Chapter 8
Biomass Processing Routes for Production of Raw Materials with High Added Value: Prospects and Challenges for the Developing Routes

Rubens Maciel Filho
University of Campinas, Brazil

Laura Plazas Tovar
University of Campinas, Brazil

Yurany Camacho Ardila
University of Campinas, Brazil

Jaiver Efrén Jaimes Figueroa
University of Campinas, Brazil

Maria Regina Wolf Maciel
University of Campinas, Brazil

ABSTRACT

In this chapter sugarcane bagasse may be submitted to a biological route in which the technologies used to obtain lignocellulosic ethanol (2nd generation ethanol) from lignocellulosic materials involve pre-treatment and the hydrolysis of the polysaccharides in the biomass into fermentable sugars for subsequent fermentation. Taking into consideration the use of sugarcane bagasse as a raw material for 2nd generation ethanol, the acid hydrolysis / pretreatment of sugarcane bagasse could be more

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feasible that others, and must be evaluated in this context. On the other hand, from biomass is possible to obtain products with high added value and energy, mainly by the use of thermochemical processes (e.g. pyrolysis and gasification) and biochemical processes (e.g., fermentation and anaerobic digestion). However, the products obtained from the thermochemical processes can be used as raw material for biochemical processes which multiplies the quantity of products to be obtained from biomass.

INTRODUCTION

One of the alternatives that could be implemented for the agro-industries to continue increasing their production of biofuels as well as to provide feedstock for chemicals is to use the byproducts formed as a source of energy. Amongst these by-products, sugarcane bagasse occupies a prominent position in Brazilian agricultural activities. The interest in sugarcane bagasse in Brazil is justified by the fact that it is available in the ethanol and sugar production units, without the problems and costs associated with the logistics and transport of lignocellulosic materials. A glance in this material brings huge possibilities for use, amongst which in the production of animal feed, in the chemical industry, in the production of microbial biomass and in the production of 2nd generation ethanol via sugarcane bagasse and straw to generate electricity.

The biological technologies used to obtain ethanol from lignocellulosic materials (2nd generation ethanol) involve pre-treatment and the hydrolysis of the polysaccharides in the biomass into fermentable sugars for subsequent fermentation. Pre-treatment is necessary due to the strong bonds existing between the cellulose, hemicelluloses and lignin. Thus, the lignocellulosic biomass requires selective separation of the components; this implies in rupturing the cellulose-hemicelluloses-lignin complex and the removal of each fraction by pre-treatment techniques for subsequent enzymatic degradation, if that is the route chosen for the hydrolysis step. Various pre-treatment methods have been proposed and developed. These methods can be classified in different methods: physical, chemical and biological pre-treatments or a combination of these, aiming at reducing the recalcitrance of this lignocellulosic biomass (sugarcane bagasse). Among all these methods the chemical and combined pre-treatments have drawn more attention, since they remove the lignin without degrading the cellulose chain (Sun & Cheng, 2002), and more recently physical methods (Boussarsar, Rogé, & Mathlouthi, 2009) and combined methods (Rocha, Martín, da Silva, Gómez, & Gonçalves, 2012) have been more extensively considered.

Nowadays, liquid hot water (LHW) pretreatment associated with high pressure carbon dioxide (HP-CO₂) from depicted sugarcane bagasse coupled to enzymatic
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