Bioelectrochemical system mediated redox balance in genetically engineered *Escherichia coli* BL21(DE3)

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Maintaining a redox balance in microorganisms is very important, for this reason many industry uses various oxidation and reduction agents. The production of 3-hydroxypropionic acid and 1,3-propanediol are greatly affected by the internal redox balance, thus the yield/titers of bioconversion are also changed by supply of external oxidants/reductants. In this study, we developed a genetically modified *E.coli* strain which harbor the metabolic pathways of 3-HP and 1,3-PDO synthesis from glycerol, and examined an electrode-based redox regulation of yield and titer in a bioelectrochemical system. For the active control of pathway, glycerol dehydratase, aldehyde dehydrogenase and 1,3-propanediol oxidoreductase were introduced into *E. coli*. Our results showed that 3-HP production was enhanced by decreasing the intracellular NADH/NAD+ ratio which induced by the electrode-driven oxidative potential. The ratio of NADH/NAD+ was increased under reductive potential was applied, simultaneously the synthesis of 1,3-PDO increased. These results suggest that the BES can be a redox controller to regulate metabolic pathway of biosynthesis.