Novel butanol pretreatment significantly improves delignification and saccharification of different lignocellulosic biomasses

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Introduction
Organosolv pretreatment using diluted acid and butanol allows the separation of cellulose, hemicelluloses and lignin into three distinct phases [1]. The butanol process has been investigated on six different biomasses: tall fescue, sugarbeet pulp, sugarcane bagasse, beech wood, eucalyptus and Japanese cedar. Dilute acid pretreatment has been performed under similar conditions for comparison.

Experimental
6 g ground biomass was suspended in 20:60 mL n-butanol/ H2SO4 1% [v/v]. Each experiment was conducted for 45 min cooking time at 200 rpm at 180°C in laboratory scale thermostirrer. Carbohydrates and fermentation inhibitors (acetate, formate, 5-HMF and 2-furfural) were analyzed by GC–MS. Saccharification was performed on pretreated biomass (100 mg mL–1) by the cellulase Cellic CTec2 at a load of 6.6 FPU g–1 at 50°C for 72h [2]. Solid surfaces were characterized using Scanning Electron Microscopy (SEM).

Results and Discussion

Table 1. Yield of the best enzymatic saccharification achieved on cellulosic pulp (from sugarcane bagasse).

<table>
<thead>
<tr>
<th>Sugar cane bagasse</th>
<th>Dilute Acid</th>
<th>Butanol</th>
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<tbody>
<tr>
<td>Cellulose (%)</td>
<td>53.0 ± 1.0</td>
<td>80.7 ± 1.9</td>
</tr>
<tr>
<td>Mass loss (%)</td>
<td>9.9 ± 0.4</td>
<td>77.5 ± 0.7</td>
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<tr>
<td>Yield (%)</td>
<td>18.7</td>
<td>96.0</td>
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<tr>
<td>[C]glucose (mg mL–1)</td>
<td>2.3 ± 0.3</td>
<td>11.6 ± 0.3</td>
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The best results were obtained on sugarcane bagasse. Up to 87% delignification was achieved, a 96% pure lignin fraction was obtained. Saccharification of the recovered pulp was greatly improved as reported on Table 1. Inhibitors concentration in aqueous phase was decreased by solubilization in the butanol phase.

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References