

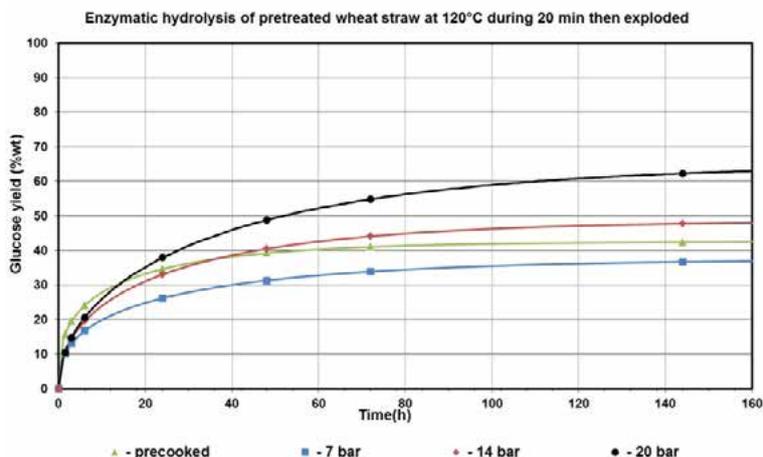
5th World Bioenergy Congress and Expo

June 29-30, 2017 Madrid, Spain

Specific effect of explosive decompression during steam explosion pretreatment of wheat straw

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Bioethanol represents an important biomass-derived fuel, which is produced by the biochemical conversion of lignocellulosic biomass. Currently, the steam explosion pretreatment is often defined as the best pretreatment at the economic and industrial level. Schematically this pretreatment can be decomposed in two stages. The first stage is an acid hydrolysis which mainly depolymerizes the hemicelluloses and the second stage is an explosive decompression which leads to mechanical disruption of biomass. The steam explosion pretreatment has been examined in many studies for maximizing the xylose yields and enhancing the enzymatic digestibility of the cellulose fractions. It has been stated that this pretreatment enables to decrease particle size, disrupt plant cells and make the biomass woollier, resulting in an increased surface area and a better accessibility of carbohydrates to enzymes. However, few authors have been independently studied the impact of the two stages on the substrate enzymatic reactivity. To our knowledge, only two articles studied the specific effect of the explosive decompression and their conclusions are opposing. Brownell et al. demonstrated that the decompression is unnecessary for the increase of cellulose accessibility of aspen wood and that the high level of digestibility is only performed by chemical autohydrolysis reactions. Unlike Pielhop *et al.* examined an improvement of cellulose digestibility for spruce wood with increase of pressure drop. For Pielhop *et al.*, the positive effect may be due to the biomass species and/or to the less-hard acid-hydrolysis conditions. In this work, 20 mm wheat straw is pretreated in various operating conditions. As a first step, the biomass is cooked in presence of 1 wt% of sulfuric acid in a conventional autoclave at low severity conditions (diluted-acid cooking). Then, the pretreated substrate is washed thoroughly and introduced into a steam explosion batch reactor where several pressure drops are applied. After complete compositional analysis and enzymatic hydrolysis of the different pretreated wheat straws, we were able to see positive effect of explosive decompression on precooked substrates at low severity and the increase of enzymatic hydrolysis reactivity when the pressure drop increases.



Biography

Charlotte Loustau Cazalet obtained her Master of Science from the UBO (Universite de Bretagne Occidentale) in 2014. After graduation, she worked for one year at the INRA labs of Montpellier for biofuel production by dry fractionation of lignocellulosic biomass. Since 2015, she is a PhD student at IFP New energies and her thesis is co-supervised by INP Pagora Grenoble and the Laboratory of Industrial and Biological Chemistry at the University of Liege.

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