Encapsulation of crosslinked α-chymotrypsin aggregates in SBA-15

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Cross-linked enzyme aggregates (CLEAs) of α-chymotrypsin (CT) were encapsulated in mesoporous SBA-15 to improve the inadequate mechanical properties. The development of CLEAs in SBA-15 consisted of simple two steps, physical enzyme adsorption followed by glutaraldehyde (GA) crosslinking. This resulted in nanometer scale CLEAs in the mesopore of SBA-15. CLEAs of CT in SBA-15 maintained high enzyme loading (22 wt%) by preventing enzyme leaching during washing steps while physical adsorption without GA treatment showed continuous loss of enzymes, and covalent attachment of CT showed much lower enzyme loading (2 wt%). Specific activity of CLEAs in SBA-15 was higher than that of conventional CLEAs without mesoporous silica. CLEAs-CT in SBA-15 significantly stabilized the enzyme activity under a rigorously shaking condition at 200 rpm in horizontal position. No activity decrease was observed for 20 days while physical adsorption and covalent attachment marginally lost the enzyme activity. This approach can be applied in various fields in bio-nanotechnology, such as biosensors, bioremediation, and biofuel cells.

Reference

1. J Lee, J Kim, J Kim, H Jia, MI Kim, JH Kwak, S Jin, A Dohnalkova, HG Park, HN Chang, P Wang, JW Grate, and T Hyeon, "Simple synthesis of hierarchically ordered mesocellular mesoporous silica materials and their successful application as a host of enzyme immobilization" (2005) Small accepted.