**RECOVERY AND PURIFICATION OF XYLITOL PRODUCED BY THE BIOTECHNOLOGICAL ROUTE USING HEMICELLULOSIC HYDROLYSIS OF CASHEW APPLE BAGASSE AS FEEDSTOCK**

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**Highlights**

* Cashew apple bagasse can be used as substrate for the production of xylitol;
* The anti-solvent and cooling rate influence the crystallization process;
* High crystallization yield and crystals with high purity were obtained.

**1. Introduction**

The cashew bagasse, an abundant residue, can be used to produce xylitol (Albuquerque et al., 2015) due to its high content of hemicellulose, and after the hydrolysis it is possible to obtain sugars (i.e glucose and xylose) for the production of bioproducts (Albuquerque *et al*., 2015). These carbohydrates can be metabolized by microorganisms capable of transforming them into bioproducts, among them xylitol. Xylitol is a polyalcohol (C5H12O) with wide applicability, ranging from food industry products, as in sweeteners, and to pharmaceutical industry (Albuquerque *et al*., 2015; Misra et al., 2011).

Xylitol is produced in industrial scale by chemical hydrogenation of xylose, but this process presents high operating costs (Misra et al., 2011). Therefore, many studies have sought alternative routes for its production, such as in processes which microorganisms or their enzymes are involved. After the production of xylitol, the recovery and purification of the product exists. In literature, very little information is available about xylitol recovery and mainly reports are related to the obtainment and treatment of the hemicellulosic hydrolysate, its fermentation and metabolic bioconversion (Wei et al., 2010; Kaialy et al., 2014).

In this context, the biotechnological production of xylitol by yeast *Kluyveromyces marxianus* ATCC36907 using the hemicellulosic hydrolysate from cashew apple bagasse was performed with emphasis in the study of the crystallization process. In this crystallization process, different anti-solvents such as: ethanol, isopropanol and protic ionic liquid 2-(hydroxy)ethylammonium acetate (2-HEAA), percentages of anti-solvents and linear cooling rate were studied.

**2. Methods**

2.1. PREPARATION OF CASHEW APPLE BAGASSE HYDROLYSATE: Cashew apple (*Anacardium occidentale* L.) bagasse (CAB) was kindly provided by Jandaia Industry of Juice (Ceará, Brazil). The CAB was washed, dried at 60 °C for 24 h and milled to pass through 20-80 meshes. Cashew apple bagasse hydrolysate (CABH) was obtained from the treatment of CAB, with diluted acid sulfuric. The treatment was conducted in autoclave at 121 °C for 15 min, using 0.6 mol L-1 H2SO4 and a solid percentage of 20% w v-1. Afterwards, the liquid fraction was collected by vacuum filtration, the pH was adjusted to 6.0 ± 0.2 with Ca(OH)2, and it was filtrated to separate the precipitate. The filtrate, here named CABH, was used as culture media for xylitol production.

2.1 PRODUCTION OF XYLITOL: The biotechnological production of xylitol by *Kluyveromyces marxianus* ATCC36907 was carried out in a shaker using the CABH as fermentative medium. This production occurred at 30 °C, 180 rpm for 96 h using 10% v/v of inoculum.

2.2 SOLUBILITY CURVES AND CRYSTALLIZATION OF XILITOL: Initially, the solubility curves of xylitol in different anti-solvent: water, 50% v/v water-ethanol, 50% v/v water-isopropanol, protic ionic liquid (2% hydroxyethanolamine acetate - 2-HEAA) – water 50% w/v at temperature of 5 °C and 70 °C, were constructed. After, crystallization processes were performed, using xylitol PA and the fermentative medium, evaluating different proportion of anti-solvent (50% and 70%) and the linear cooling rate (0.25 °C/min and 0.5 °C/min).

**3. Results and discussion**

The xylitol was soluble in the four evaluated anti-solvents (water, ethanol, isopropanol and 2-HEAA) at high temperatures, and the solubility decreases with decreasing temperature. The highest solubility of xylitol was observed in water and the lowest solubility was in 2-HEAA. Due to the shape of the curves one can use crystallization by anti-solvent, or physical precipitation, facilitating the formation of crystals of medium size, and may occur primary or secondary nucleation.

In the experiments of crystallization, the influence of the anti-solvent ratio and the cooling rate (Cr) were evaluated. The three anti-solvents showed close yields in process using xylitol PA, except in the process using ethanol 70% v/v and Cr of 0.25 °C/min, which obtained the highest crystallization yield (93%). Cr influenced the crystallization yield, a higher rate favored crystallization using 70% v/v anti-solvent ratios. However, the low cooling rates favors the formation of crystals at a lower temperature. In some conditions, the produced xylitol was not crystallized using the anti-solvent 2-HEAA and the ethanol at Cr of 0.50 °C/min in both proportions (50% and 70%), and using 70% v/v of isopropanol applying both Cr. One possible reason is the presence of xylose in the fermentative medium. Higher crystal purity 85% and higher crystallization yield 69% were obtained using 50% v/v isopropanol. Similar results were obtained by Wei *et al*. (2010).

**4. Conclusions**

These results show that the studied microorganism can be applied in promising experiments based on xylitol production from CAB hemicellulosic hydrolysate as carbon sources. Moreover, it was possible to recover xylitol from the fermentation medium through the crystallization process.

**References**

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