



Photocatalysis

Currently, the research activities in the area of Photocatalysis focus on the topics "Solar Fuel Synthesis", "Mechanisms of Photocatalytic Reactors" and "Development and Evaluation of Suitable (Standard) Test Methods".

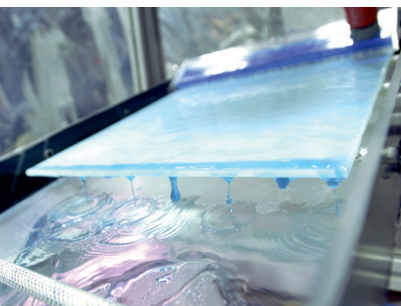
Combining photoelectrochemical, laser flash photolytical and various analytical techniques the processes are studied in detail starting from the generation of the charge carriers until the production of the final reaction products. Moreover, novel photocatalysts are being developed and synthesized (inverse opals, mesoporous materials, doped nanoparticles) aiming to increase the photocatalytic efficiency and to effectively utilize visible solar illumination.



Nanotechnology

The activities of the Nanotechnology research group are focused on the production of nanocrystalline transparent coatings with self-cleaning, air cleaning and

antireflective properties. For example, to prolong the time between cleaning cycles, various surfaces are coated with thin transparent titanium dioxide layers which degrade adhering fatty acids under the influence of artificial or solar UV-A-rays. This hinders undesired adhesion of dirt particles significantly. For this purpose a completely new surface coating technology was developed by this research group.



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Research Topics

- Bioprocess Engineering
- Bioprocess Modeling and Control
- Photocatalysis and Nanotechnology



Cultivation processes of bacteria, fungi and mammalian cell lines as well as enzymatic processes are the objectives of this research and development area.

Processes for the production of antibiotics, various enzymes, nutritional ingredients, cytokines, antibodies and vaccines are currently under investigation.

Cell Culture Technology

The cultivation of mammalian cell lines has an increased importance in the research activities of the institute. It allows for the production of biologically active proteins (e.g.



antibodies, cytokines, vaccines), for use in diagnostic and therapeutic applications. Interest is not only derived from the products but also the cells themselves. They can be utilized in gene therapies, pharma testing, and in the field of tissue engineering.

Tissue Engineering

Tissue engineering is a major field of investigation within the framework of the DFG-excellence cluster REBIRTH. Its aim is to treat tissue or organ defects through the use of artificially produced tissues. Adhered to suitable biomatrices, cells are grown into functionalized tissues under controlled and reproducible conditions.

Downstream Processing

Downstream processing remains one of the most cost decisive factors in biotechnological production. The adaption of the latest techniques and alternative materials is a major focus of this research area. Filtration,



extraction, chromatography and membrane adsorption are available at the institute and can be applied to industrial processes ranging from laboratory to production scale.

Protein Chemistry

The biological activity of proteins depends on their structural conformation. For the production of biologically active proteins the correct folding and their preservation over the course of downstream processing is of the utmost importance. Molecular, biological and proteochemical aspects of protein production of cytokines and vaccines are areas of further investigation.

Bioanalytics

Bioanalytics is necessary to understand and document biotechnological processes, as well as to control them and predict their progress. Various analytical techniques are under development (e.g. chemo- and biosensors). Emphasis is given to the development of optical sensor technologies, like chemosensors (pH and pO_2), spectroscopic sensors (fluorescence, NIR and MIR), and microscopic systems (in-situ microscopy).



Biochip Technology

DNA-chip technology was established in the institute for research and diagnostics. Several mouse and human organ-specific DNA-chips, a human tumor-chip, as well as different cell cycle-specific yeast-chips were developed. Extensive experience exists in the areas of expression profiling, probe design, and data mining and processing. Furthermore, protein- and aptamer-chips are currently under development.



Chemometrics

Analysis and interpretation of 2D-fluorescence spectra by multivariate, knowledge- and model-based algorithms and methods are major activities in this field of research.

Automated Systems

Emphasis in this area is given to the distribution of adaptable automated systems employing modern evaluation methods. This serves in the development and optimization of analytical process instrumentation as well as for the application of modern industrial online-monitoring.



Analytics and the Optimization of Processes

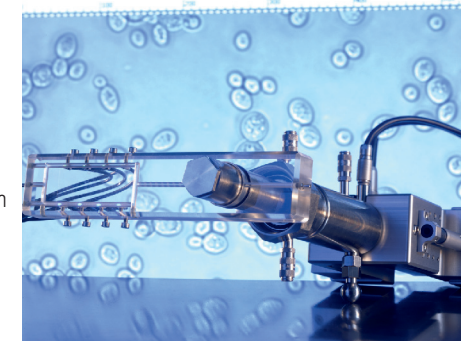
The objective of this research is the optimization of biocatalytical production processes.

Expert Systems and Model-based Applications

The objective of this research is the automation of biotechnological production processes based on online-analysis of measurements.

Image Processing for Process Automation

In this research area the potential of modern image processing for the automation of bioprocess engineering is investigated.



Metabolic Modelling and Flux Analysis

The objective of this work is the analysis and exact mathematical description of biocatalytic processes in regards to their optimization.