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UNDERSTANDING THE EFFECT OF ALKALINE PRETREATMENTS OF LIGNOCELLULOSIC BIOMASS ON CELL WALL STRUCTURE

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The emerging biorefinery concept is highly attractive to optimize lignocellulosic biomass use (Ghatak 2011). Sorghum has a high genotypic and phenotypic variability and it presents several environmental advantages as it needs few inputs. This crop has a high aboveground biomass production with a high valorization potential and can also be grown as catch crop. It has been studied and used for several energy vectors production such as bioethanol, biohydrogen or biogas. All the biological processes rely on cellulose and hemicelluloses hydrolysis and fermentation; however polysaccharides accessibility in lignocellulosic biomass is limited by lignin and its links with polysaccharides. Consequently, biomass pretreatment is a key step in bioreffinery for cell wall deconstruction and increase the accessibility of sugars to enzymes and microorganisms. Among efficient pre-treatments for delignification, chemicals and more precisely alkaline have been highlighted prior both enzymatic hydrolysis in bioethanol process (Mood et al., 2013) and anaerobic digestion (Monlau et al. 2012).

The aim of this study was to understand and compare the mechanisms of alkaline pretreatments on sorghum stem cell wall. For this purpose, three pretreatments (NaOH 10g/100g_{TS}, CaO 10g/100g_{TS} and NH_4OH 1L/100g_{TS}) in liquid medium (90 g_{TS}/L) were applied on 1 mm stem fragments of two genotypes (B140 and IS 30405). To analyse the impact of alkali pretreatment on sorghum cell wall structure, we conducted an original histochemical study on raw and pretreated biomass using FASGA staining (Tolivia and Tolivia 1987) and phloroglucinol lignin staining. In this way, we monitored the plant cell wall change. In addition cellulose, hemicelluloses and lignin contents were measured by acid hydrolysis (Table 1).

Table 1: Composition of raw and pretreated sorghum genotypes

	Hemicelluloses (%TS)	Cellulose (%TS)	Klason lignin (% TS)
B 140	**18.3 ± 0.4**	**27.7 ± 0.8**	**13.7 ± 1.5**
B140 NaOH	15.4 ± 1	23.1 ± 1.8	13.3 ± 1.1
B140 CaO	14.8 ± 0.2	20.8 ± 1	12.1 ± 0.9
B 140 NH_4OH	15.4 ± 2.5	24.9 ±1.9	nd
IS 30405	**20.4 ± 0.4**	**31.6 ± 0.3**	**17.8 ± 0.2**
IS NaOH	18.8 ± 0.06	29.3 ± 0.1	16.9 ± 0.6
IS CaO	18.0 ± 0.2	26.9 ± 1.1	16.3 ± 0.8
IS NH_4OH	11.8 ± 1.9	19.3 ± 1.2	nd

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