CO_2 as a Raw Material for the Sustainable Production of High-Value Platform Chemicals

TLB
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An innovative microbial technology enables the direct conversion of CO_2-containing gas streams into high-value platform chemicals in a single-step fermentation process.

- CO_2 as a raw material instead of fossil carbon sources
- Single-step bioprocess in a shared bioreactor
- No separate intermediate purification required
- Production of high-value platform chemicals
- Utilisation of industrial CO_2-, CO- and H_2-containing gas streams
- Potential to reduce the use of fossil and sugar-based feedstocks
- Suitable for CCU and industrial gas fermentation
- Production of cadaverine, glutarate and 5-aminovalerate

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Service
Technologie-Lizenz-Büro GmbH has been entrusted with exploiting this technology and assisting companies in obtaining licenses.

Fields of application

The technology is suitable for the utilisation of CO_2-containing industrial gas streams and opens up a range of applications in Carbon Capture and Utilisation (CCU) and industrial biotechnology.

Potential CO_2 sources include gas streams from the steel, cement, energy and chemical industries, as well as other industrial off-gases and synthesis gas streams.

The platform chemicals produced can serve as starting materials for a wide range of downstream chemical products. Potential applications include the polymer and plastics industry, for example in the production of polyamides and other polymeric materials.

Further application areas include:

- Carbon Capture and Utilisation (CCU)
- Industrial gas fermentation
- Bio-based and sustainable chemistry
- Production of platform chemicals
- Polymer and plastics industry
- Production of polyamide precursors
- Specialty chemicals

Background

The chemical industry faces the challenge of replacing fossil feedstocks with sustainable sources of carbon while simultaneously reducing CO_2 emissions. A promising approach is to use CO_2 not as a waste product, but as a raw material for the production of chemicals.

Industrial gas streams contain CO_2 as well as other potentially usable carbon and energy sources such as CO and hydrogen. Biological fixation of these gases can generate organic intermediates that are subsequently converted into higher-value chemical compounds. In this way, existing carbon can be recovered and transferred into new value chains.

Problem

The production of high-value organic chemicals from CO_2 poses significant challenges for biotechnological processes. In particular, the efficient conversion of gaseous carbon into more complex target molecules requires the combination of different metabolic capabilities.

Existing biotechnological processes for the production of platform chemicals are often based on sugar- or glycerol-based feedstocks. This makes production dependent on the availability of these raw materials and continues to require biogenic or fossil sources of carbon.

An efficient alternative is therefore an integrated process that directly uses CO_2-containing gas streams as a carbon source and combines CO_2 fixation with the synthesis of high-value platform chemicals. In particular, the process should avoid separate fermentation steps and the costly purification of intermediates.

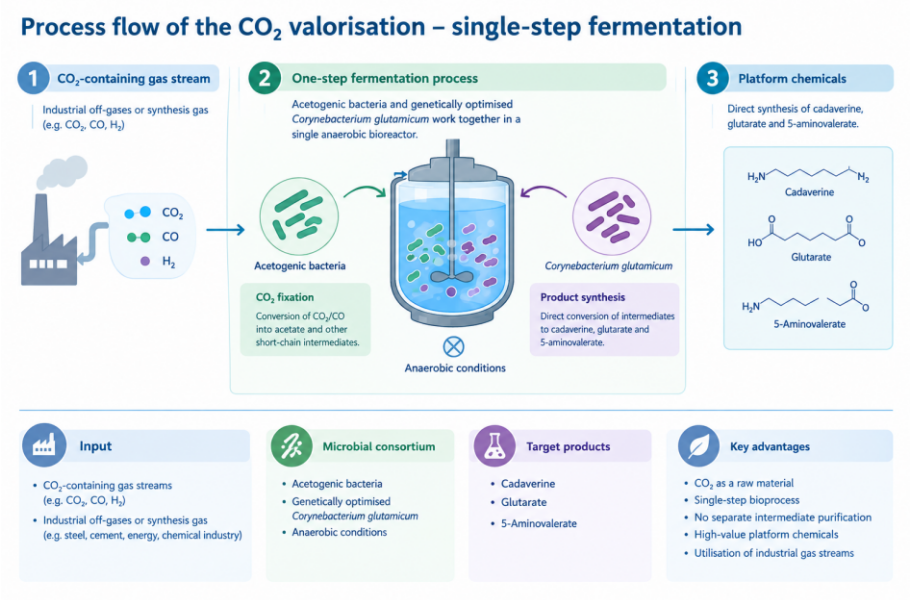
Solution

A microbial consortium technology enables the direct conversion of CO_2-containing gas streams into high-value platform chemicals. The technology combines acetogenic bacteria with a genetically optimized strain of Corynebacterium glutamicum. The process is carried out under anaerobic conditions in a single bioreactor.

The acetogenic microorganisms initially fix the CO_2 contained in the gas stream and convert the carbon into acetate and other short-chain organic intermediates. These intermediates are directly taken up by Corynebacterium glutamicum and further converted into the desired target products.

The process enables the production of cadaverine, glutarate and 5-aminovalerate. CO_2 fixation and product synthesis take place within a single fermentation process, eliminating the need for an additional fermentation step or intermediate purification.

CO_2-containing industrial gas streams can be used as the feedstock. In addition to CO_2, these gas streams may also contain CO and hydrogen. The technology therefore provides an opportunity to directly convert industrial carbon-containing gas streams into high-value



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