

Modification of Bacterial Pathways to Convert Short Chain Fatty Aids to Bioalcohols

Butanol – a valuable chemical traditionally used in the industry as a solvent and as intermediate for the synthesis of various high value chemicals and is now being explored as both blending agent as well as standalone biofuel. Production of butanol was achieved in recombinant *Escherichia coli* by recreating the butyric acid reassimilation pathway native to *Clostridium acetobutylicum* in *E. coli*.

The recombinant strain was able to convert exogenously added butyric acid to butanol with an efficiency close to 100% under anaerobic conditions. The strain was able to tolerate 100 mM of butyrate, where butanol production was observed to be 33 mM (with low cell density) and 53 mM (with higher initial cell density). A comparison of glucose vs. glycerol as the carbon source showed that the yield of butanol when glycerol was used, was almost double that with glucose and in fact improved by altering the relative ratio of glycerol to butyrate. Butanol production was also achieved at the bioreactor scale with 60 mM butanol being produced in just 24 hours. Continuous butanol generation was also demonstrated with an average yield of 37 mM and a productivity of 7.6 mM/l/h for a duration of 240 hours. The recombinant strain was able to convert fatty acids in the range of C3 – C7 (including branched chain molecules) to the corresponding alcohols, indicating the potential significance of this strain for the production of higher chain and higher value alcohols.

Graphical Description

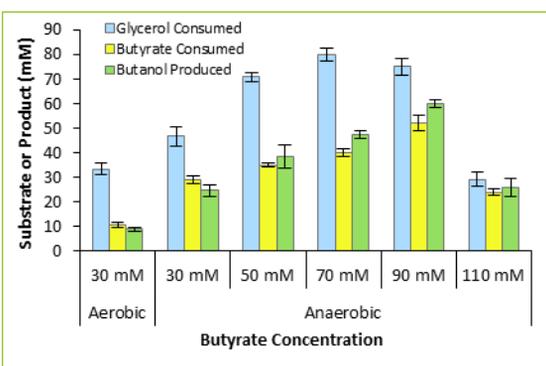
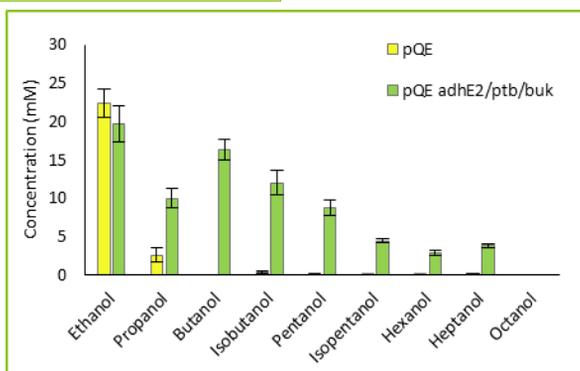


Figure 1: Conversion of butyric acid to butanol under aerobic and anaerobic conditions

Figure 2: Substrate specificity of the recombinant *E. coli* strain towards various short chain fatty acids

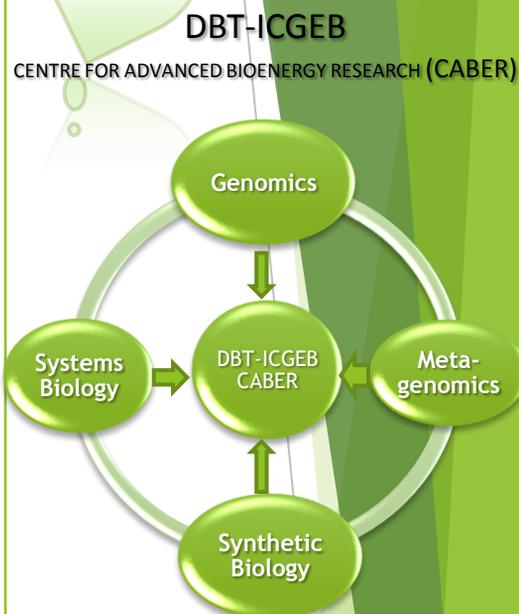


Exploitable Technology

The lab scale fermentation technology is now ready to be upscaled industrially to meet the energy needs of human beings.

Reference for the Invention

1. Yazdani, S.S., Mattam, A.J. 2013. Engineering *E. coli* strain for conversion of short chain fatty acids to bioalcohols. Indian Patent Application No. 2651/DEL/2013
2. Mattam AJ, Yazdani SS. 2013. Engineering *E. coli* strain for conversion of short chain fatty acids to bioalcohols. *Biotechnology for Biofuels* 6(1):128.



Contact Person:

Dr Brajesh Barse

Email: barsebrajesh@icgeb.res.in

Dr. Syed Shams Yazdani

Group Leader, Synthetic Biology and Biofuels
 Coordinator, DBT-ICGEB Centre for
 Advanced Bioenergy Research
 International Centre for Genetic Engineering
 and Biotechnology (ICGEB)
 Aruna Asaf Ali Marg, New Delhi 110067
 Phone: +91-11-2674-1358 (Ext. 460)
 Email: shams@icgeb.res.in