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BIOENERGÍA Y BIOPRODUCTOS

Título:
Autohydrolysis of multi-feedstocks by liquid hot water pretreatment and enzymatic hydrolysis of the pretreated solids

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Comunicación:
Lignocellulosic material (LCM), including agricultural and agroindustrial feedstocks, is a complex matrix composed by cellulose (30–50 %), hemicellulose (15–35 %), and lignin (10–20 %). The bioconversion of renewable LCM to value-added products is globally gaining significant importance, mainly due to great availability and low cost. However, this material presents a structure highly robust and resistant to any kind of hydrolysis. This highly recalcitrant nature is related to presence of lignin, the degree of crystallinity of cellulose, the degree of polymerization of the polysaccharides, and the available surface area. Thus, pretreatment is required to alter its structure and chemical composition and promote the fractionation of feedstocks.
In this context, this work evaluated liquid hot water (LHW), at 190ºC for 30 min, as a strategy of pretreatment to fractionate several agricultural feedstocks, including: brewers' spent grains (BSG), corncob (CC), corn husk (CH), wheat straw (WS) and Luffa sponge (LS), in order to increase cellulose recovery and the enzymatic conversion of cellulose into glucose.
HPLC analysis showed that LHW-pretreatment resulted in hemicellulose solubilization into the liquid phase, and a solid phase enriched in cellulose (used as substrate for further enzymatic hydrolysis). The highest and lowest content of cellulose was recovered for LS (70.80%) and BSG (26.55%), respectively. Comparative chemical analysis showed a varied susceptibility of feedstocks to LHW-pretreatment and enzymatic hydrolysis (EH). The removal of the hemicellulose from pretreated feedstocks lead to an increase in the cellulose crystallinity (X-ray analysis) and thermal stability (TGA analysis) of solid material, which improved the EH, with exception of LS. EH was performed using 5% (w/v) pretreated solids loading, 15 FPU Cellic Ctec2 (cellulase cocktail) and 15 IU NS 22083 (xylanase) per gram of dry solid. The percentage of cellulose conversion to glucose (in relation to potential glucose in the pretreated solids) followed the order: BSG > CH > WS > CC > LS, which was improved in comparison with the untreated material, with exception of LS. Pretreatment showed to be a necessary step for improving the EH of recalcitrant agricultural feedstocks to sugars, which can be further converted to ethanol-fuel and other value-added chemicals.