

Effect of different glucose feed rates on very high gravity fermentation in fed-batch system

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The demand for biofuels has increased all over the world, mainly as a way to combat the effects of global warming. In recent years, the production of ethanol from corn has grown in Brazil, as the country is one of the largest producers of the grain and because the combination of processing sugarcane and corn in the offseason allows for better use of the plant throughout the entire period of the year. The production of ethanol from corn requires higher concentrations of sugar in the wort which generates greater osmotic stress in the yeasts. To reduce osmotic stress and improve ethanol production, it is necessary to determine the amount of sugar to be fed into the bioreactor during the fermentation process. The study aimed to evaluate the effect of different glucose feed rates on very high gravity fermentation in fed-batch system. Thus, 3 feed rates were tested: T1 (4,0 g L⁻¹ h⁻¹ of glucose), T2 (4,5 g L⁻¹ h⁻¹ of glucose), T3 (5,0 g L⁻¹ h⁻¹ of glucose), which were performed in quadruplicate. The wort used for feeding was corn hydrolyzate (300 g L⁻¹) supplemented with 800 mg L⁻¹ of urea. To carry out the fermentation, 3% of the dry mass of *Saccharomyces cerevisiae* Thermosacc Dry® was inoculated in 2 L Erlenmeyers with 150 ml of wort, after 3 hours of fermentation the feeding began according to each treatment, in all, 850 mL of wort were dispensed. The fermentation was carried out in a *Shaker*, under 140 rpm, pH 4.5 and temperature of 30°C. The results at the end of fermentation showed that T1 had the highest alcohol content (15.12% v/v), the highest cell viability (85.0%), the highest fermentation yield (77.84%) and the lowest residual sugar (26.32g) (p<0.05). While T2 and T3 obtained respectively: 13.50% and 12.45% of alcoholic content, 78.1% and 74.2% of cell viability, 69.50% and 64.10% fermentative yield and 38.48 g and 59.88 g of residual sugar (p<0.05). Through these results, it is possible to verify that the feed flow of 4 g L⁻¹ h⁻¹ was essential to improve the fermentative performance of the yeast, since this feed flow provided less osmotic stress caused by the large amount of sugar in the medium. This occurred because this feed rate provided the lowest residual glucose concentration at the end of the fermentation, since most of the glucose was used to produce ethanol.

Key words: Corn hydrolyzate; Ethanol; Osmotic stress; Yeast.

Efeito de diferentes taxas de alimentação de glicose na fermentação com alto teor alcoólico em sistema de batelada alimentada

A produção de etanol a partir do milho requer altas concentrações de açúcar no mosto o que gera maior estresse osmótico nas leveduras. Para reduzir o estresse osmótico o estudo teve como objetivo avaliar o efeito de diferentes taxas de alimentação de glicose na fermentação com alto teor alcoólico em sistema de batelada alimentada. Foi possível verificar que a vazão de alimentação de 4 g L⁻¹ h⁻¹ foi essencial para melhorar o desempenho fermentativo da levedura, uma vez que, essa vazão de alimentação proporcionou menor estresse osmótico e maior conversão do açúcar em etanol.

Palavras-chave: Hidrolisado de milho; Etanol; Estresse osmótico; Levedura.

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