

SynBioForum 2019

Research on breeding of high acetic acid producing strain and its metabolism controlling

Yao Hongli^{1,2}, Li Xingjiang², Zhou Xianhan¹, Wu Xuefeng^{2,*}

1. Department of biology and food engineering, Bozhou University, Bozhou, Anhui, The People's Republic of China

2. School of Food and Biological Engineering, Hefei University of Technology, Hefei, Anhui, The People's Republic of China

Abstract: *Acetobacter pasteurium* is the main bacteria in vinegar fermentation industry in China. However, compared with the strains used internationally, it has the disadvantages of less strains with strong acid-producing ability and unstable performance. In this study, several strains of *Acetobacter pasteurium* commonly used in fermentation industry were compared in the physiological and biochemical characteristics, acetic acid production capacity, key enzymes and tolerance to different environmental stresses, and a dominant strain was selected. The strain was mutagenized by ultraviolet radiation. Subsequently, a high acid-producing and stable strain was obtained and named *Acetobacter pasteurium* YHL3 in our laboratory. Its fermentation media and products were determined by HPLC and MS/GC-MS, and the changes of substance components in fermentation broth before and after fermentation were analyzed. The main metabolic pathways of *Acetobacter pasteurium* were constructed based on references and gene information from the Kyoto Encyclopedia of Genes and Genomes(www.kegg.jp), and the related enzymes in each metabolic pathway were searched. Based on bioinformatics and biostatistics, 47 metabolic reactions and 25 key enzymes of *Acetobacter pasteurium* were determined by selecting suitable methods for the determination of enzyme activities and combining with the physiological and biochemical characteristics of *Acetobacter pasteurium*. According to the utilization of substrates and the production of metabolites in metabolic reactions, the basic metabolic reaction equations in organisms were clearly obtained, and the metabolic network of *Acetobacter pasteurium* YHL3 was constructed. Based on the quasi-stability theory, metabolic flux of 47 metabolic nodes was computed using MINVERSE and MMULT in Excel 2010. In this study, the metabolism of *Acetobacter pasteurium* YHL3 was also controlled by adding exogenous substances (Exogenous factors include nitrogen, carbon, mineral salts, accelerants, and metal ions, etc.) to the fermentation system in order to improve the efficiency of each stage of fermentation and increase the yield of the target product. The results can provide theoretical reference for the construction of industrial system of high-intensity acetic acid fermentation and the study of precise metabolic controlling of acetic acid bacteria.

Keywords: *Acetobacter pasteurium*; fermentation industry; substance components; metabolic nodes; metabolism controlling