Bacteria as CO_2 recycling powerhouse

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E. coli can live and feed on formate & methanol

Scientists from the Max Planck Institute (Germany) have reached a significant breakthrough presented in their recent *Nature Chemical Biology* publication. Their research for EU project eForFuel has redesigned the model biotechnological bacteria *Escherichia coli* (E. coli) to live and feed on methanol and formate a possibility that serves as a stepping stone towards future endeavors aiming at recycling CO_2 into various valuable carbon-based compounds.

Formate and methanol as a first step to recycle CO_2

Excessive CO_2 is responsible for global climate change, but it also has the potential to replace fossil fuel- based materials and chemicals such as fuels, plastics.
In nature, CO_2 is fixed via plants and photosynthesis, but in times of climate change this might not be enough. What other methods are available to convert CO2 into useful products? Researchers from the eForFuel project have found a new way: first electrochemistry powered by renewable electricity activates CO_2 into useful C_1 molecules and building blocks, such as formate and methanol; then bioengineers convert the resultant C_1 molecules into a useful product. Formate can be produced directly via the electrolysis of CO_2, and methanol by reacting CO_2 with hydrogen. Both processes have energetic efficiencies that are promising for further research.

Engineering an organism to live on formate and methanol

The engineered microorganism that can live and feed on either formate and methanol, transforms these C_1 molecules into carbon-based compounds that we usually derive from fossil fuels. The researchers at MPI were faced not just with the challenge of engineering an organism to grow on these two substances, but engineering it so that it could grow in aerobic conditions – i.e. an environment in which oxygen exists. This is a requirement to enable easier and more flexible cultivation and production. Their approach proved fruitful: "*We have demonstrated an important step in the eForFuel project that could have wide-reaching implications for bioproduction processes that serve to recycle CO_2 into valuable materials*," says project coordinator Arren Bar-Even from MPI.

Kim, S., Lindner, S. N., Aslan, S., Yishai, O., Wenk, S., Schann, K., & Bar-Even, A. (2020). Growth of E. coli on formate and methanol via the reductive glycine pathway. Nat Chem Biol. doi:10.1038/s41589-020-0473-5. https://www.nature.com/articles/s41589-020-0473-5

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