Global transcriptome and metabolic engineering of Zymomonas mobilis toward the inhibitor tolerant cells

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Abstract

Weak robustness of Zymomonas mobilis to inhibitors containing lignocellulose feedstock after pretreatment is the crucial obstacle for its practical application in biorefinery fermentations for production of either ethanol or other biobased products. Here we report the Global transcriptome and metabolic engineering of Zymomonas mobilis toward the inhibitor tolerant cells. We discovered a unique property of Z. mobilis on tolerance and bioconversion of aromatic compounds derived from lignin over-degradation, such as 4-hydroxybenzaldehyde, vanillin, syringaldehyde, benzoquinones etc. The robustness and ethanol fermentability of Zymomonas mobilis on aromatics is extraordinarily excellent than the widely used Saccharomyces cerevisiae strain, although it is relatively less tolerant to furan aldehydes (furfural and 5-hydroxmethylfurfural) and high concentrated organic acids (acetic acid, formic acid). This property creates specific applications for Z. mobilis in biorefinery engineering: (1) while furan aldehdyes and organic acids are completely biodegraded by advanced biodetoxification technology, considerable aromatics are generally maintained in the pretreated lignocellulose feedstock and inhibit the high performance fermentation because of their low solubility and less biodegradability; (2) some specific feedstocks such as corncob residues contains high level of aromatics, which severely inhibit the yeast cell viability and metabolism. This talk presented the detailed results of experimental observation, mechanisms, and practical applications of Z. mobilis on aromatics containing lignocellulose feedstock for ethanol production.

Speaker's biography

Prof. Bao received BS degree in Chemical Engineering, Nanjing University of Science and Technology, MS in Chemical Reaction Engineering, Zhejiang University, and PhD degree in Biochemical Engineering, Yamaguchi University, Japan. He worked as research engineer in Qilu Petrochemical Research Institute of Sinopec, China; Postdoctoral researcher in UC Davis, USA and Okayama University, and professor in East China University of Science and Technology, China since 2006. Currently he is the associate editor and editorial board member of several international academic journals. His research interests include (1) Industrial biotechnology and process engineering of lignocellulose biorefinery technology for Bioproduction of liquid biofuels and bio-based chemicals; (2) Metabolic engineering of biorefinery fermenting microorganisms for high tolerance and pentose utilization from lignocellulose.