



**Fraunhofer**  
CBP

Fraunhofer Center for Chemical-  
Biotechnological Processes CBP



Range of services and equipment

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Biotechnological  
Processes

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# Competencies

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The working group “Bioprocess Scale-up” has a broad range of bioprocess engineering know-how for the scale-up and optimization of biotechnological processes. The processes developed at laboratory scale are evaluated beforehand with regard to their transferability to an industry-relevant scale and optimized iteratively during scale-up.

This includes, for example, adapting the process control strategies (batch, fed-batch, continuous) and integrated product recovery and purification to reduce and optimize process steps or the recycling of biocatalysts (e.g. by immobilization on carrier materials).

## We offer

- Fermentations, enzyme catalysis and downstream processes
- Evaluation, development and optimization of processes
- Scale-up to pilot and demonstration scale
- Preparation of sample quantities (along the kilogram to ton scale)

## Product portfolio

- Carboxylic acids
- Enzymes/proteins
- Organic solvents
- High-protein biomass

# Equipment

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## Fermentation

- Bioreactor cascade
  - 10/75/100/300 liters, 1/10 m<sup>3</sup> (gross volume)
  - Geometrically similar and fully automated
  - Measuring/control technology for stirrer speed, temperature, headspace pressure, pH value, dissolved oxygen, methanol concentration and exhaust gas analysis (CO<sub>2</sub>/O<sub>2</sub>)
  - In-situ sterilization (SIP) and cleaning (CIP)
  - Stainless steel tanks for acid, base, antifoam and feed
  - Automated methanol dosing
  - pH control by supply of gaseous ammonia in the 10 m<sup>3</sup> bioreactor possible
- 500-liter bioreactor in ATEX-design
- Ultra-high temperature system (UHT) for continuous media sterilization (1–2 m<sup>3</sup>/h, 60–134°C, 120–240 s holding time)



## Downstream processing

### Storage tanks

- 2 × 500 liters (mobile), 2 × 2 m<sup>3</sup>, 2 × 5 m<sup>3</sup>, 2 × 10 m<sup>3</sup> (gross volume), temperature and pH controlled, stirred

### Separation technology

- Disc stack separators
  - 0.5–1 m<sup>3</sup>/h (12,300 × g) and 1–2 m<sup>3</sup>/h (12,800 × g)
- Filter press
  - 10 filter plates each with 0.4 m<sup>2</sup> filter area and 5 liters working volume
- Vacuum drum filter
  - 0.5 m<sup>2</sup> filter area
- Vacuum filter dryer
  - 0.5 m<sup>2</sup> filter area (cut-off: 1 and 10 μm)
  - 400 liters working volume, in ATEX

### Cell disruption

- High-pressure homogenizer
  - 400 L/h, 1000 bar (flow cooling possible)



## Purification technology

- Micro-/ultrafiltration (cross-flow)
  - Different membranes and cut-offs possible
- Process chromatography
  - Column volume 7–35 liters
  - Pump power up to 180 L/h
- Crystallizer (batch)
  - 180 liters (mobile) and 800 liters (in ATEX), tempered

## Finishing

- Spray dryer
  - Up to 5 kg/h (140–300°C)
- Freeze dryer
  - 0.9 m<sup>2</sup> (15 liters working volume)



*Top: Spray dryer*

*Bottom: Storage tanks and DSP equipment*

## Analytics

- Photometric analysis (e.g. optical density, enzyme activity)
- Determination of organic dry matter
- YSI 2950 (biochemical analyzer for e.g. sugar determination)
- HPLC linked with DAD, RID, VWD or SEC (e.g. sugar, organic acids, phenolic compounds)
- Headspace-GC, GC linked with MS, FID or TCD
- Thin-layer chromatography
- Protein analysis (e.g. SDS-PAGE, Bradford, Lowry)
- UV/VIS spectrophotometer for microtiter plates and cuvettes
- Infrared spectrometer

## Contact

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Sandra Torkler M.Sc.

Group manager Bioprocess Scale-up

Phone +49 3461 43-9123

[sandra.torkler@igb.fraunhofer.de](mailto:sandra.torkler@igb.fraunhofer.de)

Dr. Katja Patzsch

Project manager Bioprocess Scale-up

Phone +49 3461 43-9104

[katja.patzsch@igb.fraunhofer.de](mailto:katja.patzsch@igb.fraunhofer.de)

Sonja Höhmann M.Sc.

Project manager Bioprocess Scale-up

Phone +49 3461 43-9117

[sonja.maria.hoehmann@igb.fraunhofer.de](mailto:sonja.maria.hoehmann@igb.fraunhofer.de)

Fraunhofer Center for Chemical-

Biotechnological Processes CBP

Am Haupttor (Gate 12, Building 1251)

06237 Leuna

Germany

[www.cbp.fraunhofer.de](http://www.cbp.fraunhofer.de)