Coproduction of ethanol and lignosulfonate from Moso bamboo residues

Caoxing Huang[1,2], Juan He[1], Qiang Yong[1]*, Hasan Jameel[2], Hou-min Chang[2]

[1]Co-Innovation Center for Efficient Processing and Utilization of Forest Products, Nanjing Forestry University, Nanjing 210037, China;

[2]Department of Forestry Biomaterials, North Carolina State University, Campus Box 8005, Raleigh, NC 27695-8005, USA

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Presenting author email:szxapy@163.com

In the course of utilization of moso bamboo, some fractions are not effectively utilized due to the weakness in mechanical properties. Only a part of these residues are recovered for energy production or made into activated carbon; the remainder are discarded resulting in environment pollution (Mui et al., 2008). As the bamboo residue is a kind of polysaccharides-rich lignocellulosic material, the polysaccharides can be converted to fermentable sugars by enzymatic hydrolysis for ethanol production. During the enzymatic hydrolysis, the released mono sugars are dissolved in liquid phase, leaving the lignin remaining in the solid substrates, which is termed enzymatic hydrolysis residue (EHR). The lignin can be recovered and used in the production of value-added products, such as dye dispersant, water reducer of cement, dispersant in oil drilling, and so on (Konduri and Fatehi, 2015).

In this work, a novel integrated process to coproduce ethanol and lignosulfonate from moso bamboo residues was investigated. The whole process includes using kraft pulping with low effective alkali (EA) charge to pretreat bamboo residues, enzymatic hydrolysis of the pretreated sample to release fermentable sugars (glucose and xylose), sequential fermentation of glucose and xylose for ethanol production, and sulfomethylation of the kraft lignin (generate from pretreatment process) and EMR to produce lignosulfonate (LG).

After kraft pulping (12 % EA charge) and enzymatic hydrolysis, 31.7 g of glucose and 11.0 g of xylose could be obtained from 100 g dry bamboo residues (Huang et al, 2015). For the lignin, 22.2 g of klasson lignin and 13.6 g of EHR were generated during kraft pulping and enzymatic hydrolysis processes, respectively. Under optimal condition, the conversion yields to LG of klasson lignin and EHR were 95.7 % and 73.4 %, respectively. After sequential fermentation, ethanol yields of glucose fermentation and xylose fermentation were 77.15 % and 73.4 %, respectively. As a result, 100 g dry bamboo residues could produce 15.5 g ethanol and 200 g hydrolyzate of sulfomethylation treatment containing 10.3 % lignosulfonate. This process may be a potential economically profitable of moso bamboo residues biorefinery.

Reference

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