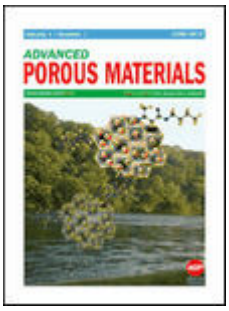

Fabrication of Nanobiocatalyst for Biomimetic CO_2 Sequestration

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In this study, Carbonic anhydrase (CA) was immobilized over gold nanoparticles confined to amine-functionalized mesoporous SBA-15. Organic amine, Tris(2-aminoethyl)amine (OA), and organic–inorganic hybrid amine, octa(aminophenyl)silsesquioxane (HA) with 3 and 8 amine groups were grafted over SBA-15 for confinement of gold nanoparticles and characterized by XRD, N_2 adsorption/desorption isotherm and zeta potential analysis. Carbonic anhydrase was immobilized over AuNps-3 and AuNps-8 and its catalytic activity was investigated by para-nitrophenyl acetate (*p*-NPA) hydrolysis. The Kcat/Km values of free CA, CAAuNps-3 and CAAuNps-8 for *p*-NPA hydrolysis were 1660, 1593 and 1637 $M^{-1}s^{-1}$, respectively. The influence of pH, temperature, storage stability, and reusability was also evaluated for above nanobiocatalyst. The study on effect of reusability and storage stability of CAAuNps-8, illustrated that the activity of Au-conjugated CA was retained at about 85% after 20 cycles and 89% after 20 days respectively, with that of its initial activity. Further, hydration of CO_2 and its sequestration as $CaCO_3$ was studied by nanobiocatalyst and the carbonation capacity was evaluated through the amount of $CaCO_3$ precipitated. Precipitated $CaCO_3$ was characterized by XRD and SEM which revealed the formation of Calcite $CaCO_3$. The results of above study substantiated that CA immobilized on AuNps-3 and AuNps-8 was reusable and stable under storage conditions. Hence, this nano-biomaterial is an eco-friendly catalyst for the capture and sequestration of CO_2.

Keywords: CARBONIC ANHYDRASE; CO2 SEQUESTRATION; GOLD NANOPARTICLES; IMMOBILIZATION; SBA-15
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