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Short Communication

Hydrothermal carbonization of lignocellulosic biomass

Ling-Ping Xiao [a], Zheng-Jun Shi [a], Feng Xu [a], Run-Cang Sun [a,b,*]

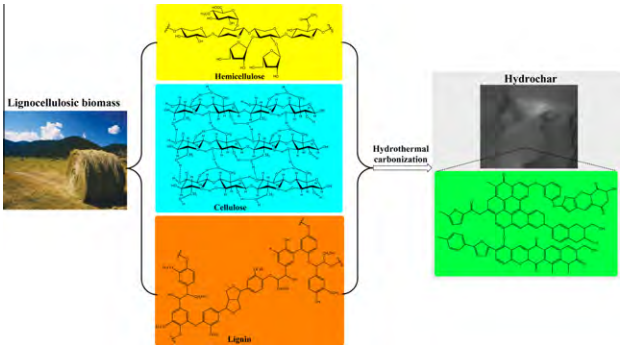
[a] Institute of Biomass Chemistry and Technology, Beijing Forestry University, Beijing 100083, China
[b] State Key Laboratory of Pulp and Paper Engineering, South China University of Technology, Guangzhou, Guangdong 510640, China

HIGHLIGHTS

- HTC allowed rapid conversion of biomass into a carbon-rich and lignite-like product.
- Carbonization involved in dehydration, decarboxylation, and demethanation processes.
- Solid residue and liquid product contained many value-added materials.
- Phenolic compounds and furan derivatives were analyzed by GC–MS.

GRAPHICAL ABSTRACT

Schematic representation of the possible formation processes of hydrochars from lignocellulosic biomass via hydrothermal carbonization.



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ABSTRACT

Hydrothermal carbonization (HTC) is a novel thermochemical conversion process to convert lignocellulosic biomass into value-added products. HTC processes were studied using two different biomass feedstocks: corn stalk and *Tamarix ramosissima*. The treatment brought an increase of the higher heating values up to 29.2 and 28.4 MJ/kg for corn stalk and *T. ramosissima*, respectively, corresponding to an increase of 66.8% and 58.3% as compared to those for the raw materials. The resulting lignite-like solid products contained mainly lignin with a high degree of aromatization and a large amount of oxygen-containing groups. Liquid products extracted with ethyl acetate were analyzed by gas chromatography–mass spectrometry. The identified degradation products were phenolic compounds and furan derivatives, which may be desirable feedstocks for biodiesel and chemical production. Based on these results, HTC is considered to be a potential treatment in a lignocellulosic biomass refinery.

1. Introduction

Hydrothermal carbonization (HTC) is a novel thermochemcial conversion process to convert lignocellulosic biomass into value-added products. Recently, HTC method has attracted a great deal of attention because it uses water which is inherently present in green biomass, non-toxic, environmentally benign, and inexpensive medium (Libra et al., 2011). Typical HTC of biomass is achieved in water at elevated temperatures (180–250 °C) under saturated pressures (2–10 MPa) for several hours (Funke and Ziegler, 2010; Mumme et al., 2011). Some publications have reported on the chemical transformations of model compounds under pressure in HTC processes, particularly cellulose, pentoses/hexoses (glucose and xylose), starch, and phenolic compounds (Titirici et al., 2008; Sevilla and Fuertes, 2009; Ryu et al., 2010; Dinjus et al., 2011). However, the majority focused on model compounds and establishing the reaction kinetics and reaction pathways of such compounds in hydrothermal medium. So far, literature on the hydrothermal

* Corresponding author at: Institute of Biomass Chemistry and Technology, Beijing Forestry University, Beijing 100083, China. Tel./fax: +86 10 62336903.
E-mail address: rcsun3@bjfu.edu.cn (R.-C. Sun).

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