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PII: S0960-8524(17)30599-0
DOI: http://dx.doi.org/10.1016/j.biortech.2017.04.092
Reference: BITE 17987

To appear in: *Bioresource Technology*

Received Date: 15 March 2017
Revised Date: 21 April 2017
Accepted Date: 22 April 2017

Please cite this article as: Ji, H., Song, Y., Zhang, X., Tan, T., Using a combined hydrolysis factor to balance enzymatic saccharification and the structural characteristics of lignin during pretreatment of Hybrid poplar with a fully recyclable solid acid, *Bioresource Technology* (2017), doi: http://dx.doi.org/10.1016/j.biortech.2017.04.092

Using a combined hydrolysis factor to balance enzymatic saccharification and the structural characteristics of lignin during pretreatment of *Hybrid poplar* with a fully recyclable solid acid

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ABSTRACT

In this study, a new pretreatment strategy for lignocellulosic was developed using a fully recyclable solid acid, Toluenesulfonic acid (*p*-TsOH). A combined hydrolysis factor (CHF) as a pretreatment severity was used to balance enzymatic saccharification and the structural characteristics of lignin. The results from degradation of carbohydrates, enzymatic hydrolysis of cellulose and characterization of lignin by FT-IR, ^{31}P NMR, GPC, 2D-HSQC NMR indicated that a CHF of approximately 3.90 was the optimal pretreatment severity to facilitate enzymatic saccharification and the potential serviceability of lignin. Then approximately 90% of the xylan was removed to result in a reasonable sugar yield of 76%. Residual lignin showed low molecular weight (Mw, 5783 g/mol), narrow polydispersities (Mw/Mn, 1.10) and high content of phenolic hydroxyl groups (3.702 mmol/g); it may be a potential feedstock for phenol monomer and polymeric materials production. In short, this process was regarded as a promising approach to achieve an efficient conversion of lignocellulosic biomass to sugar products and lignin-based materials.

Key words: Fully recyclable solid acid; Combined hydrolysis factor; Enzymatic saccharification; Lignin

Introduction