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DETOXIFICATION OF SUGARCANE BAGASSE HEMICELLULOSIC HYDROLYSATE WITH ACTIVE CHARCOAL FOR ETHANOL PRODUCTION

Priscila Vaz de Arruda, Willian Milani Zambianco, Adilson Nicanor de Assis, Rita de Cássia Lacerda Brambilla Rodrigues, João Batista de Almeida e Silva and Maria das Graças de Almeida Felipe*.

Escola de Engenharia de Lorena – USP, Departamento de Biotecnologia,
Caixa Postal 116, CEP 12602-810, Lorena/SP, Brazil. Fone/Fax: +55 (12)3153-3165
*e-mail: mgafelipe@debiq.eel.usp.br
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Introduction. Lignocellulosic biomass is a complex mixture of three main fractions: cellulose, hemicellulose and lignin. The lignocellulose hydrolysis yields D-glucose from cellulose, and a mixture of hexoses (D-glucose, D-mannose, D-galactose, L-rhamanose), pentoses (D-xylose, L-arabinose), and uronic acids from hemicelluloses (1). The characteristics of this biomass stimulate the industrial processes such as food, chemicals, enzyme and fuels productions (1). Sugarcane bagasse is a plentiful lignocellulosic biomass typically found in countries like Brazil and the high hemicellulosic percentage presented in this material, which is rich in xylose (pentose that can be assimilated by several microorganisms), stimulates researches for ethanol obtainment. The bioconversion of D-xylose into ethanol from sugarcane bagasse hemicellulosic hydrolysate is limited by the presence of toxic compounds, such as phenol, furfural, 5-hydroxymethylfurfural and acetic acid (2). These toxic compounds, formed during acid hydrolysis of bagasse, are responsible for the decrease in the bioprocess productivity. In order to reduce their concentration and enhance the hydrolysate fermentability, different treatments can be employed. By this way, in this work the chemical composition of the bagasse was determined and afterwards it was hydrolyzed in order to evaluate the procedure of detoxification with active vegetal charcoal. The hydrolyzed bagasse was fermented with *Candida guilliermondii* for ethanol production.

Methods. In a 20L stainless steel reactor with direct steam heating, sugarcane bagasse from Usina São José (Brazil) was impregnated with H_2SO_4 (100mg H_2SO_4 / g dry matter) and heated at 150ºC for 30 min. After filtration, the liquid fraction was concentrated by heating at 70ºC under vacuum. The sugars concentrations were determined by high-performance liquid chromatography. The hydrolysate treatment was made by adjusting its initial pH (from 0.53 to 7.0) with CaO followed by reduction to pH 2.5 with H_3PO_4 and then the hydrolysate was submitted to active charcoal adsorption (1% w/v) in Erlenmeyer flasks on a rotatory shaker at 200 rpm, 60 °C, for 30 minutes.

Results and discussion. The chemical analysis showed that sugarcane bagasse is composed by cellulose (38.09%), hemicellulose (29.18%) and lignin (24.15%), among others. The concentrated bagasse hydrolysate (pH = 0.53) had the following composition: 10.24 g/L glucose, 84.35 g/L xylose, 7.11 g/L arabinose, 0.079 g/L hydroxymethylfurfural, 0.082 g/L furfural and 5.64 g/L acetic acid. It was observed low reduction in sugar concentration after detoxification of hydrolysate. In addition, reduction of toxic compounds and color of hydrolysate was verified. The fermentation results revealed that the yeast was able to produce the maximum ethanol concentration (4.7g/L) within 48h.

Conclusions. The treatment using the combination of pH adjustment and active charcoal adsorption was not enough efficient to removal acetic acid under the employed conditions. The yeast *C. guilliermondii* was able to produce ethanol from sugarcane bagasse hydrolysate. Considering these preliminary assays, other methodologies will be studied in order to enhance the ethanol production from hemecellulosic hydrolysate. New researches must be performed to establish conditions for the most effective reduction of the toxic compounds, improving the hydrolysate fermentability and decreasing the xylose loss.

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