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Enhancing butanol production from lignocellulosic biomass via mitigation of aldehyde- and butanol mediated inhibition of *Clostridium* species

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Lignocellulosic biomass is an abundant and renewable source of fermentable sugars for microbial production of biofuels. The overarching goal of this talk is to address bottlenecks that prevent large-scale industrial production of biofuels and feedstock chemicals from lignocellulosic biomass. The co-production of fermentation-inhibitory compounds, especially the furan aldehydes furfural and 5-hydroxymethyl furfural (HMF), during biomass hydrolysis pose a significant challenge to efficient microbial utilization of sugars in lignocellulosic hydrolysates. Other factors that impede sugar utilization result from carbon catabolite repression (CCR) in solventogenic clostridia and butanol (fermentation end product) toxicity. We are taking a multi-pronged strategy to address these limitations. First, through microarray based transcriptional analysis and functional tests of recombinant versions of C. *beijerinckii* 8052 aldehyde reductases, which have been annotated but not validated, we sought to identify biocatalysts that can reduce furfural and HMF to their corresponding non-toxic alcohols; indeed, we have determined that overexpression of some of these candidate genes in Escherichia coli facilitates bio-abatement of furfural and HMF. Second, we are investigating the use of cell penetrating peptide (CPP) as part of a peptide-morpholino oligonucleotide conjugate to transport a guide sequence into growing bacteria and elicit cleavage of target mRNAs to down-regulate gene expression of transcription factors that adversely affect pentose utilization. Lastly, we have integrated in situ vacuum-aided recovery of butanol into *Clostridium beijerinckii* butanol fermentation and drastically reduced butanol toxicity. Results from these studies which collectively seek to improve utilization of biomass-derived sugars and butanol productivity during fermentation will be presented at the conference.

Biography

Thaddeus Ezeji completed his Ph.D. 11 years ago from University of Rostock, Germany and Postdoctoral studies from University of Illinois, Urbana-Champaign. He is currently an Assistant Professor of Microbiology, Department of Animal Sciences, The Ohio State University and Ohio State Agricultural and Development Center (OARDC), Columbus & Wooster. Dr. Ezeji has published more than 45 papers and book chapters in reputed journals and books. He is a co-Editor of a book on Biofuels, and associate Editor of three international journals.

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