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Performance of Immobilized Enzymes in Metal Organic Frameworks (MOFs)

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Abstract

The interest in enzymes has seen a drastic increase in the last few decades, owing to their numerous advantages over their chemical catalyst counterparts. Nevertheless, most enzymatic processes could not find their way into commercialization, mainly because of the high cost and low stability of the enzymes. Although advancements in biotechnology and genetic engineering promise to provide enzymes with better properties and lower prices, repeated use of the enzyme is essential for the economic feasibility of the application. The most common way to simplify the separation of the enzyme from the reaction mixture is immobilization, which not only allows easy repeated use but may also enhance enzyme activity and stability. The use of the enzyme in immobilized form, however, creates additional challenges, mainly diffusional resistances, and in some cases, may have an adverse effect on the activity. Therefore, careful selection of the support plays a vital role in the overall success of the immobilization process. Metal Organic Frameworks (MOFs) have gained popularity lately as efficient supports for immobilizing various enzymes. So far, MOFs have shown to be superior to other porous materials because of the easy tuning of their properties, crystallinity, and structure uniformity.

This talk will mainly focus on using MOFs for immobilization of lipase used in simultaneous microalgae oil extraction and transesterification for biodiesel production. The enhancement of enzyme stability and reduction of the diffusion resistance will be presented. The use of MOFs for immobilizations of enzymes used in other applications will also be presented, which include cyclodextrin production from waste food, CO2 conversion to formate, and treatment of emerging pollutants. Our attempts to increase the pore sizes and improve surface properties will be also discussed.