Microbial Biotechnology (2009) **2**(5), 537 doi:10.1111/j.1751-7915.2009.00132.x

Editorial

Currently, industrial (or white) biotechnology is fully attracting the attention of scientists, of industry as well as of policy makers; in the last decade, it has positioned itself clearly from medical (red) and agro (green) biotechnology.

As to industrial biotechnology, it exploits microbiological systems for the synthesis of chemicals, materials and fibres, and for the production of energy. The enabling technologies are based on the direct or indirect use of biomass as a renewable resource, which is converted by chemical, physical or (micro)biological transformations or a combination of them.

The types of (micro)biological conversions involved are biocatalysis and enzyme technology, and fermentation technology: biocatalysis encompasses the use of cells and enzymes to catalyse desirable chemical reactions, while fermentation relates to the directed and controlled mass production of microbial cells, their enzymes and metabolites.

Scientific breakthroughs respectively in molecular genetics of industrial microbial strains, in high-throughput screening methodologies, in directed evolution, and metabolic engineering and moreover in enzyme and cell engineering, novel culture techniques and downstream processing have all contributed to the growing impact of industrial biotechnology.

As to the use of microbial biotechnology for the generation of energy carriers from renewable resources, emphasis has been mainly on 'conventional' bioethanol from sugars, biodiesel from plant oils and biogas production from agro-waste, with microbial production of advanced fuels, such as hydrogen, (iso)butanol and other higher alcohols, fatty acid derivatives, long-chain alkanes/alkenes, isoprenoid derivatives, still in their infancy of study and rather neglected.

Even in the well-established conventional microbial bioenergy generation sectors, there is an urgent need for improved processes and technologies. The efficient cracking of cellulosics into fermentable sugars using thermo-physical, enzymatical, chemical and/or (mixed) microbial reactions remains a bottleneck since many years. The biocatalytic formation of biodiesel via enzymatic (lipase, . . .) transesterification reaction also needs further optimization. The same holds true for the improved biogas efficiency on different types of materials and downstream products.

The review of Steinbuchel's group, dealing with biotechnological production of biodiesel-like molecules, focuses on the use of soluble or immobilized enzymes to replace chemical transesterification processes, which are now the ones commonly in use. The use of microbial lipase-enzymes or microorganisms as whole-cell biocatalysts, with improved or engineered lipase activity, could indeed lead towards a totally green biodiesel process, if also bioethanol is used as a substrate, next to plant oils.

This enzymatic process can be further optimized by using hydrophilic organic solvents as a reaction medium. As to whole-cell biocatalysis, filamentous fungi, yeast as well as bacteria have great potential for biotechnological biodiesel production, due to their ability to synthesize intra- and extracellular lipases. Another neglected route would be to screen or develop microbial strains and microalgae as efficient producers of fatty acids, alcohols or – directly – hydrocarbons from cellulosics or CO_2 respectively.

The articles in relation to methanogens demonstrate once more that the *Methanoarchaea*, and their associations, can bring about remarkable bioconversions and moreover self-organize most effectively as 'microbial tissues'. There is still a long way to go to achieve in-depth understanding and optimal organization of these consortia.

In this issue, articles focus on new developments in the field of advanced biofuels and discuss the basic science behind it, but always with potential applications in mind.

It may awake the mind of scientists active in other fields of microbiology and biotechnology to help to progress the biofuel research field beyond the current scientific bottlenecks.

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