XXIII SINAFERM
XIV SHEB
XIV ENZITEC

Búzios, Rio de Janeiro, Brasil
28 a 31 de agosto de 2022
XXIII Simpósio Nacional de Bioprocessos
XIV Simpósio de Hidrólise Enzimática de Biomassas
XIV Seminário Brasileiro de Tecnologia Enzimática

Differences in chemical composition and physical properties caused by industrial storage on sugarcane bagasse result in its efficient enzymatic hydrolysis

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1. INTRODUCTION

Developing renewable energy technologies with low carbon emission is a global strategy for dealing with climate change and environmental challenges. The utilization of agricultural and household residues for heat, electricity, fuel, and chemical products, incurring little or no carbon debt, is regarded as one of the most promising renewable energy approaches[1].Sugarcane bagasse (SCB) is a promising feedstock for second-generation ethanol production[2]. Bioconversion of lignocellulose into fermentable sugars involves several technological steps, with biomass pretreatment being among the most expensive ones. Here, we set out to investigate how SCB storage under industrial conditions influences SCB's enzymatic saccharification in the absence of pretreatment. Two sets of SCB samples, fresh (fSCB) and around 6 months aged (aSCB), were collected at relevant industrial settings and compared in terms of their chemical composition, physical structure and efficiency of enzymatic hydrolysis. Chemical and physical analyses revealed significant differences between these samples which had a significant impact on the SCB enzymatic conversion. X-Ray diffraction showed that an average crystallite size is about 20% smaller in aSCB as compared to fSCB. Field emission scanning electron microscopy characterization revealed that fSCB is mainly composed of uniform fibers, while aSCB fibers are more disorganized and unstructured. Confocal laser scanning microscopy images of aSCB demonstrated changes in the autofluorescence spectra, indicating alterations in the lignin structure. Nuclear magnetic resonance relaxometry showed differences in the accessibilities between fresh and aged SCB. Both aSCB and fSCB were hydrolyzed using 25 mg of Cellic® CTec3 per gram of biomass (about 4.1 FPU g 1), and after 96 hours of enzymatic hydrolysis of aSCB without any thermomechanical pretreatment, the yield reached 93% while the fSCB hydrolytic yield was almost 40% smaller. These results can have significant impacts on the optimization of lignocellulosic biomass conversion processes

2. FIGURE

Figure 1. *Enzymatic hydrolysis efficiency*

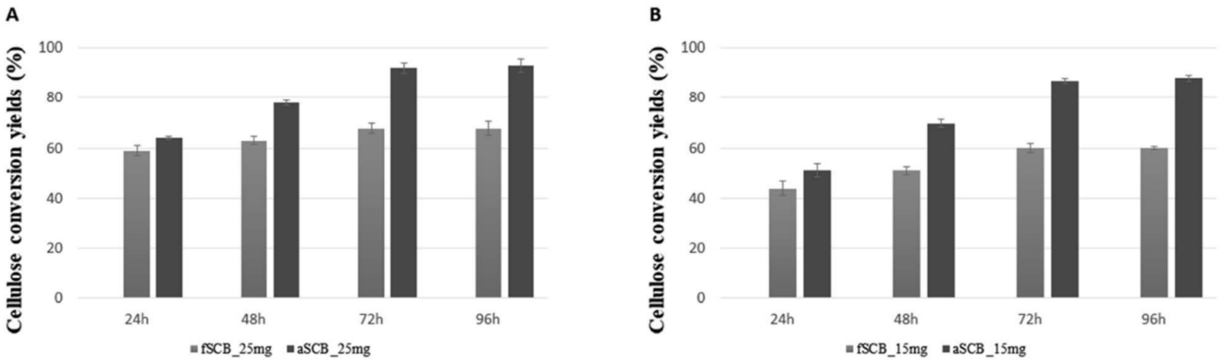

Figure. 1 Total cellulose conversion for fresh SCB and aged SCB over a period of 96 hours of hydrolysis. Enzymatic loading of 25 mg of cocktail (4.1 FPU) (A) and 15 mg of cocktail (2.5 FPU) (B) per g substrate.

3. REFERENCES

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4. ACKNOWLEDGMENTS

1 Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) via grant 15/13684-0,

2 Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) via grants 303988/2016-9 and 423693/2016-6