Fraunhofer CBP

Fraunhofer Center for Chemical-Biotechnological Processes CBP

Chemical processes

Stirred Tank Reactor

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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 batch reactor is a discontinuously operated stirred reactor and suitable for carrying out both homogeneously and heterogeneously catalyzed reactions in the gas and liquid phase of aqueous or solvent-containing systems. The 50-liter reactor permits temperatures up to 300 °C and pressures up to 98 bar. There is a continuous gas supply with nitrogen, oxygen, hydrogen and ammonia.

Technical data

- ATEX compliant unit (zone 2b+H2, T3)
- Volume 50 liters
- Pressure max. 98 bar
- Material Hastelloy C-22
- Temperature max. 300 °C
- Rapid cooling
- Skew blade gas injection stirrer
- Robinson-Mahoney type catalyst basket
- Gas dosing of O_2 and H_2 controlled by means of mass flow controllers (MFCs)

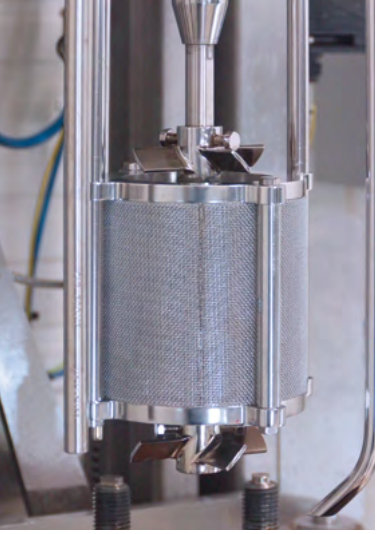
Process

Heterogeneously catalyzed production of sorbitol from glucose using Raney nickel

$$C_6H_{12}O_6 + H \xrightarrow{\text{Catalyst}} C_6H_{14}O_6$$

First, the reactor is rinsed with N_2 and then filled with the feed mixture of water/glucose and the catalyst suspension.

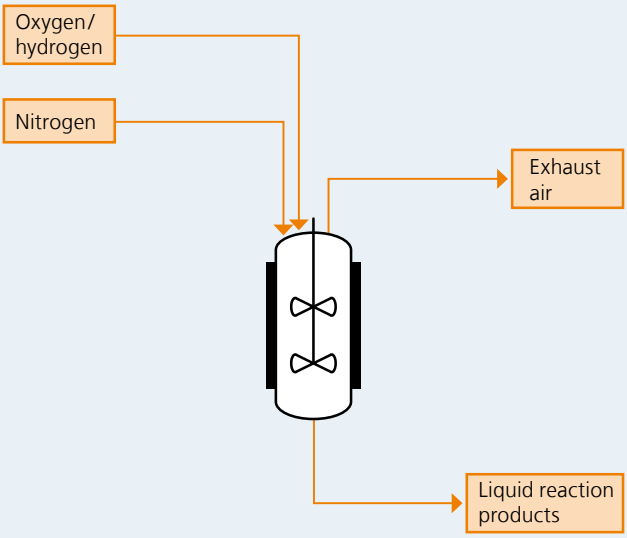
In the second step, the reactor is pressurized with H_2 to a maximum of 98 bar and the mass flow rate control for continuous hydrogen supply is activated. The temperature control is set to 120 °C. All measured values are documented using a data logging system. After the reaction is complete, the cooler is activated and the reactor pressure is reduced. Finally, after a final inertization, the sorbitol mixture can be removed from the reactor via the product discharge device.



Left:
High-pressure stirred tank reactor enclosed in ATEX cabin

Right:
Optional catalyst basket (Robinson-Mahoney type)

Flow chart of the stirred tank reactor



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