Construction of Nanoscale enzyme reactors in mesoporous media

[1]Jin Hyung Lee, [2]Jungbae Kim, [1]Kyoung-Woong Kim,
[1]Chul Han Song and [3]Man Bock Gu*

[1]Dep't Environmental Sci. & Eng., Gwangju Institute of Science and Technology (GIST), Rep. of Korea

[2] Pacific Northwestern National Laboratory (PNNL), WA, USA

[3] College of Life Sciences and Biotechnology, Korea University, Rep. of Korea

*Tel: +82-2-3290-3417, Fax: +82-2-928-6050, E-mail: mbgu@korea.ac.kr

Abstract

We constructed nanoscale enzyme reactors by immobilizing lipase in mesoporous silica particles. Mesocellular Mesoporous Silica (MMS) are small particles (200-500nm) with many meso-size pores having 37nm diameter and connected by mesoporous channels (13nm). Enzyme was immobilized in meso-size pores by 1) only adsorption and 2) adsorption followed by cross-linkage using 0.5% glutaraldehyde (GA) treatment to construct nanoscale enzyme reactors and their efficiencies were compared through the measurement of activity and stability. The GA treated reactor showed higher activity than GA-untreated one and there is no significant difference in the amount of enzyme loading with or without GA treatment. In our experiment, GA treated reactor showed 1.6 times higher activity compared to GA-untreated reactor. Stability of immobilized enzyme was measured under shaking and static conditions. Free lipase rapidly lost its activity after starting the experiment. However, GA treated reactor could be kept active under both experimental conditions and the loss in activity for GA treated reactor is less than that under GA-untreated condition. This high stability in enzymatic activity might be resulted of strongly immobilized enzyme in media through adsorption and cross linkage bonding.

Our reactor system can be used for long-term biodegradation process due to high stability. This advantage might make economically viable for the use of

expensive enzymes and hence opens a new horizon for enzymatic catalysis in contaminants treatment, food production and even biofuel cell.

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