

THE GUNT LEARNING CONCEPTS OF CHEMICAL PROCESS ENGINEERING

WHAT DOES CHEMICAL PROCESS ENGINEERING DEAL WITH?

Unlike in mechanical or thermal process engineering, the focus of chemical process engineering is not to change substance properties or the composition of a substance. The central subject of chemical process engineering is the creation of a new substance type through chemical reaction.

The knowledge which reacting agents are required for a desired product comes from chemistry. Chemistry also provides the knowledge of the conditions that enable a smooth chemical reaction process.

These conditions include the activation of the reaction, pressure and temperature adjustment and the composition of the reacting agents. The aim of chemical process engineering is to create these conditions for industrial-scale use. In addition to these conditions, the aggregate state of the reacting agents and reaction products also has a significant influence on the design of the reactors and the overall production process.

HOW CAN THE CHEMICAL PROCESSES BE CLASSIFIED?

There are several ways of classifying chemical processes. One of them is based on activation energy. Many thermodynamically possible chemical reactions do not take place at all or are too slow for technical applications unless a certain activation energy is applied.

Chemical reactions can be activated in different ways. The activation method significantly influences the design and operation of chemical reactors. It is also possible to combine different activation methods:

■ Thermal activation

The energy required to activate the chemical reaction can be applied through heat. The desired temperature range is achieved by heating or cooling. In this temperature range, the reaction conditions are optimal and undesired side reactions are avoided.

■ Catalytic activation

Many reactions are too slow for technical applications at ambient temperature because the required activation energy is very high. Catalysts lower the required activation energy and accelerate the chemical reaction. There are two types of catalysis:

▶ a) Homogeneous catalysis

The catalyst and the starting substances of the chemical reaction are in the same phase.

▶ b) Heterogeneous catalysis

The catalyst is in the solid phase in most cases. The starting substances of the reaction are in the liquid or gaseous phase.

■ Photochemical activation

The reaction is activated by atoms or molecules absorbing optical radiation. The mostly organic substances thus achieve a higher energy level and are activated.

■ Microbiological activation

The starting substances are converted by means of microorganisms, cells or enzymes. Due to the special requirements of these reactions, biological process engineering has become an independent discipline.



Supply Unit for Chemical Reactors CE 310 with Stirred Tanks in Series CE 310.03

The chemical activation methods...

Thermal activation

- ▶ CE 310.01 *Continuous Stirred Tank Reactor*
- ▶ CE 310.02 *Tubular Reactor*
- ▶ CE 310.03 *Stirred Tanks in Series*
- ▶ CE 310.04 *Discontinuous Stirred Tank Reactor*
- ▶ CE 100 *Tubular Reactor*

Catalytic activation

- ▶ CE 380 *Fixed Bed Catalysis*

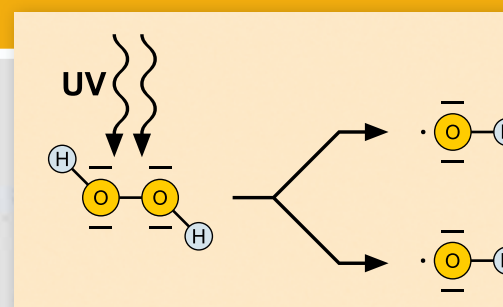
Photochemical activation

- ▶ CE 584 *Advanced Oxidation*

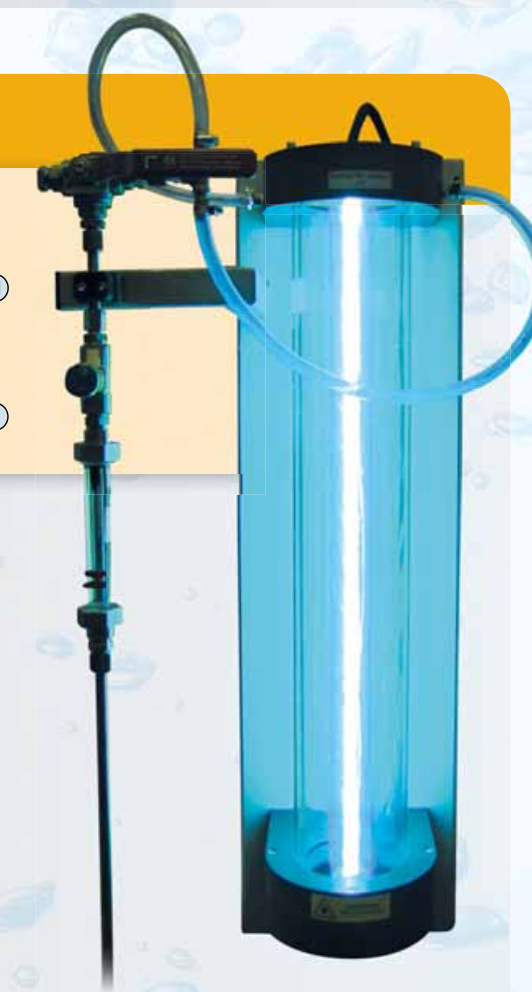
Microbiological activation

- ▶ *Biological Processes (▶ chapter 6)*

Abstract processes clearly illustrated



CE 380 *Fixed Bed Catalysis*



CE 584 *Advanced Oxidation*