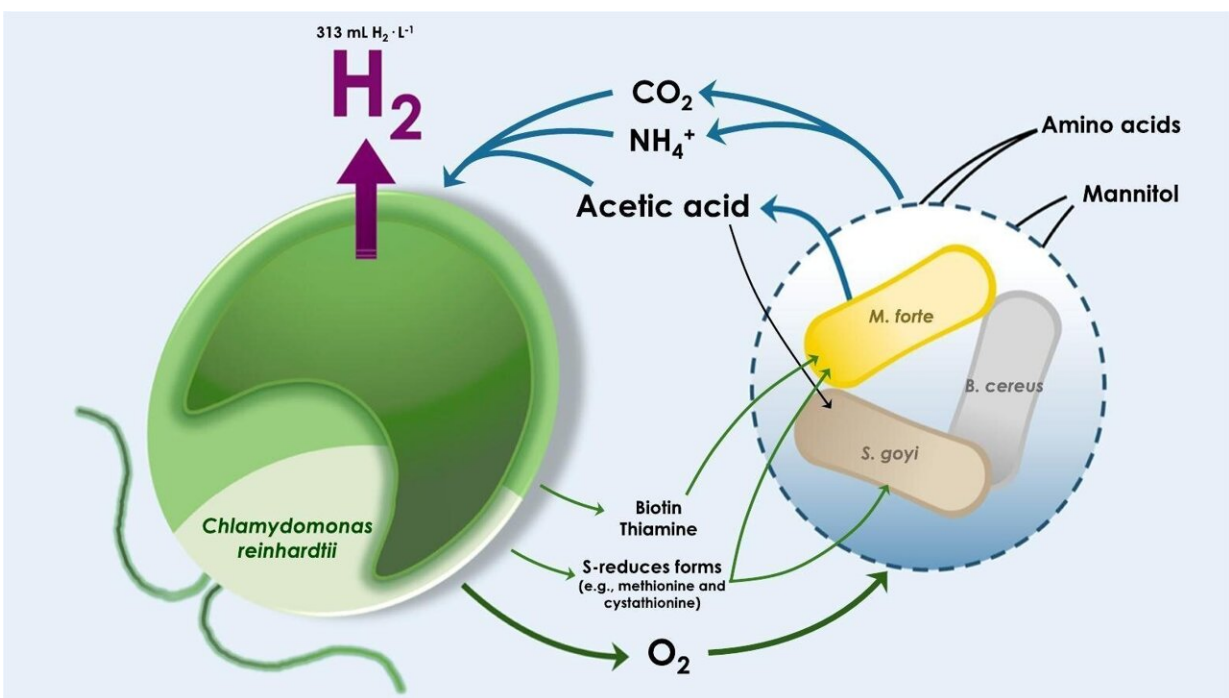


A consortium of algae and bacteria boosts the production of green hydrogen and biomass while cleaning water

March 5 2024



Graphical abstract. Credit: *Science of The Total Environment* (2023). DOI: 10.1016/j.scitotenv.2023.169559

The mutual relationship between algae and three bacteria studied by a team at the University of Cordoba presents the highest hydrogen production obtained so far by this type of consortium

Hydrogen is set to become one of the fuels of the future, so researchers are striving to make it as sustainable and green as possible. Hydrogen production using [algae](#) and [bacteria consortium](#) is a strategy that averts the use of fossil fuels or the electrolysis of water using energy, which are the current ways this fuel is produced. Within this approach, guided by the principles of the Circular Economy, the question is: what is the most effective combination of algae and bacteria?

The BIO128 research group at the University of Córdoba has been looking for these relationships of mutualism where algae and bacteria benefit from their union, resulting in a combination of hydrogen and [biomass production](#) while cleaning the wastewater where they grow.

Now, they have discovered the relationship between a combination of an algae and three bacteria that, when working together, are able to produce hydrogen and to grow together, producing biomass that can then be recovered and, at the same time, that cleans the wastewater in which they grow.

This winning combination is composed of the *Chlamydomonas reinhardtii* alga model and the three bacteria *Microbacterium forte* sp. nov., *Bacillus cereus* and *Stenotrophomonas goyi* sp. nov., and the production of hydrogen obtained is the highest reported for any combination of algae and bacteria.

The *M. forte* bacterium helps the *Chlamydomonas* alga generate hydrogen. With the inclusion of the other two bacteria in the combination, while hydrogen is generated, both the bacteria and the algae grow, thus producing biomass, which can then be recovered as a fuel or energy source.

"This consortium is better because it is more lasting; you can grow it and obtain hydrogen and biomass for a long time, unlike other consortia,"

explains researcher David González. "We also discovered that *Microbacterium forte* and *Stenotrophomonas goyi* need vitamins (biotin and thiamine) and reduced sources of sulfur to grow, and what *Chlamydomonas* surely does is provide them with those nutrients that bacteria need to grow."

Thus, the bacteria benefit from the relationship with the alga to grow, offering it the CO₂ and [acetic acid](#) that the alga requires to grow and produce hydrogen.

In this win-win relationship, water and the environment also win. These consortia are grown in wastewater, using that waste to grow and complete water bioremediation tasks. This specific consortium has been tested in synthetic wastewater mimicking lactic residues, including, for example, lactose.

As another author, Neda Fakhimi, points out, "Our approach also harnesses the potential of using [waste materials](#) as a source of nutrients, thereby facilitating renewable and sustainable biohydrogen production. With the advantage that this consortium has a [hydrogen production](#) approximately ten times greater than that of the previous ones."

"This consortium came about thanks to a fortuitous contamination of a *Chlamydomonas* culture in the laboratory, which led to the discovery and sequencing of the genome of two new bacteria: *Microbacterium forte* and *Stenotrophomonas goyi*," says researcher Alexandra Dubini, also an author of the work.

"We realized that the contaminated culture produced more hydrogen than those that were not, and from there, we followed up and saw that there were three bacteria," continues González.

Therefore, in addition to the progress in the search for biological and

sustainable methods to produce green hydrogen, this work also yields the genomes of these two newly discovered bacteria.

The study is [published](#) in the journal *Science of The Total Environment*.

More information: Neda Fakhimi et al, *Chlamydomonas reinhardtii* and *Microbacterium forte* sp. nov., a mutualistic association that favors sustainable hydrogen production, *Science of The Total Environment* (2023). [DOI: 10.1016/j.scitotenv.2023.169559](https://doi.org/10.1016/j.scitotenv.2023.169559)

Provided by University of Córdoba

Citation: A consortium of algae and bacteria boosts the production of green hydrogen and biomass while cleaning water (2024, March 5) retrieved 28 April 2024 from <https://phys.org/news/2024-03-consortium-algae-bacteria-boosts-production.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.