MODIFICATIONS ON SUGARCANE BAGASSE FIBERS AFTER SPORL PRETREATMENT AT DIFFERENT TEMPERATURES

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Introduction. Sugarcane bagasse is a lignocellulosic feedstock of interest for cellulosic ethanol production because of its high productivity, low inputs, and positive environmental effects. Processes and platforms that can efficiently and economically convert lignocellulosic biomass to ethanol are still deficient. In this study, the SPORL (sulfite pretreatment to overcome recalcitrance of lignocelluloses) process was proposed for sugarcane bagasse pretreatment. This process is reported to cause changes on biomass fiber surface, such as reduction of the polymerization degree, removal of the hemicellulose and lignin sulfonation, making the biomass more susceptible for further enzymatic saccharification (1).
The objective of this study was to evaluate the modifications occurred in the sugarcane bagasse fibers after SPORL pretreatment at different temperatures.

Methods. Different samples of sugarcane bagasse were pretreated with a solution of Na_2SO_3 5% (g reagent/g biomass), pH 2.1 (adjusted with H_2SO_4), at 130, 150 and 160 °C, for 2 h. Subsequently, the pretreated material was refined in an industrial blender, washed and dried at room temperature. The percentage of cellulose, hemicellulose and lignin was determined as described by Ferraz et al. (2). The samples were also characterized regarding the contents of sulfonic groups (SG), water retention (WRV), SEM, FITR and XRD.

Results.

Table 1. Chemical characterization of sugarcane bagasse samples pretreated with acid sulfite at different temperatures.

Samples	T (°C)	Y (%)	C	H	L
VC	in natura	100.0	43.7	27.3	24.4
	130	73.2	31.5	15.6	18.5
	150	78.1	39.4	12.6	18.4
	160	70.7	40.3	6.4	15.2
H89	in natura	100.0	43.6	29.5	18.2
	130	85.4	33.5	21.4	17.0
	150	65.7	33.4	11.7	12.0
	160	65.0	37.5	8.0	12.4
H146	in natura	100.0	41.9	32.4	19.0
	130	78.0	31.3	20.9	17.0
	150	82.2	33.2	20.5	17.0
	160	64.9	38.2	7.4	13.6
H166	in natura	100.0	44.0	32.1	20.0
	130	87.1	33.8	23.3	20.5
	150	70.8	39.5	9.4	14.9
	160	71.3	38.3	9.4	15.2

T: temperature; Y: pretreatment yield; C: cellulose (g/100g biomass); H: hemicellulose (g/100g biomass); L: lignin (g/100g biomass).

The SPORL process was able to remove over 70% of hemicellulose and 20% of lignin present in all the sugarcane bagasse samples (Table 1). Among the tested samples, H146 showed the best correlation between the variables. The temperature increase caused an increase in the sulfonation degree of the residual lignin, while the water retention (WRV) was decreased (Fig 1). The crystallinity of the H146 sample was increased (Fig 2) with the hemicellulose removal increase.

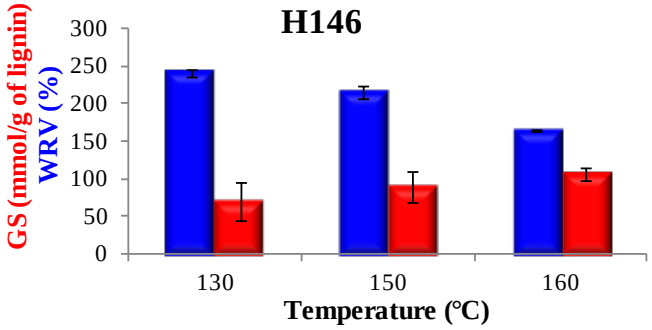

Fig.1. Analysis of sulfonic groups and water retention of sugarcane bagasse H146 pretreated with acid sulfite at different temperatures.

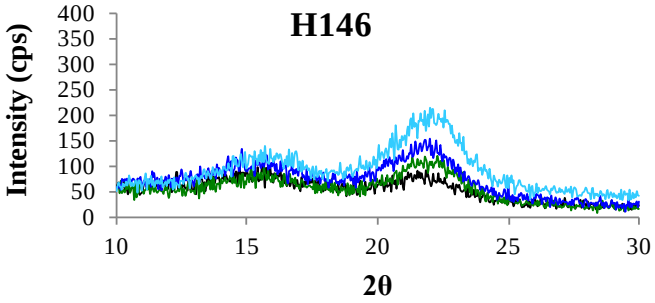

Fig.2. X-Ray of sugarcane bagasse H146 pretreated with acid sulfite at different temperatures. Black: in natura; green: 130 °C, blue: 150 °C and cyan: 160 °C.

Conclusions. This study demonstrated that the temperature increase leads to a greater removal of hemicellulose, main change on sugarcane fiber able to directly influence the other variables.

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References

1. Zhu JY, Pan XJ, Wang GS, Gleisner R. (2009). *Bioresource Technol.* 100:2411-2418.
2. Ferraz A, Baeza J, Rodriguez J, Freer J. (2000). *Bioresource Technol.*74:201-212.