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Hairui Ji, Yanliang Song, Xu Zhang, Tianwei Tan

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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

Hairui Ji, Yanliang Song, Xu Zhang *, Tianwei Tan

National Energy R&D Center for Biorefinery

College of Life Science and Technology, Beijing University of Chemical Technology, Beijing, China

Tel./fax: +86 10 64448962. E-mail address: zhangxu@mail.buct.edu.cn

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, ³¹P 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 (M_w, 5783 g/mol), narrow polydispersities (M_w/M_n, 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

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