

# MODULAR DIRECT AIR CAPTURE AND BIOELECTROCHEMICAL CONVERSION OF CO<sub>2</sub>

Tech ID: 32358 / UC Case 2021-148-0

## PATENT STATUS

Patent Pending

## BRIEF DESCRIPTION

Reducing atmospheric carbon dioxide levels is essential for mitigating climate change, yet capturing and converting CO<sub>2</sub> from ambient air remains a significant technical hurdle. UC Berkeley researchers have invented a modular, integrated system that directly captures CO<sub>2</sub> from the air and converts it into high-value products. The process utilizes specialized sorbents, such as functionalized metal-organic frameworks (MOFs) or covalent organic frameworks (COFs), to isolate CO<sub>2</sub> from the atmosphere. In a two-step bioreactor sequence, autotrophic microorganisms first convert the purified CO<sub>2</sub> into an organic intermediate, like acetate, using electrochemically generated hydrogen as an energy source. A second population of metabolically engineered microbes then utilizes this intermediate as a feedstock to synthesize specific value-added products, ranging from fuels and biopolymers to pharmaceuticals and industrial enzymes.

## SUGGESTED USES

- » Carbon-Negative Manufacturing: Enabling industrial supply chains to offset their footprint by producing essential chemicals directly from atmospheric carbon.
- » Sustainable Fuel Production: Creating carbon-neutral liquid fuels for aviation or shipping using captured CO<sub>2</sub> and renewable electricity.
- » Biopolymer Synthesis: Generating biodegradable plastics and materials from air-derived carbon intermediates to reduce reliance on petroleum feedstocks.
- » Pharmaceutical and Enzyme Manufacturing: Utilizing engineered microbial platforms to produce complex medical compounds or industrial catalysts in a modular, decentralized format.
- » Long-Term Carbon Sequestration: Producing carbon-dense solid or liquid biomaterials that can be stored securely on centennial time scales.

## ADVANTAGES

- » Atmospheric Versatility: Unlike systems that require concentrated flue gas, this technology can be deployed anywhere to capture CO<sub>2</sub> directly from ambient air.
- » Modular and Tailorable: The system can be customized for a wide variety of end-products by simply swapping the secondary microbial strain.
- » Integrated Process: Combines capture and conversion into a single, streamlined platform, reducing the energy and logistical costs of CO<sub>2</sub> transport.
- » High Specificity: Leverages the precision of metabolic engineering to produce high-purity multi-carbon products with fewer side-reactions than traditional thermochemical methods.
- » Renewable Energy Integration: Efficiently pairs with electrochemical hydrogen generation, making it an ideal candidate for storage of intermittent renewable power in chemical form.

## RELATED MATERIALS

## CONTACT

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## INVENTORS

- » Clark, Douglas S.

## OTHER INFORMATION

### CATEGORIZED AS

- » **Biotechnology**
- » Industrial/ Energy
- » **Energy**
- » **Environment**
- » **Materials & Chemicals**
- » **Chemicals**
- » **Other**

### RELATED CASES

2021-148-0

**ADDITIONAL TECHNOLOGIES BY THESE INVENTORS**

▶ [Hyperthermophilic Single-Peptide For Deconstruction Of Crystalline Cellulose](#)



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