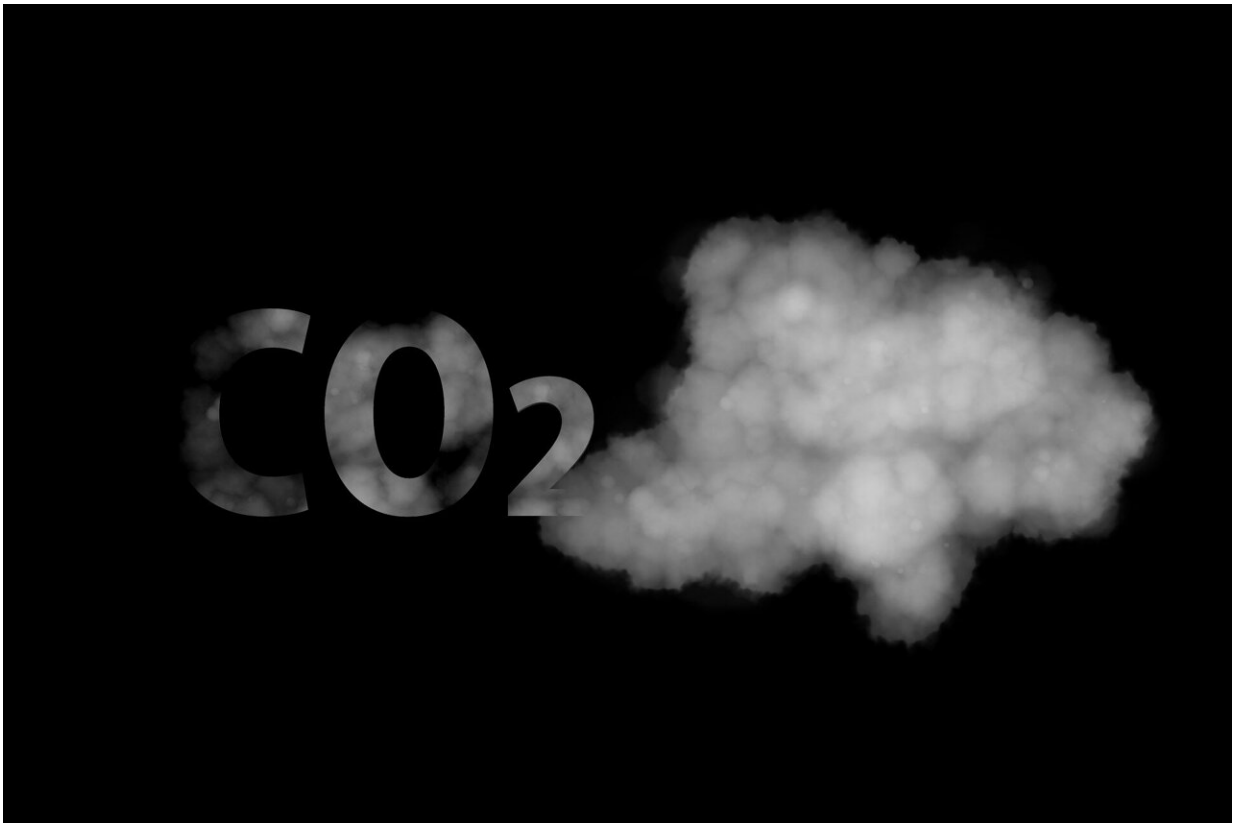


Engineered *E. coli* could make carbohydrates, renewable fuel, from CO₂

September 10 2021



Credit: Pixabay/CC0 Public Domain

Researchers from Newcastle University, UK have engineered *Escherichia coli* bacteria to capture carbon dioxide (CO₂) using hydrogen gas (H₂) to convert it into formic acid. The research, published today in

Applied and Environmental Microbiology raises the possibility of converting atmospheric CO₂ to commodity chemicals.

Normally, an enzyme in *E. coli* catalyzes the reverse of this reaction—production of H₂ and CO₂ from [formic acid](#). In nature, the latter is best known as a type of vinegar compound ants use to ward off predators (Formic comes from the Latin 'formica,' meaning ant.)

To reverse the normal reaction in *E. coli*, the investigators got the bacteria to switch out molybdenum, a metal that is normally a critical part of the enzyme, for tungsten, by growing the bacteria in an excess of the latter. "This is fairly easy to do as *E. coli* cannot readily tell the difference between the 2," said principal investigator Frank Sargent.

"Swapping of tungsten for molybdenum changed the properties of our enzyme so that it was locked in CO₂ capturing mode rather than being able to switch between CO₂ capture and CO₂ production," said Dr. Sargent.

The investigators used a special pressurized bioreactor filled with H₂ and CO₂ to make the gases available to the microbes. "It worked—the bacteria could grow under gas pressure and generate formic acid from the CO₂," said Dr. Sargent.

Dr. Sargent developed the idea from reading about the emergence of life on Earth, both in primary literature and popular science books, he said. Three and a half billion years ago, there was no oxygen in the atmosphere, but there were high levels of CO₂ and H₂, and cellular life had begun evolving 10,000 meters below the ocean's surface.

Back then, these compounds would have needed to be converted into the carbohydrates on which all life depends. That could have been accomplished by an enzyme "such as the one we found in *E. coli*,

hydrogenating carbon dioxide into an organic acid," said Dr. Sargent. "We wanted to try this in the lab."

"Around the world, societies understand the importance of combatting [climate change](#), developing sustainable energy sources and reducing waste," said Dr. Sargent. "Reducing [carbon dioxide](#) emissions will require a basket of different solutions. Biology and microbiology offer some exciting options."

"The ultimate aim would be to capture wasted CO₂ using renewable [hydrogen gas](#) from biohydrogen—as in this research—or electrolysis powered by renewable electricity, and convert it to formic acid," said Dr. Sargent. "The key is for a microbe to use formate as its sole carbon source. Then we can make fuel, plastic or chemicals. This is the vision of a truly cyclic bioeconomy where CO₂ is constantly produced, captured and returned to the market."

Provided by American Society for Microbiology

Citation: Engineered E. coli could make carbohydrates, renewable fuel, from CO₂ (2021, September 10) retrieved 23 June 2024 from <https://phys.org/news/2021-09-engineered-e-colicould-carbohydrates-renewable-fuel.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.