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EDITORIAL

Enzymes –Biocatalysts in Life Sciences

The enzymes are very efficient catalysts in living biological systems. The enzymes are also versatile biocatalysts outside their natural media; they are a key point in biotechnological processes supporting the development in life sciences.

In the past, the structure of the enzymes and their specific properties made the scientist consider that the enzymes are not suitable to be used in a large number of industrial technologies (labile protein structure, narrow substrate specificity, availability of the enzymes, the possibility to obtain enzymatically only the natural optical isomer, cofactors requirement, high dilutions required by the enzymes and the difficulty of their use on an industrial scale etc). Today, after deep research, the enzymes are accepted as robust catalysts for the synthesis of active biological compounds. As a result of the development of DNA technology and running many microbiological studies, nowadays, many new, chemo-, enantio-, regioselective and stable enzymes, with greater biocatalytic performances are available. The enzymes are performant machineries dealing with any biotransformation in order to obtain different molecules required by biotechnologies, in aqueous or organic media. The biocatalytic route is one of a very few ways to obtain enantiomerically pure compounds. Among the enzymes specificities, this is crucial for chiral molecules technologies, considering that each enantiomer has its own characteristics.

The enzymes are used as biocatalysts in isolated form and as part of whole cells. The first industrial scale biotransformation processes used especially purified hydrolases, lyases and isomerases were used at lower level. The enzymes from other classes, like oxidases and transaminases, became more attractive for industry after they became commercially available. The cofactor dependent enzymes are used frequently as whole cells and not as purified enzymes. By using the whole cells containing all the enzymes' needs prepared by the cells themselves, the separation and purification steps are avoided and these biocatalysts become even more cost competitive.

The applications of biocatalysts are wide, they can be found in all fields related to biosciences: biosensors, food and feed technology, biofertilizers, biostimulants, pesticides, biofuels, wastewater and waste treatment, paper and textile industry, detergents and cosmetics, pharmaceuticals, biomedical applications.

In all of these applications the enzymes and the whole cells are used in soluble or

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immobilized form, being bonded to the support, microencapsulated or entrapped in porous biocompatible matrices. The immobilized biocatalysts exhibit enhanced stability in time and against harsh reaction media. However, the most important goal of using immobilized biocatalysts is the possibility to separate and recirculate them in the biotechnological processes.

The biocatalysis evolution is greater than ever before, offering many advantages for eco-friendly biotechnologies and green chemistry: high yields by using short paths, reducing the waste, high selectivity and performance under mild conditions, often performed in water. The biocatalysts are renewable materials, completely biodegradable, in general with low toxicity for humans or animals. By combining the versatility of the increasing highly active biocatalysts with the enormous variety of bioresources it may enable the bioconversion technologies to provide useful bioactive compounds in a natural, sustainable and economical route. The novel biocatalytic paths are interesting alternatives for replacing the chemical processes with biological conversions.

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