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Optimization of simultaneous saccharification and fermentation conditions with amphipathic lignin derivatives for concentrated bioethanol production.

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Abstract

Amphipathic lignin derivatives (A-LDs) prepared from the black liquor of soda pulping of Japanese cedar are strong accelerators for bioethanol production under a fed-batch simultaneous enzymatic saccharification and fermentation (SSF) process. To improve the bioethanol production concentration, conditions such as reaction temperature, stirring program, and A-LDs loadings were optimized in both small scale and large scale fed-batch SSF. The fed-batch SSF in the presence of 3.0 g/L A-LDs at 38 °C gave the maximum ethanol production and a high enzyme recovery rate. Furthermore, a jar-fermenter equipped with a powerful mechanical stirrer was designed for 1.5 L-scale fed-batch SSF to achieve rigorous mixing during high substrate loading. Finally, the 1.5 L fed-batch SSF with a substrate loading of 30 % (w/v) produced a high ethanol concentration of 87.9 g/L in the presence of A-LDs under optimized conditions.

Keywords: amphipathic lignin derivative, bioethanol, enzymatic saccharification, fed-batch simultaneous saccharification and fermentation (SSF), powerful mechanical stirrer

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