Introduction

- The utilization of edible biomass for chemical and biofuel productions greatly affects the food supply and food productions.
- We engineered a biosynthetic non-phosphorylative 'shortcut' pathway to convert xylose and arabinose, present abundantly in inedible lignocellulosic biomass, to produce Gamma-Aminobutyric Acid (GABA).
- GABA is a four carbon amino acid commonly used for food productions and a precursor of nylon 4, a thermally stable and biodegradable polymer that has been developed in the last few decades.

Metabolic Pathways for GABA Productions

GABA Titters From Different E. coli strains

- Endogenous E. coli is able to produce GABA from both D-xylose and L-arabinose. Therefore, we overexpressed the related genes and introduced an arabinose transporter (araE) to improve the production of GABA.
- Endogenous genes (xylA, xylH, and ygh) which metabolize xylose and arabinose were deleted from E. coli.
- The initial D-xylose or L-arabinose concentration for the GABA production was 20 g/L.
- The result from xyBCDX + godA + gdh strain from D-xylose was supposed to be higher than the strain from xyBCDX + godA strain. This was probably due to the failure of the plasmid transformations, thus the genes were not over-expressed.
- The knocked-out gdh gene improved the final titer of GABA from D-xylose but not from L-arabinose.

Conclusions

- We managed to produce 0.61 g/L of GABA from 20 g/L of D-xylose and 0.81 g/L of GABA from 20 g/L of L-arabinose.
- A previous study showed that 1.12 g/L GABA was able to be produced using an initial glucose concentration of 20 g/L. Although the final titers from both D-xylose and L-arabinose sugars were not as high as the titer from glucose, we managed to use the underutilized sugars as an alternative for the GABA production.

References