Chemical Engineering Thesis Defense

Engineering and Investigating the Effects of Renewable Chemical Production in Bacteria

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Abstract

Metabolic engineering of bacteria has become a viable technique as a sustainable and efficient method for the production of biochemicals. In the first study, genes that were shown to be highly differentially expressed when exposed to styrene were investigated in E. coli by testing their deletion and overexpression strains. It was found that plsX, a gene responsible for the phospholipid formation in membranes, had the most promising results when overexpressed at 10 μM IPTG, with a relative OD600 of 706 ± 117% at 175 mg/L styrene when compared to the control plasmid at the same concentration. This gene is likely to be an effective target when engineering styrene- and other aromatic-producing strains, increasing titers by reducing the cytotoxicity. In the second study, cyanobacterium Synechococcus sp. PCC 7002 was being engineered for the overproduction of L-serine. As a robust, photosynthetic bacteria, it has potential for being used in such-rich regions to capture CO2 and produce industrially relevant products. In order to increase L-serine titers, a key degradation gene, ilvA, was explored. While ilvA is responsible for degrading L-serine into pyruvate, it is also responsible for initiating the only known pathway for the production of isoleucine in PCC 7002. Herein, a plasmid containing the native A0730 gene was designed to be transformed into a strain of E. coli with an ilvA knockout to investigate its potential to restore isoleucine production. If shown to be effective, a Synechococcus sp. PCC 7002 Δilva strain can be engineered with minimal effects on growth and is expected to lead to increased L-serine accumulation.

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Zoom Link: https://asu.zoom.us/j/85668516273