Chemical Engineering Master's Defense

Improving Yields and Productivity of Microbe-Catalyzed Production of Targeted Bio-Molecules using In-situ Adsorption

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abstract

With the aid of metabolic pathways engineering, microbes are finding increased use as biocatalysts to convert renewable biomass resources into fine chemicals, pharmaceuticals and other valuable compounds. These alternative, bio-based production routes offer distinct advantages over traditional synthesis methods, including lower energy requirements, rendering them as more "green" and "eco-friendly". Escherichia coli has recently been engineered to produce the aromatic chemicals (S)-styrene oxide and phenol directly from renewable glucose. Several factors, however, limit the viability of of this approach, including low titers caused by product inhibition and/or low metabolic flux through the engineered pathways. This thesis focuses on addressing these concerns using magnetic mesoporous carbon powders as adsorbents for continuous, in-situ product removal as a means to alleviate such limitations. Using process engineering as a means to troubleshoot metabolic pathways by continuously removing products, increased yields are achieved from both pathways. By performing case studies in product toxicity and reaction equilibrium it was concluded that each step of a metabolic pathway can be optimized by the strategic use of in-situ adsorption as a process engineering tool.

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