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Exploring crystalline-structural variations of cellulose during alkaline pretreatment for enhanced enzymatic hydrolysis

Zhe Ling, Sheng Chen, Xun Zhang, Feng Xu*

Beijing Key Laboratory of Lignocellulosic Chemistry, Beijing Forestry University, Beijing 100083, China

Highlights

Crystallinity and crystallite size reduced under high alkaline concentration.

Low yield for 8 wt% NaOH were induced by increased crystallinity and hemicelluloses.

Mercerization to cellulose II allomorph enhanced the enzymatic accessibility.

Crystallinity of cellulose II provided a positive effect on enzymatic hydrolysis.

Abstract

The study aimed to explore the crystallinity and crystalline structure of alkaline pretreated cellulose. The enzymatic hydrolysis followed by pretreatment was conducted for measuring the efficiency of sugar conversion. For cellulose Iβ dominated samples, alkaline pretreatment (＜8 wt%) caused increased cellulose crystallinity and depolymerized hemicelluloses, that were superimposed to affect the enzymatic conversion to glucose. Varying crystallite sizes and lattice spacings indicated the separation of cellulose crystals during mercerization (8 wt%- 12 wt% NaOH). Completion of mercerization was proved under higher alkaline concentration (14 wt%- 18 wt% NaOH), leading to distortion of crystalline cellulose to some extent.