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Short Communication

Thermogravimetric kinetics of *sugarcane bagasse* pretreated by hot-water

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ABSTRACT

The thermogravimetric of *sugarcane bagasse* pretreated by hot-water has been studied in this paper. Results indicated that residual solid pretreatment by hot water could decrease the activation energy of phase 2 (270–350 °C) obviously, which makes the pyrolysis more energy-saving. By hot water pretreatment, the hemicellulose, especially xylose (9.78%/o.d. dry mass at 170 °C and 1 h) was greatly extracted into hydrolyzates liquor. Greatly minimized hemicellulose waste at low temperature during pyrolysis also agreed with biorefinery concept. Therefore, *bagasse* with hot-water pretreatment should be a good pyrolysis material for value-added material.

1. Introduction

Non-renewable fuel is facing scarcely and the energy consumption is keeping grows at rising rate, which compel researchers to found out newly alternative material to meet the energy demanding (Ragauskas et al., 2006). Lignocellulose biomass, as a most available and renewable resources, represent a promising low cost raw material for the production of biofuel, bioenergy and added value bimolecular (Panwar et al., 2011). *Sugarcane bagasse* (SCB), as an abundant source of agriculture waste, has roused researchers' interesting (Ojeda et al., 2010).

Recently, biomass decomposition has attracted significant attention for the one single process of pyrolysis and the first step to combustion and biomass gasification. However, the heat value of hemicellulose is much lower than other composition of biomass (Van Heiningen, 2006); it's a waste to pyrolysis the lignocellulose as entirety. Hemicelluloses are mainly composed of xylans, provide an important source of interesting molecules such as xylose and xylo-oligosaccharides which have potential applications in different areas (Girio et al., 2010). Integrated with biorefinery concept (Carvalheiro et al., 2008), i.e. pretreated lignocellulose to separate hemicellulose for other value added chemical and then pyrolysis the residual solid, would generate much more potential value. Several technologies were proposed for fractionation or extraction of hemicellulose, such as alkaline pretreatment (Beukes and Pletschke, 2011), acid pretreatment (Taherzadeh and Karimi, 2008), organosolvation method (Papatheofanous et al., 1995), wet oxidation (Martin et al., 2007) and so on. However, the hydrothermal treatment is considered the efficiency way for xylan yields and compatible with sustainability and biorefinery concepts (Nabarlatz et al., 2007).

In thermo-chemical processes of conversion of biomass into energy and products, the thermal decomposition kinetics of biomass is a key component. Non-isothermal thermogravimetric analysis (TGA) is proved to be one of the best methods for the study and understanding of the kinetics of pyrolysis (Saddawi et al., 2010). Lastly, iso-conversional models have been developed, according to which only a single step process is considered (Simon, 2004). By using such a model, the activation energy for the whole reaction is estimated as a function of the heating rate and the process temperature without previous assumptions on the reaction mechanism. Therefore, the need for accurate reaction kinetics and a good knowledge of the reaction scheme is eliminated.

In this study, hydrothermal pretreated was selected by varied the hot-water temperature at the range of 150–190 °C. The thermochemical properties shifting of the solid were observed based on the TG/DTG curves.

2. Methods

2.1. Material and chemical component

SCB used in this study was collected from Nanning City, Guangxi Province, China. Before experiment, the SCB was screened, air-dried at room temperature, and stored in a polythene bag. Typical chemical compositions of the SCB were analyzed according to China National Standards (GB), giving the following results: a moisture content of 7.82% (GB/T 2677.2-1993), a soluble content in ethanol–benzene of 1.94% (GB/T 2677.6-1993), lignin content of 21.0% (GB/T 2677.8-1993), respectively.

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