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Assessment of the effect of autohydrolysis treatment in banana's pseudostem pulp

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ABSTRACT

Banana's pseudostem pulp (BPP) is a potential by-product obtained in the mechanical fiber extraction of banana's pseudostem. Its chemical characterization revealed to have an interesting composition, with a high polysaccharides content and low content in lignin, which makes it particularly relevant for the biorefinery's biochemical platform. Autohydrolysis pretreatment, studied under isothermal (140 °C) and non-isothermal conditions (140–220 °C), yielded oligosaccharides, mainly *gluco*-oligosaccharides, as the main soluble products. The highest oligosaccharides production (24 g/100 g raw material) was obtained at a severity factor of 2.3. Autohydrolysis pretreatment effectively disrupted the structure of the material, inducing an improvement of the enzymatic digestibility from 73% for the raw material up to 90% for the most severe conditions. Two stage autohydrolysis, with increasing severity, was also studied, allowing to obtain a higher amount of oligosaccharides (32 g/100 g raw material) and higher digestibility of the remaining solid (up to 97%).

1. Introduction

In recent years, there has been an increasing trend towards more efficient utilization of agro-industrial residues. Banana is cultivated over 130 countries, being the second largest produced fruit, after citrus (Mohapatra et al., 2010), and its residues are available around the world (Gabhane et al., 2014), including in Europe. Global production reached a record of 114 million tons in 2017 (FAO). Canary Islands is the largest banana producer region in the European Union, with 0.4 million tons of bananas produced each year (ASPROCAN).

As banana plants only bear fruit once in its lifecycle, once they have been harvested the plant is cut, producing significant amounts of agricultural residues. For each ton of fruit harvested, around four tons of lignocellulosic wastes are generated, among which 75% consists of banana plant pseudostem (Souza et al., 2014). This by-product is sometimes processed into low-grade animal feed by local farmers and has been used to produce various handcrafts, eating utensils, food wrapping, etc. (Santa-Maria et al., 2013); however in most cases it is usually left in the plantation, producing wastes accumulation and having no nutritional value for the soil. An interesting strategy to manage these wastes is the development of new applications, which could also represent an interesting income for banana producers, thus boosting the regional economy (Oliveira et al., 2007), particularly in the Canary Islands, where banana crop is an essential socio-economic pillar.

Mechanical fiber extraction is one of the most relevant alternatives proposed for the valorization of the pseudostem (Saraiva et al., 2012). This material contains 90% of moisture, 0.6% of fiber and 9.4% of pulp (Benítez et al., 2013). Banana fiber has high strength, lightweight, low elongation and shiny appearance, among other textile qualities (Sengupta et al., 2019) and it has been proven in different applications like composite materials (Ortega et al., 2013). Fiber extraction also produces important amount of a lignocellulosic by-product, banana's pseudostem pulp (BPP), which is the raw material in this study, and whose charac-

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