**Co-production of hydrogen and ethanol of Esherichia coli SS1 isolate**

ABSTRACT

Background: The development of a potential single culture that can co-produce hydrogen and ethanol is beneficial for industrial application. Strain improvement via molecular approach was proposed on hydrogen and ethanol co-producing bacterium, Escherichia coli SS1. Thus, the effect of additional copy of native hydrogenase gene hybC on hydrogen and ethanol co-production by E. coli SS1 was investigated. Results: Both E. coli SS1 and the recombinant hybC were subjected to fermentation using 10 g/L of glycerol at initial pH 7.5. Recombinant hybC had about 2-fold higher cell growth, 5.2-fold higher glycerol consumption rate and 3-fold higher ethanol productivity in comparison to wild-type SS1. Nevertheless, wild-type SS1 reported hydrogen yield of 0.57 mol/mol glycerol and ethanol yield of 0.88 mol/mol glycerol, which were 4- and 1.4-fold higher in comparison to recombinant hybC. Glucose fermentation was also conducted for comparison study. The performance of wild-type SS1 and recombinant hybC showed relatively similar results during glucose fermentation. Additional copy of hybC gene could manipulate the glycerol metabolic pathway of E. coli SS1 under slightly alkaline condition. Conclusions: HybC could improve glycerol consumption rate and ethanol productivity of E. coli despite lower hydrogen and ethanol yields. Higher glycerol consumption rate of recombinant hybC could be an advantage for bioconversion of glycerol into biofuels. This study could serve as a useful guidance for dissecting the role of hydrogenase in glycerol metabolism and future development of effective strain for biofuels production.

**Keyword:** Hydrogen; Ethanol; Co-production; Escherichia coli; Glycerol