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ScienceDirect
Bioresource Technology 100 (2009) 1238–1245
BIORESOURCE TECHNOLOGY

Comparative hydrolysis and fermentation of sugarcane and agave bagasse

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Received 2 June 2003; received in revised form 12 August 2006; accepted 12 September 2006

Abstract

Sugarcane and agave bagasse samples were hydrolyzed with either mineral acids (HCl), commercial glucanases or a combined treatment consisting of alkaline delignification followed by enzymatic hydrolysis. Acid hydrolysis of sugar cane bagasse yielded a higher level of reducing sugars (37.21% for depithed bagasse and 35.37% for pith bagasse), when compared to metzal or metzontete (agave pinecone and leaves, 5.02% and 9.91%, respectively). An optimized enzyme formulation was used to process sugar cane bagasse, which contained Celluclast, Novozyme and Viscozyme L. From alkaline–enzymatic hydrolysis of sugarcane bagasse samples, a reduced level of reducing sugar yield was obtained (11–20%) compared to agave bagasse (12–58%). Selected hydrolyzates were fermented with a non-recombinant strain of *Saccharomyces cerevisiae*. Maximum alcohol yield by fermentation (32.6%) was obtained from the hydrolyzate of sugarcane depithed bagasse. Hydrolyzed agave waste residues provide an increased glucose decreased xylose product useful for biotechnological conversion.

Keywords: Sugarcane; Agave; Bagasse; Fermentation; Hydrolysis

1. Introduction

There is an increased interest in producing bioethanol as an octane booster or as a liquid fuel. Lignocellulosic materials from different crop residues have been used for conversion to ethanol (Lynd et al., 1991; Wiselogel et al., 1996; Rabinovich, 2006).

One of the most extensively used agricultural residues is sugarcane bagasse. In Latin America, sugarcane is widely produced and provides the main source of fermentable carbohydrates for alcohol production. In 1997–98 Brazil produced more than 15,000,000 m^3 of ethanol obtained from alcoholic fermentation of sugarcane juice, providing all factory power from burning the residual bagasse (almost 100 million tons), (Boddey, 1993; CFC–ISO–GEPLACEA, 1999).

Using simultaneous saccharification and fermentation (SSF), conversion of lignocellulosic residues such as bagasse to ethanol is technically and economically feasible (Philippidis et al., 1992; Hinman et al., 1992).

In Mexico, sugar cane (47 million tons produced in 1997) is used entirely for sugar production. The byproduct blackstrap molasses (1.8 million tons produced in 1997) is fermented and distilled to produce alcohol. Molasses is also used as a feed supplement for cattle production or sold on to the international markets as a fermentation raw material. Bagasse, an important residue from sugarcane processing (13.6 million tons per year), could become an important biomass source for saccharification and fermentation to produce bioethanol, but only 3% is processed in Mexico's pulp and paper industry (González-César, 2002).

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doi:10.1016/j.biortech.2006.09.062