UTR engineering-driven redox rebalancing enables higher productivity of n-butanol production in *Escherichia coli*

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Advances in metabolic engineering and synthetic biology could design a novel cell factory for post-petroleum era. To achieve the successful design of the biological systems, however, one of the important issues to be solved is balancing the intracellular redox state that plays a governing factor for the continuation of both catabolism and anabolism. Here, we show that how the changes of intracellular redox state affect the pathway performance of n-butanol production depending on carbon flux, such as glucose and galactose, in Escherichia coli as a model system. We tuned redox state by varying expression level of NAD+ -dependent yeast formate dehydrogenase through UTR engineering. The redox rebalanced strain showed the highest n-butanol productivity of 0.26 g/L/h from glucose in a batch system. Interestingly, optimal redox state was significantly different depending on whether the substrate was glucose or galactose. One intriguing implication of this work is that additional strain improvement can be achieved, in a genetic-context dependent manner, through rebalancing of intracellular redox state according to target products and substrates.