producing valuable chemicals directly from CO_2 and light, bypassing the need for scarce agricultural land or fossil resources. The researchers utilize the microalgae Chlamydomonas reinhardtii, which they are optimizing for industrial use with novel mutation methods and AI-based screening.

The three project partners have already made significant progress and are working with innovative approaches. PhotoKon is developing the scientific basis for the use of ionizing radiation as a new method for the targeted cultivation and optimization of photosynthetically active cells.

Fraunhofer FEP in Dresden has developed a novel mutation method based on low-energy electron radiation (< 300 keV). Prof. Simone Schopf from Fraunhofer FEP emphasizes: "Accompanying dosimetry experiments with commercial film dosimeters and in-house dose measurement methods enable us to precisely control the mutagenic effect."

Leipzig University has already demonstrated the basic feasibility of photocatalytic glycolate production and is developing an innovative pH-based screening method. This method uses color indicators on agar plates, which change as a result of glycolate excretion by the algae cells. This approach is based on the experimental observation that the accumulation of glycolate in the surrounding medium correlates with a decrease in pH.

Chemnitz University of Technology has made significant progress in robotics-assisted mutant screening using AI-based image analysis. The team is developing automated screening routines that can independently analyze thousands of algae colonies and identify promising mutants.

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"This interdisciplinary approach enables us to specifically utilize the natural photorespiration of algae - normally an unwanted side effect - for targeted glycolate production," explains Prof. Severin Sasso from Leipzig University.

AI-based technology and intelligent process control

Screening and isolation of positive mutants are performed using an AI-based image recognition process with transfer learning approaches. By isolating promising cell factories, it is possible to investigate the biological basis of the effect of ionizing radiation on cells and to implement scaling in technical bioprocesses.

"We aim for a biologically and technologically improved process, which will be validated on a laboratory scale at the new Controlled Environment Agriculture Lab at Chemnitz University of Technology," reports Dr. Felix Krujatz. Through intelligent control technology for the efficient production of glycolate on a laboratory scale, PhotoKon technology opens the door to sustainable, bio-based conversion of CO_2 into the base chemical.

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About the project

PhotoKon – Photocatalytic conversion of CO_2 into glycolate by microbial cell factories using random mutagenesis and artificial intelligence

This project is co-financed with tax funds based on the budget approved by the Saxon State Parliament.

Funding period: June 1, 2024, to May 31, 2027.

Liquid culture of *Chlamydomonas reinhardtii*
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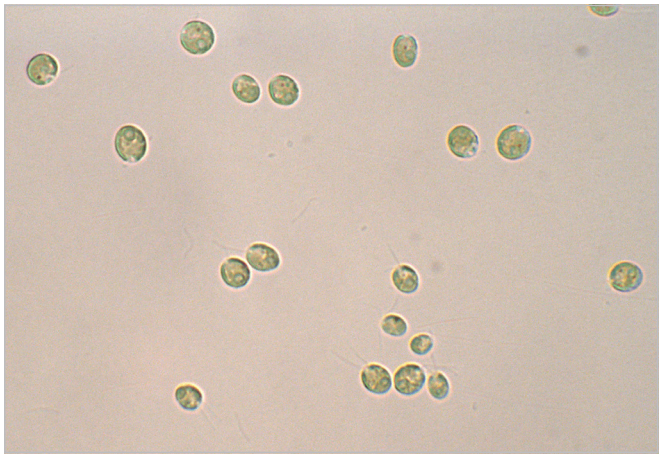
Picture in printable resolution: www.fep.fraunhofer.de/press



Light microscope image of *Chlamydomonas reinhardtii*
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