Simultaneous Saccharification and Fermentation (SSF) of pretreated sugarcane bagasse using cellulase and Saccharomyces cerevisiae - Kinetics and modeling

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Abstract

Optimization of process variables in the bioconversion of pretreated sugarcane bagasse using cellulase and *Saccharomyces cerevisiae* by Simultaneous Saccharification and Fermentation (SSF) was investigated in the present study. A 2^3 five level Central Composite Design (CCD) experiments with central and axial points were used to develop a statistical model for the optimization of process variables such as incubation temperature , pH and fermentation time. Data obtained from Response Surface Methodology (RSM) on ethanol production were subjected to the analysis of variance (ANOVA) and analyzed using a second order polynomial equation and the contour plots were used to study the interactions among three relevant variables of the fermentation process. The fermentation experiments were carried out using an online monitored modular fermenter 2L capacity. The processing parameters setup for reaching a maximum response for ethanol production was obtained when applying the optimum values for temperature (35°C), pH (5.5) and fermentation time (114 h). Maximum ethanol concentration (4.80 g/l) was obtained from 50 g/l pretreated sugarcane bagasse at the optimized process conditions in aerobic batch fermentation. Various kinetic models such as Monod, Modified Logistic model, Modified Logistic incorporated Leudeking – Piret model and Modified Logistic incorporated Modified Leudeking – Piret model have been evaluated and the constants were predicted.

Keywords: Optimization, response surface methodology (RSM), simultaneous saccharification and fermentation (SSF), ethanol, *Saccharomyces cerevisiae*

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