



Cost Effective Preparation of Highly Stable, Reusable Whole Cell Biocatalysts

A novel method to immobilize, stabilize, and enhance the reactivity of whole cell biocatalysts.

Technology No. 20180127

Microbial exoskeleton for enhanced activity and stability

Whole cell biocatalysts offer several advantages over purified enzymes; The main advantage is the elimination of costly enzyme purification steps. However, whole cell biocatalysts suffer from inherent disadvantage of low reaction rates due to transport resistance imposed by the cell membrane. In addition, limited working conditions, predation, and difficulties in separation of biocatalysts from the reaction mixture pose additional challenges. To tackle these problems, Prof. Aksan and Prof. Wackett at the University of Minnesota have developed a method to create a microbial exoskeleton that enhances the overall performance and stability of whole cell biocatalysts.

This technology presents a method to construct an exoskeleton using layer-by-layer deposition of inorganic material on the membrane of the whole cell biocatalysts. This encapsulation technique has been shown to

- significantly increase the reaction rate by increasing the permeability of the membrane
- increase the biocatalyst tolerance and stability against desiccation, freeze/thaw, exposure to high temperatures, osmotic shock, as well as against enzymatic attack by lysozyme, and predation by protozoa
- facilitate easy separation

As increased stability at higher temperatures is achievable, the catalysts can be subjected to higher temperature processes, which has been shown to further enhance the reaction rates (up to 12 fold). Reaction rates can also be enhanced up to 15-fold by additional treatments using detergents to solubilize parts of the cell wall.

Phase of Development

Proof of concept. Enzymatic activity, storage stability confirmed.

Features & Benefits

- Longer shelf life and repeated usage of biocatalysts
- High stability against variety of external stressors
- Increased membrane permeability enhances reaction rate
- Easy separation enabled by immobilization facilitates reusability

Applications

- Whole cell biocatalysis
- Unpurified enzyme, Inorganic shielded catalysis
- Pharmaceutical manufacturing
- Biofuel production
- Bioremediation processes
- Diagnostic and testing kits

Researchers

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Publications

[*Enhancement of biocatalyst activity and protection against stressors using a microbial exoskeleton*](#)

Scientific Reports, 9, Article number: 3158 (2019)

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