467d Immobilization of Pseudomonas Cepacia Lipase in Ordered Mesoporous Silicas: Effects of Pore Size and Surface Chemistry on Catalytic Activity

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Abstract

Lipases as a class of enzymes are stable and extremely valuable catalysts for many practical applications. They have been used to generate chiral entities from alcohols, carboxylic acid esters, cyanohydrins, chlorohydrins, diols, amines, diamines and amino alcohols [1], which are used as building blocks for a variety of pharmaceuticals and other fine chemicals. Some studies [2, 3] suggest that lipases are interfacially activated after adsorption on solid surfaces. Hence, lipase immobilization by adsorption may not only improve the stability and ease of product separation, but also enzyme activity.

Ordered mesoporous silicas are a promising class of host materials for lipase immobilization. The main goal of this study is to investigate the potential of mesoporous silicas as hosts for lipase immobilization. We have explored the effect of pore structure on enzyme immobilization and catalytic activity employing dense nonporous silica spheres and ordered mesoporous SBA-15 as model silicas. The effect of the functional groups (-COOH, $-NR_3$, $-NH_2$, alkyl, aryl, etc) attached to the surface of SBA-15 has also investigated.

In this study, SBA-15 with different pore sizes (55, 80, 240Å) was synthesized. Various charged polar (-COOH, $-NR_3$, $-NH_2$) and uncharged hydrophobic groups (alkyl, aryl) were attached to the surface of SBA-15. Subsequently, lipase was immobilized in these hosts by adsorption from solution. The catalytic activity of immobilized lipase was investigated in the hydrolysis reaction of p-nitrophenol acetate (50-1500 uM) at pH 7, 23^0C. The catalytic properties (K_m, V_{max} and k_{cat}) [4] of the immobilized and free lipase were compared. The results obtained are discussed in terms of enzyme stability and activity as a function of the pore structure and surface chemistry of the model silica.

References

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