TOLERANT ETHANOLOGENIC YEAST DETOXIFY BIOMASS CONVERSION INHIBITORS

Z.L. Liu

Crop Bioprotection Research, National Center for Agricultural Utilization Research, ARS-USDA, 1815 N. University Street, Peoria, IL 61604, USA

At NCAUR, we conduct functional genomic studies for microbial stress tolerance for low cost bioethanol production. Our research covers both basic and applied science. Using directed genomic adaptation and protein engineering approaches, we created tolerant ethanologenic yeast *Saccharomyces cerevisiae* NRRL Y-50049 and numerous tolerant strains that can *in situ* detoxify biomass conversion inhibitors such as furfural and 5-hydroxymethylfurfural (HMF). One of technical challenges for biomass conversion to ethanol is the generation of inhibitors during biomass pretreatment that interfering microbial growth and subsequent fermentation. These inhibitors are formed in dehydration of pentoses and hexoses derived from degradation of cellulose and hemicellulose biomass, and also caused by complex chemical conversions of biomass pretreatment. Inhibitors furfural and HMF are commonly encountered in biomass hydrolysate, especially for those treated by economic acid hydrolysis. Removal of these toxic compounds prevents cost-efficient biomass conversion to ethanol. Our tolerant yeast strains can be directly applied to cellulosic ethanol production for industrial processes seeking for 5-carbon based value-added chemical production using biomass and economic ethanol production using the processing residues. Under laboratories conditions, increased mass inoculum and/or fed-batch fermentation managing procedures can be applied to reduce the inhibitor effects. Our newly generated tolerant yeast strains are the first available that can be used as an initial culture to detoxify the inhibitors while producing ethanol without any of the above mentioned conditioning procedures. Fermentation based bioprocess including economic biomass conversion to ethanol relies extensively on microbial performance. Application of these tolerant ethanologenic yeast strains provides benefits of reduced production cost and simplified fermentation procedures for comprehensive utilization of low-cost biomass feedstocks.

Contact: Zonglin Lewis Liu, Crop Bioprotection Research, NCAUR-ARS-USDA, 1815 N. University Street, Peoria, IL 61604, USA. Tel: 309-681-6294. E-mail: Zlewis.Liu@ars.usda.gov.