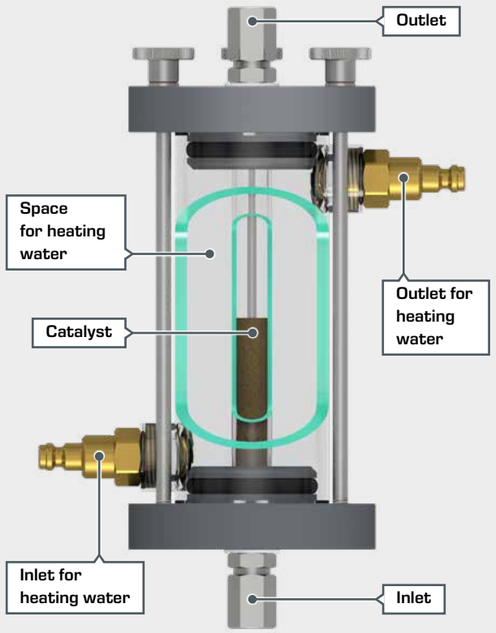
Overview

CE 380 Fixed bed catalysis



Design of the fixed bed reactors

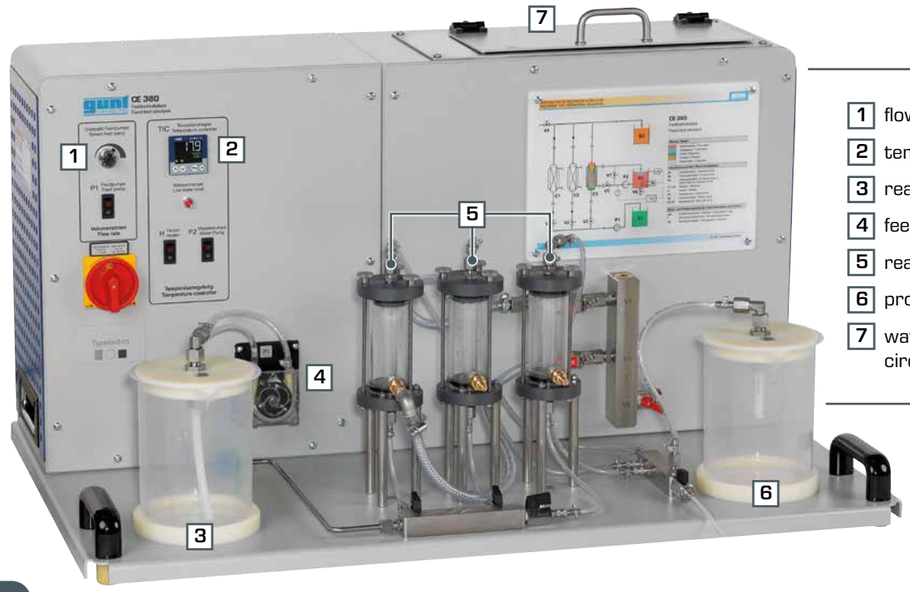
Chemical reactions are often carried out with catalysts. Catalysts accelerate chemical reactions or make them possible in the first place. Catalysts reduce the required activation energy or produce temporary compounds for other reaction paths. Catalysts emerge from the reactions unchanged and are therefore available again for the next reaction.

In **fixed bed catalysis**, the catalyst is present as a fixed bed in a reactor. The flow through with the starting substances (educts) and the reaction in the fixed bed take place continuous. This enables consistent reaction conditions and a higher product yield.

The main components of CE 380 are three fixed bed reactors. This makes it possible to create three experimental setups, each with different catalyst quantities, for example. The reactors are designed as double tubes, with the catalyst located in the inner tube. The area between the two tubes is used to heat the reactors with hot water. The flow rate of the starting solution, and thus the hydraulic detention time in the reactor, can be adjusted continuously.

Learning objectives

- fundamentals of chemical catalysis
- dependence of the reaction on
  - catalyst mass
  - temperature
- use of a photometric analyser
- drawing up a quantity balance
- determining yield



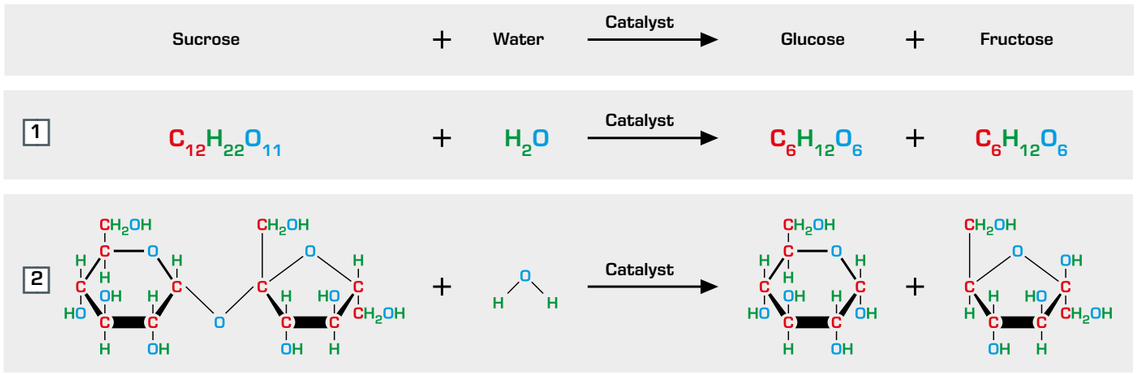
1 flow control
2 temperature controller
3 reactant tank
4 feed pump
5 reactors
6 product tank
7 water tank for heating circuit

About the product:
www

Catalysed hydrolysis of sucrose

Hydrolysis generally refers to the splitting of a chemical compound by reaction with water. An example of this is the decomposition of sucrose into glucose and fructose. This reaction also requires a catalyst. Although glucose and fructose have the same molecular formula, they differ in terms of how the individual atoms are arranged.

The CE 380 device is designed for the hydrolysis of sucrose into glucose and fructose. A strongly acidic ion exchanger, which is included with the device, serves as a catalyst.

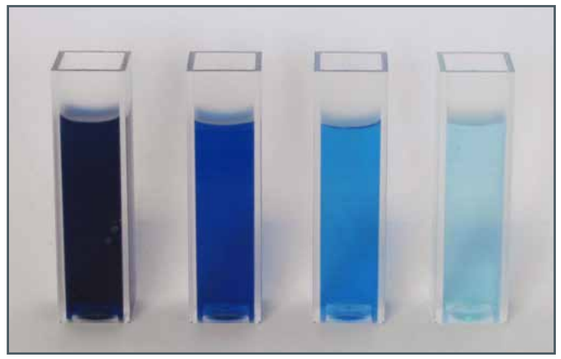


Hydrolysis of sucrose: **1** reaction equation and **2** Haworth projections

Experiment evaluation with photometer

The conversion rate is an important parameter for evaluating chemical reactions. With CE 380, this is done by determining the glucose concentration in the reaction product. To do this, an iodine-starch complex is first prepared from the product solution using various chemicals. A blue colour is characteristic for an iodine-starch complex. The intensity of the colour is a measure of the glucose concentration.

The iodine-starch complex absorbs light in the yellow-orange range, so that the glucose concentration can be determined photometrically. Therefore the device is supplied with a photometer to allow analysis of the experiments. The data from the photometer is transmitted directly to a PC where it can be analysed using a software.



Iodine-starch complexes with decreasing glucose concentration from left to right

Photometer for analysing the experiment