

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

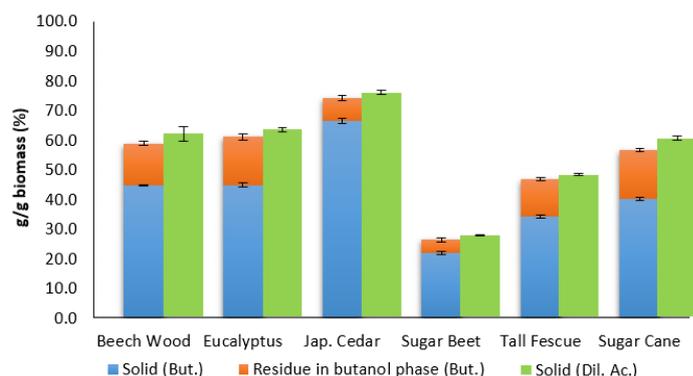


Figure 1. Delignification improvement of butanol pretreatment (blue & orange) compared to dilute acid (green).

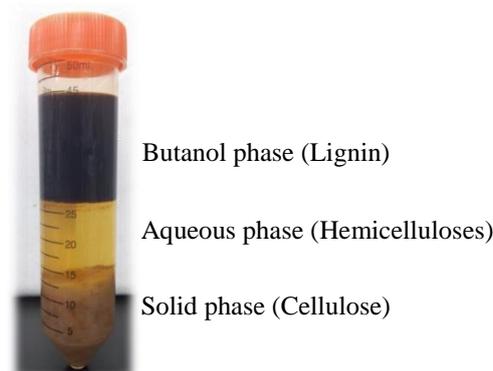


Figure 2. Different fractions after butanol pretreatment.

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

		^a Cellulose (%)	^b Mass loss (%)	^c Yield (%)	^d [C] _{glucose} (mg mL ⁻¹)
Sugar cane bagasse	Dilute Acid	53.0 ± 1.0	9.9 ± 0.4	18.7	2.3 ± 0.3
	Butanol	80.7 ± 1.9	77.5 ± 0.7	96.0	11.6 ± 0.3

^aCellulose in the solid residue after pretreatment/ ^bMass removed after enzymatic saccharification
^cPercentage of cellulose hydrolyzed/ ^dConcentration of glucose produced

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.

Acknowledgements

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References

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