

ABSTRACT

Schumm, John J. MS ABE, Purdue University, May, 2009. Cumulative Effects Of Propagation, Fermentation Media, and Inoculum Size on the Fermentation and Economic Performance of Glucose and Xylose Co-Fermentation by *Saccharomyces cerevisiae* 424A(LNH-ST). Major Professor: Nathan S. Mosier.

Propagation methods, fermentation media, and inoculum size have a significant impact on fermentation performance. This study examined the effect of these three processing parameters on glucose/xylose co-fermentations by recombinant *S. cerevisiae* (LNH-ST 424A) for cellulosic ethanol production. Inoculums were prepared with in batch propagation (2% initial glucose) and fed batch propagation (under 0.5% glucose) in laboratory media (yeast extract with peptone (YEP)) and industrial media (4% Corn Steep Liquor (CSL)). Cells were then inoculated to high (4.5 g/L) and low densities (1.1 g/L) into varying concentrations of fermentation media with 8% glucose and 5% xylose to simulate lignocellulosic hydrolysates. Monod type kinetics were applied to the fermentation data to determine parameters for specific glucose and xylose utilization rates. When fermented in rich media (YEP) difference in fed batch propagation methods and batch propagation methods were not significant. However, when fermented in industrial type media (4% CSL) fermentations inoculated with cells from fed batch propagation had 27% lower xylose consumption rates. High inoculum low nutrient fermentations inoculated with cells from both fed batch and batch propagation methods had faster xylose consumption rates than low inoculum fermentations. Fermentation media had the largest effect on propagation; at 20% YEP, the specific xylose consumption rates slow as much as 48% from 100% YEP. The economic model found the optimal process methods were CSL fed batch propagation with low inoculum into 2% CSL. A sensitivity analysis found that of the modeled parameters, cost of fermentation media has the largest effect on fermentation costs.