The inhibition of hemicellulosic sugars on cellulose hydrolysis are highly dependant on the cellulase productive binding, processivity, and substrate surface charges

Rui Zhai, Jinguang Hu, Jack N. Saddler

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The inhibition of hemicellulosic sugars on cellulose hydrolysis are highly dependant on the cellulase productive binding, processivity, and substrate surface charges

Rui Zhai[a, b], Jinguang Hu[b*] and Jack N. Saddler[b]

[a] School of Environmental and Biological Engineering, Nanjing University of Science and Technology, 200 Xiaolingwei Street, Nanjing 210094, China.
[b] Forest Products Biotechnology and Bioenergy Group, Department of Wood Science, Faculty of Forestry, The University of British Columbia, 2424 Main Mall, Vancouver BC, Canada.

Corresponding author: Jinguang Hu, Email: jinguang@mail.ubc.ca

Abstract

In this study, the influence of major hemicellulosic sugars (mannose and xylose) on cellulose hydrolysis and major enzyme activities were evaluated by using both commercial enzyme cocktail and purified cellulase monocomponents over a "library" of cellulosic substrates. Surprisingly, the results showed that unlike glucose, mannose/xylose did not inhibit individual cellulase activities but significantly decreased their hydrolytic performance on cellulose substrates. When various enzyme-substrate interactions (e.g. adsorption/desorption, productive binding, and processive moving) were evaluated, it appeared that these hemicellulosic sugars significantly reduced the productive binding and processivity of Cel7A, which in turn limited cellulase hydrolytic efficacy. Among a range of major cellulose characteristics (e.g. crystallinity, degree of polymerization, accessibility, and surface charges), the acid group content of the cellulosic substrates seemed to be the main driver that determined the extent of hemicellulosic sugar inhibition. Our results