University of Nottingham
Institute for Policy and Engagement

COP26 Policy Brief:
Gas Fermentation: Turning Emissions from a Menace to a Resource

Engineering Biology offers the potential to not just capture greenhouse gas emissions, but use them to make the chemical building blocks for key industrial components

KEY POLICY RECOMMENDATION:

Invest in capacity for microbial gas fermentation as part of a strategy towards developing the circular economy.

Background

There has never been a more urgent need to tackle greenhouse gas (GHG) emissions and to create sustainable, environment-friendly, circular systems for organic chemical production. Breaking reliance on petrochemical reserves is a necessity driven by dwindling supplies, consumer demand and the inherent climate change problems caused by adding yet more carbon into our world. As we transition from the age of fossil resources to the Age of Biology, there is huge potential for biomass and greenhouse gas upcycling in the UK, and globally, to yield economic and social impact as well as, crucially, mitigating climate change.

Biological systems (bacteria) can be exploited to transform industrial emissions into the chemical building blocks for a range of industrial components. Such emissions – and potentially even GHG captured from the atmosphere – therefore offer an alternative to petrochemicals to provide us with the fuels and chemicals we rely on in many aspects of our lives.

Research at Nottingham

The Synthetic Biology Research Centre (SBRC) at the University of Nottingham is arguably the best-equipped UK academic facility capable of doing this. Our research uses engineering biology approaches to understand and then modify industrially relevant bacteria. The bacteria in our gas fermentation systems use carbon dioxide (CO_2) as the building block to make larger organic molecules which could be sustainable jet fuel, biodegradable plastics, or chemical building blocks for the chemicals industries which currently rely on petrochemical feedstocks.
Our primary focus is not on making fuels which would be burnt (releasing CO_2), but on the production of chemicals which lock up carbon for longer periods of time.

Implications for Climate Change

The potential to contribute to climate mitigation lies behind a resurgence in interest in gas fermentation as a biological process, driven by our ability to engineer bacteria to more efficiently and effectively convert GHGs into the everyday

chemicals society needs. The SBRC's science is world-leading, and it is linked with a wide range of companies which are once more taking gas fermentation from academic lab research to industrial application.

However, our discussions with BEIS suggest that the government is not fully aware of the potential for gas fermentation. Microbial gas fermentation will be a key part of sustainable economies and provides a solution for keeping industrial gases out of the atmosphere as well as for municipal solid waste recycling. It is important to add that gas fermentation has a minimal footprint and does not compete with agricultural land.

This technology is "oven-ready" for at least one biofuel product and has a great deal more to offer in terms of the products it can make – potential that the SBRC is working to develop. Supporting capacity for further development and expansion of these technologies offer rich rewards in terms of climate change mitigation.

Further Reading

The Synthetic Biology Research Centre homepage

Read the COP26 blog

Contact the Researchers

Professor Nigel Minton

Director of the UKRI-BBSRC/EPSRC Synthetic Biology Research Centre – Nottingham (SBRC)

Email: nigel.minton@nottingham.ac.uk