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A xylanase-aided enzymatic pretreatment facilitates cellulose nanofibrillation

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Abstract

Although biological pretreatment of cellulosic fiber based on endoglucanases has shown some promise to facilitate cellulose nanofibrillation, its efficacy is still limited. In this study, a xylanase-aided endoglucanase pretreatment was assessed on the bleached hardwood and softwood Kraft pulps to facilitate the downstream cellulose nanofibrillation. Four commercial xylanase preparations were compared and the changes of major fiber physicochemical characteristics such as cellulose/hemicellulose content, gross fiber properties, fiber morphologies, cellulose accessibility/degree of polymerization (DP)/crystallinity were systematically evaluated before and after enzymatic pretreatment. It showed that the synergistic cooperation between endoglucanase and certain xylanase (Biobrite) could efficiently "open up" the hardwood Kraft pulp with limited carbohydrates degradation (<7%), which greatly facilitated the downstream cellulose nanofibrillation during mild sonication process (90Wh) with more uniform disintegrated nanofibril products (50-150 nm, as assessed by scanning electron microscopy and UV-vis spectroscopy).

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