

Industrial Solutions  
Electrolysis & Polymers Technologies

Uhde High Pressure Technologies GmbH  
Buschmuehlenstr. 20  
58093 Hagen, Germany  
P: +49 2331 967-0  
F: +49 2331 967-370  
www.uhde-hpt.com

Industrial Solutions

# Extraction of natural substances



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# Extraction of spices and herbs

# Plants for the extraction using supercritical CO<sub>2</sub>



Typical products for the extraction of valuable ingredients using supercritical CO<sub>2</sub>

The supercritical extraction of spices and herbs plays a major role in obtaining high quality products from natural raw materials.

The main applications of these products are in:

- Food industry
- Cosmetics industry
- Pharmaceutical industry

The extraction using supercritical CO<sub>2</sub> covers processes like:

- Decaffeination of coffee
- Extraction of hops
- Extraction of essential oils
- Extraction of flavour
- Extraction of colour pigments

## Supercritical extraction using CO<sub>2</sub> as extraction agent

For the extraction of the above mentioned products, in most cases traditional extraction processes cannot be used. Hence, a high pressure process using supercritical CO<sub>2</sub> is applied for extracting the valuable products from the natural feedstock.



## Advantages of supercritical CO<sub>2</sub>

Using supercritical CO<sub>2</sub> for the extraction process has a lot of advantages in comparison to processes using organic extraction solvents, e.g.:

- Easy availability
- Low price
- Non-toxicity
- Non-explosivity
- Solvent free products
- Reduction of pesticides
- No thermal stress due to moderate temperature conditions (below 100°C)
- Easy separation of solvent and product



## The extraction process

The extraction process of solid feedstock is very similar even for different kinds of products. The product is filled into a product basket which is then put into the extractor. The extractor is pressurized using CO<sub>2</sub> up to process conditions and the extraction begins. CO<sub>2</sub> is fed from the CO<sub>2</sub> tank via high pressure pump into the extractor where it dissolves the extract from the feed material and is then led to the expansion valve. Here, the CO<sub>2</sub> is depressurized down to gaseous conditions and the CO<sub>2</sub> and extract are routed to the separation system, where the extract is separated from the gaseous CO<sub>2</sub>. Afterwards, the CO<sub>2</sub> can be recondensed up to CO<sub>2</sub> tank conditions and recycled to be used for the extraction again.

## Pre-treatment of raw material and products

The feedstock to be treated for the supercritical extraction process is filled in corresponding suitable product baskets. Usually, the feedstock is a ground powder with a mean particle size of approx. 0.1mm. Furthermore, the feedstock is dried in advance to the extraction to prevent clogging which can be caused by high water content of the material.

## Uhde's scope of supply and services

Uhde High Pressure Technologies is able to assist its customers in all steps of establishing a supercritical extraction facility.

This covers:

- Process engineering for initial process evaluation
- Process engineering for process intensification
- Extraction experiments for validation of process data
- Equipment engineering
- Specification of utilities
- Specification of equipment
- Process engineering for lab-scale up to production-scale
- Supply of complete turnkey plants pre-mounted on skids or delivered in parts to be assembled at site
- Assistance with installation and commissioning
- Training of plant operators
- After sales services
- Spare parts

Picture top left: Product handling inside the extraction autoclave using a product basket

Picture bottom left: 500 bar extraction plant consisting of 3 extractors, 2 separators and a CO<sub>2</sub> recycling system

Chart: Simplified flowsheet for the extraction process using supercritical CO<sub>2</sub>

