Fermenters of the new production plant of Lonza Biotec, Kourim (Czech Republic)

Picture: Lonza

Biotechnology has long since established itself in the process industries. The term "white" or "industrial" biotechnology refers to the application of biotechnological processes in the production of a highly diverse range of products: bulk and fine chemicals, enzymes as active ingredients for the process industries, foodstuffs, food and feed additives, agricultural and pharmaceutical preliminary products, and biofuels. The combination of the topic biotechnology with the Industrial Biotechnology Exhibition and two-day Partnering Conference at ACHEMA 2006 will bring together experts from all over the world.

A *promising* tool

White biotechnology is multi-disciplinary. It has the potential to make a substantial contribution towards mastering the fundamental challenges of our times. Studies made during the last few years (OECD 2001, EuropaBio 2003) cite numerous examples to illustrate how industrial biotechnological processes can by all means accord with the economic and ecological dimensions of sustainability. White biotechnology has the potential to produce existing products more cost-effectively because its use results in lower consumption of raw materials and materials, lower investment costs, lower energy consumption, and lower disposal costs due to less hazardous emissions. It provides a basis for completely new products and systems. Thus several studies (Festel Capital 2004, McKinsey 2003, Frost & Sullivan 2003) estimate the share of biotechnological processes in the production of various chemical products to be currently around 5%; by 2010, however, they postulate that this figure will soar to about 20%. Alone for the chemical industry, the potential value added of biotechnological production is predicted to reach €11–22 bn worldwide annually by 2010.

The potential of white biotechnology consists in its ability to replace classical chemical production processes and to permit the production of new products. Products of white biotechnology are to be found in the sectors of fine chemicals, bulk chemicals, and energy sources.

Fine and specialty chemicals

The term 'fine chemicals products' refers to substances that are highly functional and for which world demand is typically below 10,000 t/a. The current world market share of biotechnological processes in this area is estimated to be some US$ 50 bn, the potential volume within the next 10–20 years to be around US$ 250 bn. A study by McKinsey & Company (2003) anticipates that 30–60% of all fine chemicals production will involve a biocatalytic step by 2010. In this area white biotechnology has the greatest potential to make a strong impact on the market for existing and new products.

In future white biotechnology process steps will be increasingly integrated into chemical synthesis paths. Lonza has provided an example with its vitamin B3 (nicotinamide) production. Another example of biotechnological production of vitamins is that of vitamin B2 (riboflavin). Here within four years there was an almost complete transition from a chemical to a biotechnological process. Depending on the process, the number of production steps was reduced from between six and eight to only one step. Production costs were reduced by 50%, minimum plant size by over tenfold. More and more amino acids are also being produced by biocatalytic or fermentative processes.

Enzymes play an increasingly important part in industrial production processes. In the past ten years the market volume for enzymes rose by approximately 50%. A US study made in 2004 anticipates annual growth of the US-American enzyme market of 6% and a market volume of US$ 1.9 bn by 2008. The prof-

Biotechnology at ACHEMA 2006

Equipment for biotechnology is represented in all exhibition groups. Additionally, a special Industrial Biotechnology Exhibition and a Partnering Conference will take place in the New Forum. The exhibition will provide an overview of the latest developments, products and services in industrial biotechnology. At the conference international research institutions and companies will present their market-oriented products, processes and services. The main focus of the presentations will be on:

- products and processes for new applications in different industries;
- scale-up processes and downstream processing;
- new production organisms and biocatalysts;
- analytics and optimization of production organisms.

Four lecture series will give a survey of industrial biotechnology activities worldwide, particularly developments in Eastern Europe, India, China and Japan. Further lecture topics include biocatalysis in chemical production, renewables, and production and isolation of biopharmaceuticals.

itability of the industrial use of enzymes is particularly evident in the detergent industry and also in the food, feed, paper and textile industries.

More info:
www.achema.de/industrial-biotechnology-exhibition

Bulk products and polymers

Bulk products designates products exceeding 10,000 t annually. According to a study by McKinsey & Company white biotechnology will significantly affect bulk products and polymers. It is expected that, by the year 2010, 6–12% of bulk products and polymers produced by chemical means will be produced by biotechnological processes. High-volume, biotechnologically produced goods are to be found in the food, feed, and the beverages and tobacco industries.

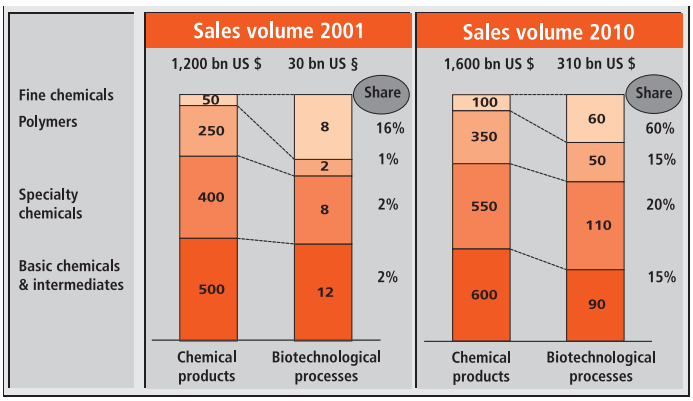
A prime example of a bulk product derived by an enzymatic process is acrylamide. Global biotechnological production capacities have continually grown in the last few years and are today probably in the region of 100,000 t/a (OECD 2001). Monomers and polymers produced by biotechnological processes for the plastics and polymer industry are becoming increasingly interesting.

Energy sources

Independent of how acute the necessity to substitute oil is judged to be, it can be maintained that renewable resources are the sole, self-regenerating source of organic carbon compounds, therefore, from the point of view of sustainability and given the finiteness of fossil resources, they represent a viable alternative for the future. The basis for the majority of bioprocesses used in industry today is sustainable resources, in general carbohydrates and sugar-containing fractions. In 2003 the worldwide volume of sugar production was 136 million tons. Sugar is produced in the individual crop-growing regions from various plants, such as sugar and sugar cane. With a current world market volume of around ten million tons, glucose extraction by starch hydrolysis is becoming increasingly important. It should be borne in mind that at the European level the promotion of biofuels is under discussion.

This is not the only case where the question of recycling by-products has to be raised since it has not yet been satisfactorily settled. The conversion of raw materials by microorganisms gives rise to large quantities of biomass whose use as feed is limited. In the long-term more efficient use of by-products is called for. One approach is the 'biorefinery' which aims to use the material and energy of renewable raw materials completely. As for the energy industry, besides bioethanol two further products should be mentioned: biogas and hydrogen. Whereas the technology for biogas recovery is state-of-the-art, hydrogen production is far more complex and requires long-term research efforts.

In the field of white biotechnology, Europe and the USA are the leaders and are still on a par with respect to state-of-the-art research and industrial transfer of research results into marketable products. ■



The development of the share of biotechnological processes in the sales volume of chemical products by product groups in 2001 and in 2010 (Source: Festel Capital, 2004)