OPTIMIZATION OF ISOPRENE PRODUCTION USING A METABOLICALLY ENGINEERED ESCHERICHIA COLI

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The volatile C5 hydrocarbon, isoprene is an important platform chemical, which has been used in the manufacture of synthetic rubber for tires and also has the potential for various other applications such as elastomers and adhesives. Moreover, isoprene is convertible to biofuel blend stocks such as C10 gasoline, C15 diesel, and jet fuels because of its higher energy content than other biofuels. Although isoprene is currently derived from petroleum, its sustainable supply has been suffered from price fluctuation of crude oil, high refining cost and energy consumption, and low recovery yield of pure isoprene. As an alternative, the biologically produced isoprene (bio-isoprene) has been developed rapidly for the last decade. Bio-isoprene is synthesized from dimethylallyl diphosphate (DMAPP), which is derived from mevalonate (MVA) pathway or the methylerythritol phosphate (MEP) pathway, by isoprene synthase.

In this study, metabolic engineering for enhanced production of bio-isoprene was performed by deletion of relevant genes and optimization of culture condition. In comparison of isoprene production between *E.coli* DH5α and MG1655, lower isoprene production was observed in MG1655. The lower isoprene production in *E. coli* MG1655 was ascribed to the presence of *recA* gene which is absent in the DH5α strain. The deletion of *recA* gene in *E.coli* MG1655 allows higher isoprene production than *E. coli* DH5α. Moreover, the optimized expression of isoprene synthesis pathway with 0.03mM IPTG induction enhanced the isoprene production up to 2,850 mg/L. Overall, isoprene production through the optimization was improved by 28.5-fold compared to the initial production of MG1655 strain.

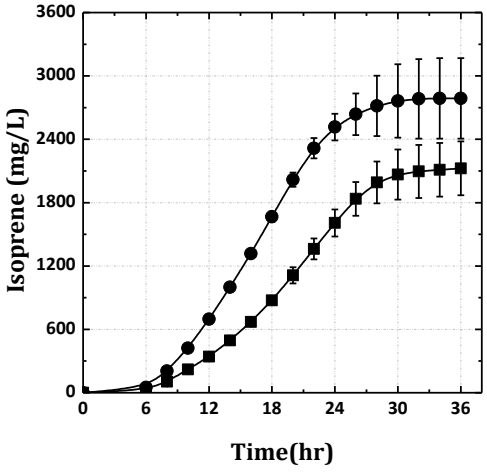

Figure 1 – Comparison of isoprene production from E. coli MG1655ΔrecA transformed with the pTSNK-sPtispS-MVA and pSNA plasmids (square), and the pTSNK-sPtispS-MVA plasmid alone (circle). Culture was carried out for 36hr in TB medium containing 2% glycerol. The recombinant strain harboring pTSNK-sPtispS-MVA was induced with 0.03mM IPTG.

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