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Reusability of Coimmobilized Enzymes

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Abstract : Multienzymatic cascade reactions are nowadays widely used in pharmaceutical, chemical and cosmetics industries to produce high valuable compounds. They can be carried out in two ways, step by step and one-pot. If two or more enzymes are in the same reaction vessel is necessary to work out the compromise to run the reaction in optimal conditions for each enzyme. So far most of the reports of multienzymatic cascades concern on usage of free enzymes. Unfortunately using free enzymes as catalysts of reactions accomplish high cost. What is more, free enzymes are soluble in solvents which makes reuse impossible. To overcome this obstacle enzymes can be immobilized what provides heterogeneity of biocatalyst that enables reuse and easy separation of the enzyme from solvents and reaction products. Usually, immobilization increase also the thermal and operational stability of enzyme. The advantages of using immobilized multienzymes are enhanced enzyme stability, improved cascade enzymatic activity via substrate channeling, and ease of recovery for reuse. The one-pot immobilized multienzymatic cascade can be carried out in mixed or coimmobilized type. When biocatalysts are coimmobilized on the same carrier the are in close contact to each other which increase the reaction rate and catalytic efficiency, and eliminate the lag time. However, in this type providing the optimal conditions both in the process of immobilization and cascade reaction for each enzyme is complicated. Herein, we examined immobilization of 3 enzymes: D-amino acid oxidase from Rhodotorula gracilis, commercially available catalase and transketolase from Geobacillus stearothermophilus. As a support we used silica monoliths with hierarchical structure of pores. Then we checked their stability and reusability in one-pot cascade of L-erythrulose and hydroxypuryvate acid synthesis.

Keywords : biocatalysts, enzyme immobilization, multienzymatic reaction, silica carriers
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