Pretreatment of lignocellulosic materials for high pentose recovery

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Lignocellulosic materials are the largest renewable and potentially sustainable sources that can be used in a biorefinery framework for the production of biofuels, chemicals and value-added products. Wheat straw (WS), eucalyptus residues (ER) and olive tree pruning (OP) are abundant lignocellulosic materials in the Mediterranean region and have interesting chemical compositions that encourage their study aiming their valorisation by the biochemical approach. In this framework, biomass fractionation processes are an absolute requirement. The autohydrolysis is an efficient process for the selective hemicellulose solubilization of these materials, leaving the cellulose and lignin fractions mostly intact in the solid phase. But, as the hemicellulosic fraction is only partially hydrolyzed, the resulting liquors are constituted mainly by xylo-oligosaccharides and a dilute-acid post-hydrolysis step is necessary to obtain monosaccharides, mainly pentoses.

In this work, the autohydrolysis of WS, ER and OP was performed for different temperatures (205, 210, 215 and 220ºC) under non-isothermal conditions. The oligosaccharides hydrolysis was further studied using dilute-sulphuric acid (4% w/w) at 121ºC. The resulting hydrolyzates were characterized and observed that the maximal pentoses recovery (xylose and arabinose) was obtained at similar conditions for all feedstocks, although with different final concentrations (25.8; 18.6 and 17.6 g/L to WS, ER and OP, respectively), together with low sugar degradation products. These results show that autohydrolysis together with dilute-acid hydrolysis is an efficient combined process for pentose's recovery and the composition of the hydrolyzates suggests their feasible utilization in fermentative processes.

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