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Arabinose substitution degree in xylan positively affects lignocellulose enzymatic digestibility after various NaOH/H_2SO_4 pretreatments in *Miscanthus*

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HIGHLIGHTS

- Xylan effect on biomass digestion remains unknown in *Miscanthus* and other grasses.
- Hemicelluloses positively affect biomass digestibility upon various pretreatments.
- Arabinose substitution degree in xylan is the key factor on biomass saccharification.
- Arabinose association with cellulose negatively affects cellulose crystallinity.
- Provide biomass digestion mechanism and a goal for xylan genetic modification.

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ABSTRACT

Xylans are the major hemicelluloses in grasses, but their effects on biomass saccharification remain unclear. In this study, we examined the 79 representative *Miscanthus* accessions that displayed a diverse cell wall composition and varied biomass digestibility. Correlation analysis showed that hemicelluloses level has a strong positive effect on lignocellulose enzymatic digestion after NaOH or H_2SO_4 pretreatment. Characterization of the monosaccharide compositions in the KOH-extractable and non-KOH-extractable hemicelluloses indicated that arabinose substitution degree of xylan is the key factor that positively affects biomass saccharification. The xylose/arabinose ratio after individual enzyme digestion revealed that the arabinose in xylan is partially associated with cellulose in the amorphous regions, which negatively affects cellulose crystallinity for high biomass digestibility. The results provide insights into the mechanism of lignocellulose enzymatic digestion upon pretreatment, and also suggest a goal for the genetic modification of hemicelluloses towards the bioenergy crop breeding of *Miscanthus* and grasses.
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1. Introduction

Lignocellulose, the most abundant biomass on earth, represents a major source of carbon for biofuels and other chemical compounds (Ragauskas et al., 2006). Non-food perennial grasses (such

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