Optimization of hemicellulose hydrolysis from rice straw under very dilute acid conditions

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Rice is one of the most important cereal crops in the world, together with corn and wheat. Rice residues (husks and straw) are produced in large quantities and are usually used in low value agricultural related applications, combustion to produce energy or left in the fields. But, as these materials have high polysaccharide content, they can be upgraded to produce numerous products, such as chemicals, materials or fuels, in the biorefinery framework.

In order for this potential to be met, the biomass fractionation must be carefully studied. Environmental friendly processes, yielding separate streams that can be further used for different product lines, are preferential. Many pretreatment methods have been studied and among them, autohydrolysis and the use of dilute inorganic acid hydrolysis are the main choices. These processes are oriented either towards the production of xylo-oligosaccharides, which are potential food ingredients, nutraceuticals, and bioactive polymers (autohydrolysis), or to monomeric sugars (acid hydrolysis). Typically autohydrolysis requires higher temperatures and presents lower hemicelluloses recoveries. Conversely acid hydrolysis presents higher recoveries, but imposes the use of catalysts and their subsequent neutralization together with lower sugars recovered in the added-value oligomeric form.

In this work, we introduce and apply the concept of “assisted autohydrolysis”, to rice straw in which the material was subjected to autohydrolysis in the presence of very dilute acid for different temperatures and non-isothermal conditions.

In order to assess the effects of reaction severity in products formation, the composition of both liquid and solid phases was evaluated. The yields of the solid residue and of the soluble products, namely oligosaccharides, monosaccharides, acetic acid and degradation compounds, such as furfural, hydroxymethylfurfural are presented and interpreted using the combined severity parameter (*CS*). The results, in particular the oligosaccharides yield and composition and soluble saccharides recovery are discussed and compared to more hydrothermal standard pretreatment conditions.

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