Bioresource Technology 126 (2012) 64–70

Contents lists available at SciVerse ScienceDirect

Bioresource Technology

journal homepage: www.elsevier.com/locate/biortech

Biorefinery process for production of paper and oligomers from *Leucaena leucocephala K360* with or without prior autohydrolysis

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HIGHLIGHTS

- *Leucaena leucocephala* was subjected to a two-stage fractionation process.
- *L. leucocephala* was obtained a valorized liquor, containing hemicellulose derivatives.
- The properties of the pulp sheets were better obtained with prior autohydrolysis.

ARTICLE INFO

Article history:
Received 23 July 2012
Received in revised form 12 September 2012
Accepted 13 September 2012
Available online 24 September 2012

Keywords:
Biorefinery
Autohydrolysis
Oligomers
Soda-anthraquinone process
Leucaena

ABSTRACT

Lignocellulosic material from *Leucaena leucocephala* was subjected to a two-stage fractionation process to obtain a valorized effluent containing hemicellulose derivatives and a solid phase for producing cellulose pulp by conventional soda-anthraquinone delignification. This solid phase allows the production of cellulose pulp, under less rigorous conditions from NaOH-AQ process (177 °C, 21%, 120 min) than without pretreatment delignification (185 °C, 25%, 150 min) and better or similar properties in the paper sheets obtained (yield 27.6 and 34.0%, brightness 39.3 and 31.6% ISO, tensile index 7.8 and 10.5 N m/g, burst index 0.43 and 0.29 MPa m^2/kg with and without previous autohydrolysis) have be found. Also, the first autohydrolysis stage allows up to 46.6% of the initial hemicellulose in the raw material to be extracted as xylooligomers, xylose and furfural into the liquid phase.

1. Introduction

Lignocellulosic biomass (LCB) is considered to be a major source for 'green' chemicals, biofuels, and biobased products. Among the advantages of using LCB can be mentioned that it is abundantly available around the world, non competitive with food production, and it is a renewable and sustainable resource. Achieving more advantageous use of these natural renewable resources is a political goal in which societies are more and more immersed. This is especially the case when biomass derived products can become competitive with fossil oil derivatives in the short term. To meet this challenge, the biorefinery concept is receiving a renewed interest, with emphasis on using all the fractions present in plant biomass (Ligero et al., 2011). Biorefining is the sustainable processing of biomass into spectrum of marketable products (food, feed, materials and chemicals) and energy (fuels, power and heat) (Huijgen et al., 2012).

The biorefinery or integral fractionation from lignocellulosic biomass can be achieved using various stages of hydrolysis and delignification. The development of wood autohydrolysis and acid-catalyzed prehydrolysis dates back to the 1940s (Overbeck and Muller, 1942). In the field of cellulosic pulp and paper, by means of these processes, short-chain polysaccharides are removed from wood before the production of dissolving pulp (Rydholm, 1965). Today, autohydrolysis is seen as a potential stage to precede alkaline pulping for the production of both paper grade and dissolving-grade pulps. In conventional alkaline pulping, the dissolved hemicelluloses are mainly used as low calorific value fuel. Autohydrolysis applied before pulping yields low molecular weight xylooligosaccharides and monomeric xylose as well as

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http://dx.doi.org/10.1016/j.biortech.2012.09.051