Biocatalysts Prepared by the Immobilization of Enzymes within the Sol-Gel Derived Hybrid Polysaccharide-Silica Nanomaterials

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ABSTRACT

O-glycoside hydrolases (EC3.2.1), like 1→3-β-D-glucanase and α-D-galactosidase, which provide modification of polysaccharides of brown algae, were entrapped into polysaccharide-silica nanocomposites generated *in situ* by the sol-gel processing. An essential feature of our approach is that the immobilization conditions are dictated by the enzymes, but not the sol-gel procedure. The entrapment proceeded at circumneutral pH and decreased temperature that were suitable for the highly labile enzymes. To perform it, a cross-linking agent, organic solvent and catalyst were not needed. The porosity of nanocomposites was enough to provide the accessibility of immobilized enzyme by the substrate and the diffusion of products, whereas the protein molecules were easily not washed out of the matrix. The immobilization did not lead to loss in the enzyme activity that sometimes was even increased in comparison with that in the initial solution. In addition, it could cause a rise in the long-term enzyme stability hundreds times. This depended on the type and concentration of polysaccharide inside the silica matrix. It was demonstrated that one of the developed biocatalysts provided an enzymatic synthesis of biologically active translam – an analog of well-known schizophillan – from practically unimportant laminaran which is a wide-spread polysaccharide of the brown seaweeds.

Keywords: Sol-Gel Processing, Hybrid Silica Nanocomposite, Enzyme Immobilization, Biocatalyst

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