



One-pot quantitative hydrolysis of lignocelluloses mediated by black liquor

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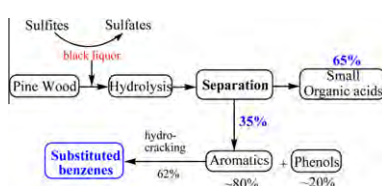
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HIGHLIGHTS

- ▶ Lignocelluloses are hydrolyzed into small organic molecules with good selectivity.
- ▶ Cellulose and hemicellulose into small organic acids, lignin into small molecular aromatics.
- ▶ Neither gasification nor black tar formation was observed.
- ▶ Most of sulphur-chemicals in black liquor are oxidized into sulphates.
- ▶ Oxygen-transfer between carbohydrates and lignin may be the possible reaction mechanism.

GRAPHICAL ABSTRACT



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ABSTRACT

Black liquor from the kraft process facilitates quantitative biomass hydrolysis converting cellulose and hemicellulose into organic acids such as lactic acid (~50%), and lignin into small molecular aromatics, without gasification and black tar formation. Oxygen transfer between lignin and carbohydrates may be the mechanism. With this method, three tons of lignocellulosic biomass can potentially produce up to one ton of lactic acid, and one ton of small molecular aromatics. This novel usage of black liquor is environmentally viable because it is accompanied by significant emission reduction of particulates, sulfur and nitrogen oxides, most organic sulfur compounds and sulfites of black liquor were converted into sulfates.

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1. Introduction

On Earth Day 2012, human beings began believing that we are approaching the “Turning Point in the Fight against Global Warming”. In July of 2012, Scientists confirmed that extreme weather events are caused by man-made climate change (Peterson et al., 2012). The survival of human beings depends on how soon we can replace petroleum oil with regenerable resources such as bio-

mass. Fossil oil is considered as the blood of contemporary human society, because it is the raw material of two necessities.

1. Transportation liquid fuels.
2. Fundamental organic chemicals.

In light of increased demands for energy, coupled with rapid depletion of fossil oil resources, extensive research has been carried out to identify fossil fuel alternative, especially for renewable resources that have the following criteria: availability, economics, acceptability, environmental and emissions, national security, technology, and versatility. Unfortunately, all thermo-chemical methods and bio-chemical methods researched by scientists can-

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