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研究论文

二氧化硅纳米与微米颗粒作为固定化酶载体的生物效应

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摘要 分别将二氧化硅纳米颗粒(SiNPs)与微米颗粒(SiMPs)作为固定化载体, 选择多聚酶牛肝过氧化氢酶(CAT)和单体酶辣根过氧化物酶(HRP)作为酶模型, 通过考察酶固定化后在酶活回收率、热稳定性、 酶促反应最适温度以及酶在水-有机溶剂混合体系中催化能力的变化, 对载体与酶所产生的生物效应差异进行了系统研究. 酶活回收率结果表明, SiNPs显示出比SiMPs优越的对酶无选择性的高生物亲和性, 而SiMPs则能使固定于其上的酶热稳定性大幅度提高, 且二者都能使固定化酶在有机相中的稳定性得到明显增强. 但酶促反应最适温度的变化结果表明, 对不同类型的酶所产生的生物效应则表现出无规律性.

关键词 二氧化硅纳米颗粒 二氧化硅微米颗粒 固定化载体 酶 生物效应

分类号 0657

Bioeffects of Silica Nanoparticles and Silica Microparticles as Carriers for Enzyme Immobilization

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Abstract In this paper, the differences between silica nanoparticles(SiNPs)and silica microparticles(SiMPs)in the bioeffects of them as carriers for enzyme immobilization were investigated. By choosing bovine liver catalases and horseradish peroxidases as the multimeric enzyme model and monoer enzyme model, respectively, four kinds of immobilized enzymes were obtained through the covalently binding method. After the characterization of above four immobilized enzymes, the following conclusion was stated. Firstly, in the yields of enzyme activity, SiNPs exhibit non-selective excellent biocompatibility to both enzyme models; secondly, SiMPs are superior to SiNPs on thermostability; thirdly, both SiNPs and SiMPs could greatly improve the stability of enzymes in organic solvents; lastly, there is no obvious rule indicated on the optimum temperature of enzyme catalysis, namely, SiNPs are better than SiMPs in the multimeric enzyme model and SiMPs possess much more advantages over SiNPs in the monomer enzyme model. The results would be instructional to the evaluation of nanomaterials' bioeffcts and the application of nanomaterials for enzyme immobilization.

Key words Silica nanoparticles Silica microparticles Carriers for immobilization Enzyme Bioeffect

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