BIOTECHNOLOGICAL PRODUCTION OF XYLITOL FROM SUGARCANE BAGASSE

Maria das Graças de A. Felipe*, Silvio Silvério da Silva, José Marcelo Marton e Débora Danielle Virgínio da Silva
Faculdade de Engenharia Química de Lorena (FAENQUIL) - Departamento de Biotecnologia
CP 116, 12600-970, Lorena-SP, Brasil.*E-mail: mgafelipe@debiq.faenquil.com.br

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Introduction. Sugarcane bagasse is one of the most abundant residues of the Brazilian agroindustry. Its use in biotechnological processes is principally intended for the extraction of D-xylose from its hemicellulosic fraction. Presently, there is a growing need to develop alternative technologies to reuse this residue to obtain new products. One of the products resulting from fermentation of D-xylose is xylitol, a poliol with sweetening and anticariogenic properties and a reduced caloric value indicated for obese and diabetic people (1). Recent researches confirm the therapeutic capacity of xylitol to prevent otitis and osteoporosis (2,3). The current production of xylitol on a commercial scale by chemical synthesis, does not give high yields and is very costly, requiring xylitol recovery and purification. On a laboratory scale, *Candida guilliermondii* yeast has been employed with success for the biotechnological production of xylitol from xylose present in sugarcane bagasse hemicellulosic hydrolysates (4,5). This bioconversion process is, however, limited by the presence of toxic compounds, such as phenols and acetic acid (6), which are formed during hydrolysis, affecting the productivity.

In this work attempts were made to reduce the toxicity of sugarcane bagasse hydrolysate and to stablish the best conditions for optimizing the upstream parameters in order to develop a xylitol production biotechnological process able to compete with the chemical process.

Methodology. *Candida guilliermondii* was cultivated in sugarcane bagasse hydolysate pretreated by neutralization of its pH with CaO and H_3PO_4 and adsorption on activated charcoal. The treated hydrolysate was concentrated and supplemented with nutrients. The experiments were carried out in a fermenter (Bioengineering KLF), pH 5.5, at 30ºC, 300 rpm, K_{La} 20h^{-1}. The concentrations of sugars, ethanol, glycerol and toxic compounds were quantified by a high-performace liquid chromatograph (5) and growth was quantified by turbidiometrically at 600nm.

Results. According to the results, the biotechnological process for xylitol production appears to be efficient, since high xylitol production rates can be obtained with treated hydrolysate and under controlled oxygen supply. The treatment consisting in pH neutralization combined with adsorption on charcoal activated provided a significant removal of acetic acid and phenolic compounds from the hydrolysate. *Candida guilliermondii* cells with high xylose reductase activity and low xylitol dehydrogenase activity were obtained during the fermentation runs. Besides, two by-products, ethanol and glycerol, were formed during the xylose-xylitol bioconversion, and xylitol proved to be a carbon source for *C. guilliermondii*. The figure 1 ilustres the metabolism of xylose to xylitol.

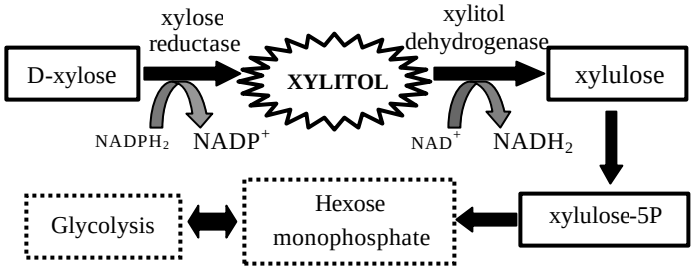

Fig.1. Schematic diagram of xylose metabolism in C.guilliermondii

Conclusion. *Candida guilliermondii* yeast, used in this bioprocess is a microorganism potentially useful for xylitol production from hemicellulosic substrates. However, as, lignocellulosic hydrolysates also contain several compounds that are toxic to the microorganisms, its is necessary to develop more efficient methods for detoxification of the hydrolysates. In addition, for the biotechnological production of xylitol to become competitive with to the chemical process, it is also necessary to improve microorganisms genetic and to keep investigating the inhibitory mechanism of the toxic compounds, as well as their individual and interactive effects on the xylose reductase and xylitol dehydrogenase enzymes.

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