

New Screening System Detects Algae with Increased H₂ Production

Highlights in
Science

NREL's high-throughput screen facilitates the selection of novel H₂-producing algae.

Researchers at the National Renewable Energy Laboratory (NREL) have developed a powerful method for screening through million-member algal libraries for strains with increased hydrogen production.

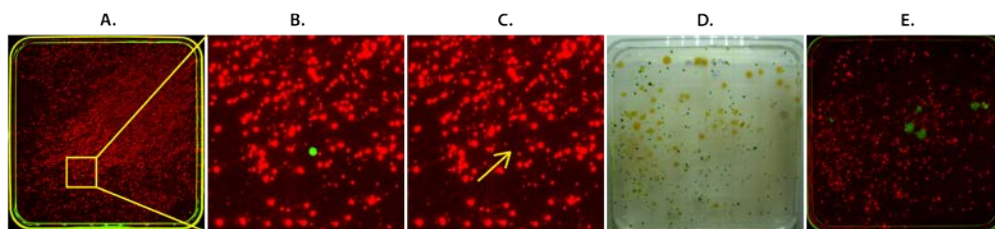
The screen uses H₂-sensing bacteria that fluoresce when hydrogen is detected and is used as an agar overlay on top of growing algal colonies. The screen was first verified by comparing algal strains that differentially produce H₂ under conditions of high light. Subsequently, the system was used to parse through algal libraries, allowing the selection of a single H₂-producing algal colony out of a field of ~10,000 H₂ non-producers (see figure below). The system is also useful for screening for H₂-producing strains from libraries from natural algal populations.

The long-term objectives of this research are to understand the factors that influence the H₂-producing capability of microalgae and to develop practical algal systems for producing H₂ via photobiological water splitting, with the H₂ harvested directly from the gas phase of the cultures.

This material is based on work supported by the U.S. Department of Energy, Office of Science, Office of Biological and Environmental Research (BER), Genomic Sciences Program.

Technical Contact: Maria Ghirardi, maria.ghirardi@nrel.gov

Reference: Wecker, M.S.A.; Ghirardi, M.L. (2014). "High-Throughput Biosensor Discriminates Between Different Algal H₂-Producing Strains." *Biotechnology and Bioengineering*. DOI: 10.1002/bit.25206.



(A) NREL's sensor detects a single H₂-producing colony (green dot) in a field of non-H₂-producing colonies (shown in red). (B) Details of the boxed area in A. (C) The faint underlying colony in the absence of the sensor signal. (D) Plate showing colonies of microorganisms taken from a local stream that were then screened for their ability to produce H₂, shown as green dots in E.

Key Research Results

Achievement

NREL has validated an efficient, high-throughput method of screening for algae strains that produce high levels of hydrogen.

Key Result

This plate-based screen can pinpoint one H₂-producing strain out of 10,000 unproductive strains in a single, inexpensive test.

Potential Impact

This tool enables the high-throughput selection of natural and engineered algal strains for H₂ production, increasing our capability to develop photobiological H₂ as a clean and renewable fuel.

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

15013 Denver West Parkway
Golden, CO 80401
303-275-3000 | www.nrel.gov

NREL/FS-2700-62550 | August 2014

NREL prints on paper that contains recycled content.