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Fraunhofer Center for Chemical-  
Biotechnological Processes CBP

Product processing

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# High-Pressure Extraction Plant for Solvent-Free Extraction

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## Fraunhofer CBP in Leuna, central Germany, closes the gap between the lab and industrial implementation.”

The Fraunhofer Center for Chemical-Biotechnological Processes CBP in Leuna, central Germany, develops and scales up chemical and biotechnological processes for the utilization of renewable raw materials. By providing infrastructure, pilot plant facilities and a staff of highly qualified experts, the CBP closes the gap between laboratory and industrial implementation and enables partners from research and industry to scale up processes to production-relevant dimensions, and thus accelerate process developments.

The Chemical Processes working group focuses on the process-technological development of chemical processes to produce biobased basic and fine chemicals for further processing in the chemical, pharmaceutical or food industries. In addition to new process concepts, the optimization of the resource and energy efficiency of existing processes also plays an important role here. Established processes can be adapted and optimized from the ecological and economic viewpoint. In doing this, we both consider biobased raw materials and also examine conventional processes for manufacturing petrochemical products.

# Portfolio

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Valuable ingredients can be enriched or isolated from biomass by extraction with supercritical carbon dioxide (scCO<sub>2</sub>) or propane using our high-pressure extraction plant. The special process is characterized by the fact that carbon dioxide has excellent solvating properties under supercritical conditions and, after the extraction procedure, is separated from the extract obtained by decompression without leaving any residue. The selectivity of the extraction and fractionation can be further enhanced by using ethanol as a co-solvent as well as several pressure reduction stages. For the extraction of nonpolar recyclable materials, liquid propane as an alternative extraction agent can be used. The plant can be operated continuously or batch-wise.

## Technical data

- Temperature max. 80°C
- Extraction agent
  - Propane (up to 100 bar) max. 10 kg/h
  - scCO<sub>2</sub>/EtOH (up to 500 bar) max. 10 kg/h
- Extraction material
  - Solids (in 2-liter batch extractor, particle size min. 100 µm)
  - Suspensions in counterflow column, output 2 kg/h, particle size min. 1 – 10 µm, solids content 0.5–20%
- Separation of valuable compounds
  - One to two stages with scCO<sub>2</sub>
  - Three stages with propane
  - Recovery of extraction agent
- Material stainless steel, suitable for sea water
- ATEX compliant (zone 1, T3)

# Process

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## Extraction of $\beta$ -carotene from microalgae

Extraction processes of valuable compounds from algae biomass have been studied intensively. Microalgae can produce a large number of substances that are interesting for the food sector. Depending on the species used and the cultivation conditions, the microalgae produce large quantities of fatty acids (as triacylglycerides), proteins, polar membrane lipids (with omega-3 fatty acids), as well as various carotenoids, and phytosterols. Recently, the extraction of  $\beta$ -carotene from the microalgae *Dunaliella salina* has been demonstrated successfully.

*High-pressure super critical fluid extraction (SFE) pilot plant*

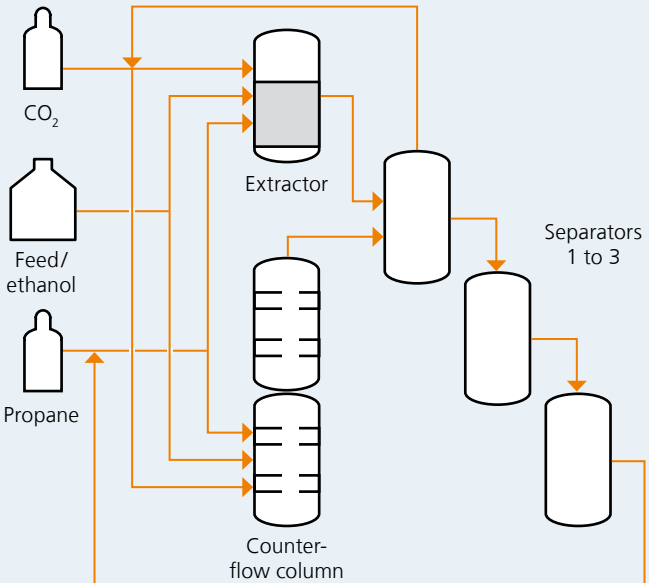




*Microalgae, a promising feedstock for SFE*

## Flow chart of the high-pressure extraction plant

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## Contact

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