ABSTRACT

Lignocellulosic biomass is a promising renewable feedstock for the microbial production of chemicals, especially ethanol. The major fermentable sugars released from the processing of lignocellulosic biomass are glucose and xylose. However, the primary processing steps required for this conversion also produce a range of compounds that can inhibit the subsequent microbial fermentation. One such inhibitory compound is acetic acid, liberated during the pretreatment of the biomass.

In this poster, we report the effect of acetic acid on the glucose/xylose co-fermentation by S. cerevisiae 424A(LNH-ST), a genetically engineered yeast strain that can effectively co-ferment both glucose and xylose to ethanol. The co-fermentation of glucose and xylose was performed under acetic acid conditions of 7.5, 10, and 15 g/L over a pH range of 5 – 6. To maintain the pH at the specified initial value, the fermentations were carried out in 1L New Brunswick BioFlow 110 benchtop fermentors equipped with pH control.

RESULTS AND CONCLUSION

Results showed that the fermentation of both sugars was negatively affected by the presence of acetic acid, although this effect was much more severe for xylose. Results also indicated that the inhibitory effect increased as acetic acid concentration increased and pH decreased. However, metabolic ethanol yields either remained about the same or showed improvement when compared to the control, regardless of pH or acetic acid concentration.

MATERIALS AND METHODS

Strain: Saccharomyces cerevisiae 424A(LNH-ST)

Fermentation: Largely anaerobic batch fermentation was done in a 1L New Brunswick BioFlow110 benchtop fermentor with agitation and temperature set points of 200 rpm and 28°C, respectively. Appropriate amounts of glucose, xylose, and acetic acid (7.5, 10, or 15 g/L) were added to 800 ml YEP media and the pH was manually adjusted to the set point (pH 5, 5.5, or 6) with ammonium hydroxide (28-30% NH₃). At this point, the media was inoculated to 400 KU and the fermentation was monitored.

pH Control: The pH was continuously controlled within ±0.1 from the set point using the pH control system provided with the BioFlow110 fermentor. 1M phosphoric acid and 1M ammonium hydroxide were the acid and base, respectively, used for pH control. BioCommand Plus software was used to monitor the real time media pH to verify proper control.

Analysis: HPLC analysis of samples collected throughout the fermentation time course was performed using a Bio-Rad HPX-87H column to quantify concentrations of glucose, xylose, glycerol, xylitol, acetic acid, and ethanol.

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