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Fraunhofer Center for Chemical-Biotechnological Processes CBP

Chemical and downstream processes

Reaction and Extraction Plant

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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

The reaction unit consists of a 100-liter steel-enamel reactor with a condenser and alternating recipient tanks. Liquid phase reactions at temperatures between –10°C and +200°C can be carried out in the plant. Using the condenser, solvents can be separated by distillation and reaction products are concentrated. Alternatively, operation under reflux is also possible. Reaction and distillations are performed under normal pressure or vacuum, with pressures down to 20 mbar (abs). Separation processes of liquid media are investigated in the extraction unit by means of liquid/liquid extraction at atmospheric pressure and temperatures up to 65 °C. In order to achieve the optimum exchange of substances, the two phases in the extraction column are conducted in counterflow. By varying the operating parameters such as the stirrer speed or volume flow, optimal conditions for the separation process can be adjusted.

Extraction plant with DN80 countercurrent extraction column

Left: 100-liter reaction and distillation unit
Right: Two 20-liter distillate receiving flasks

Technical data

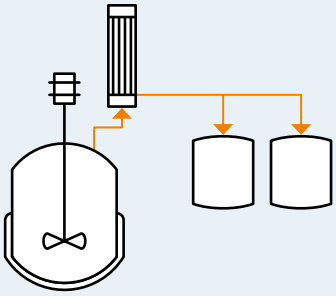
- Reaction unit
  - Distillation/reflux boiling possible
  - Material steel-enamel/borosilicate glass/PTFE
  - Volume 100 liters
  - Pressure 50–1013 mbar
  - Temperature –10–200 °C
  - Dosing pumps max. 80–120 L/h
  - ATEX compliant (zone 2, T3)
- Extraction unit
  - Stirred countercurrent extraction column with two heatable 100-liter recipient tanks and two 100-liter product tanks
  - Material borosilicate glass and PTFE
  - Throughput up to 84 L/h
  - ATEX compliant (zone 2, T3)
  - Temperature 20–65 °C
- Accessory
  - Mobile filter unit for pressure and vacuum filtration

Process

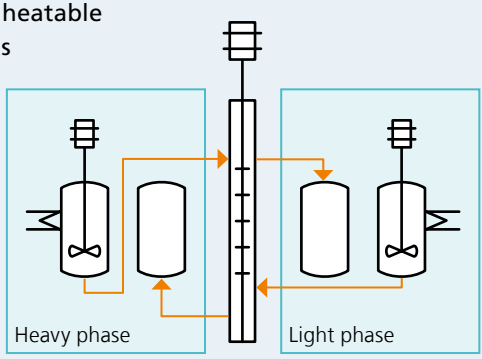
Extraction of phytosterols from tall oil soap

The reaction and extraction plant is used, for instance, to obtain phytosterols from tall oil soap. Tall oil soap is a by-product of the cellulose industry and contains at least 2 percent sterols, chiefly β-sitosterol, which, after separation and purification, is used in the cosmetics industry or as a food supplement. In a multistage process consisting of continuous liquid/liquid extraction, crystallization, filtration as well as solvent recovery, and drying phytosterols with a purity of more than 98 percent are obtained.

Reaction section with distillation head and 2 recipient tanks



Extraction column with stirrable and heatable product tanks



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