Artificial nanocoating: an efficient shielding protection strategy to improve the performance of immobilized enzymes

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Abatract: as a green and efficient biocatalyst, enzymes have been applied in the fields of medicine, food, environmental protection and chemical industry. However, free enzymes are easy to inactivate and have poor stability in the use process, which makes it difficult to recycle and reuse, thus limiting their wide application. In the past 20 years, enzyme immobilization technology has become the main method to improve the catalytic performance of enzymes. Although the catalytic performance of enzymes can be improved by immobilizing enzymes on carriers. However, the enzyme immobilized on the surface of the carrier can not be protected by the carrier, and will inevitably be affected by the harmful environment and denaturation conditions, resulting in inactivation of the enzyme. To solve this problem, we describe enzyme-shielding strategy to prepare hybrid organic/inorganic nanobiocatalysts. It exploits the self-assembly of silane or metal-organic complex at the surface of immobilized enzymes on Fe_3O_4/silica core-shell nanospheres to grow a protective silica layer (silica nanocoating) or metal-organic complex (Fe^{3+}-tannic acidmnanocoating). The results showed that the artificial nanocoating provided obvious protective effect for the enzyme. Compared with the immobilized enzyme and free enzyme without artificial nanocoating, the performance of immobilized enzyme with nanocoating has been significantly improved in resistance to high temperature, acid/base, denaturant and protease hydrolysis, and its reusability has also been greatly improved. These results show that the presence of artificial nanocoating can improve the performance of immobilized enzyme. The enzyme shielding strategy can significantly improve the reusability and stability of immobilized enzymes to a certain extent.

Keywords：Immobilized enzymes; Artificial nanocoating; Self-assembly; Nanobiocatalyst; Shielding protection strategy