Influence of demineralization on thermal degradation of bagasse and harvesting residues of sugarcane

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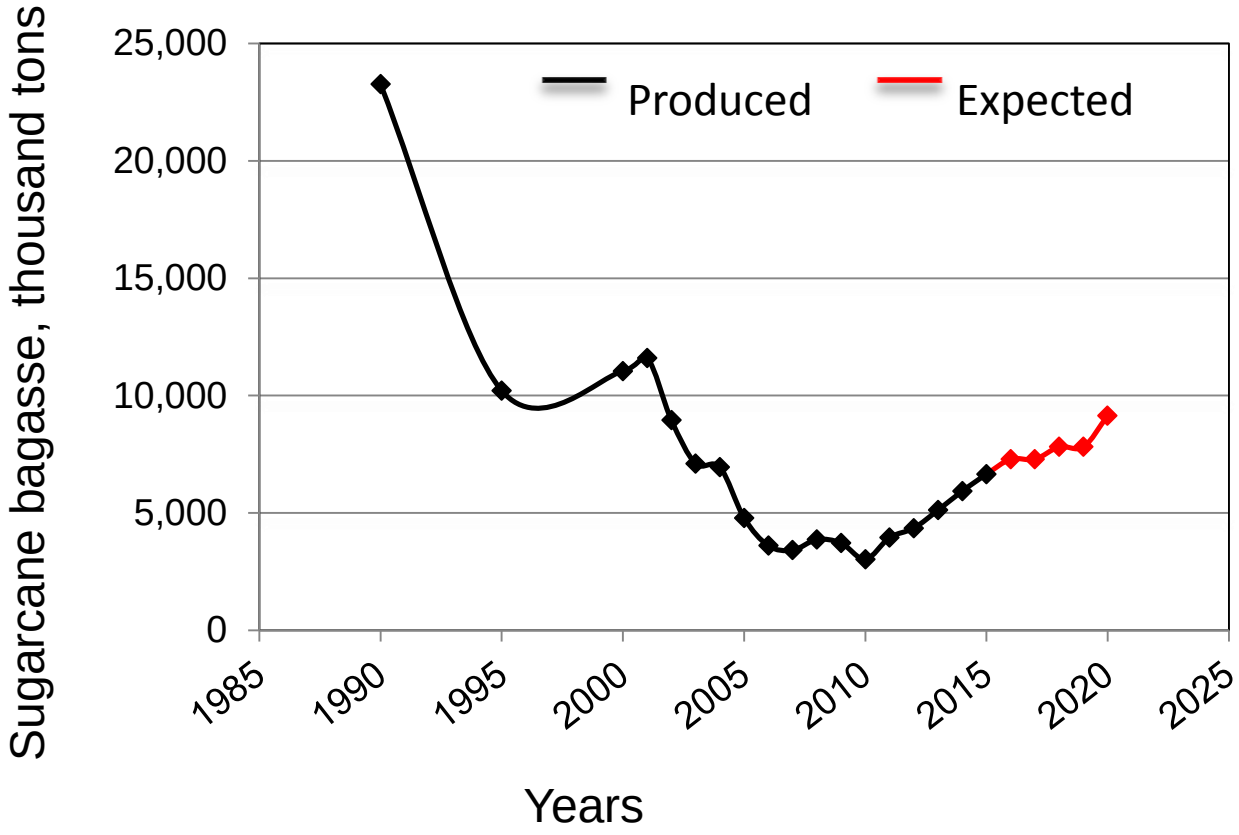
Authors: Rodríguez-Machín, L.; Arteaga-Pérez, L.E.; Pérez-Bermúdez, R.A.; Casas- Ledón, Y.; Prins, W.; Ronsse, F.

Universidad Central de Las Villas, Cuba

Ghent University, Belgium

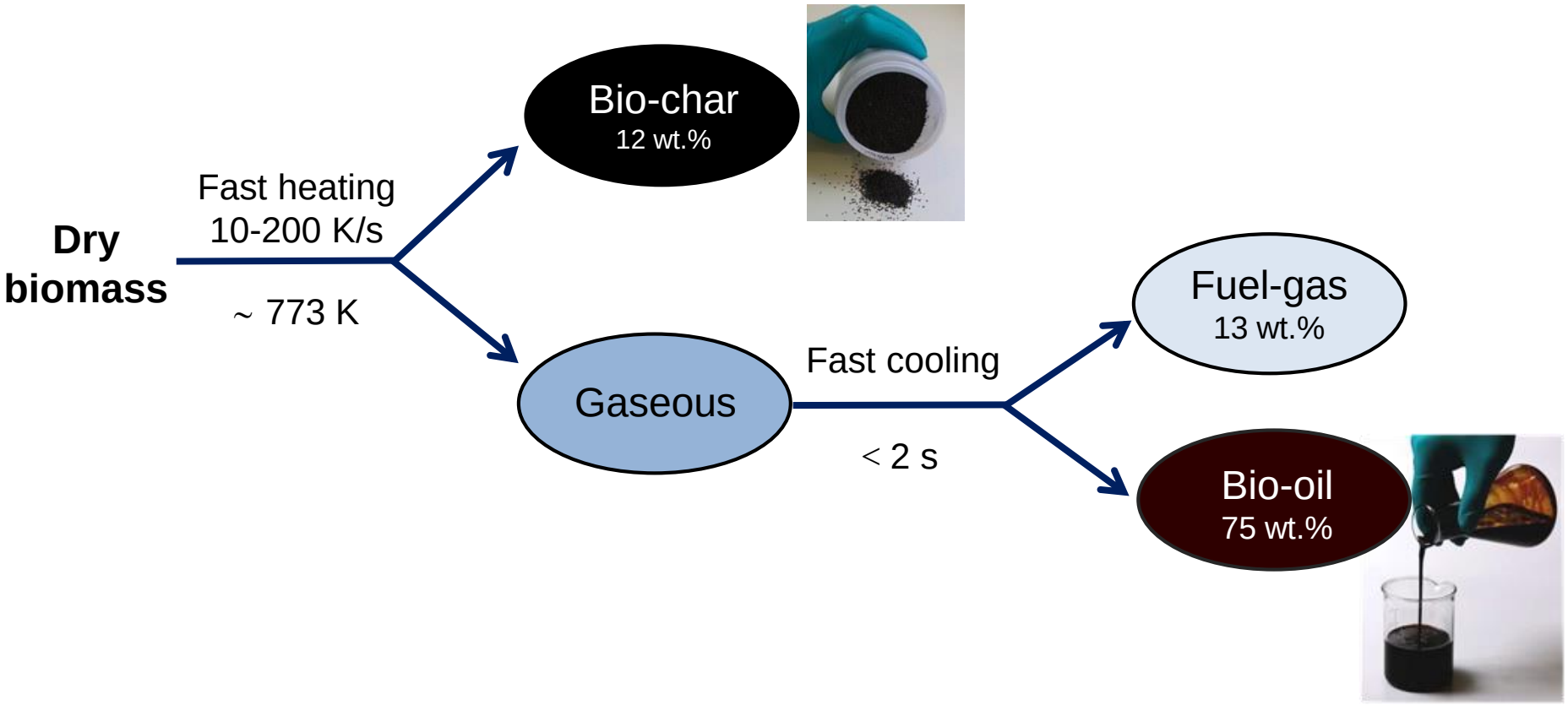
Domestic production of sugarcane bagasse in Cuba



Statistical Yearbook of Cuba, **2014**

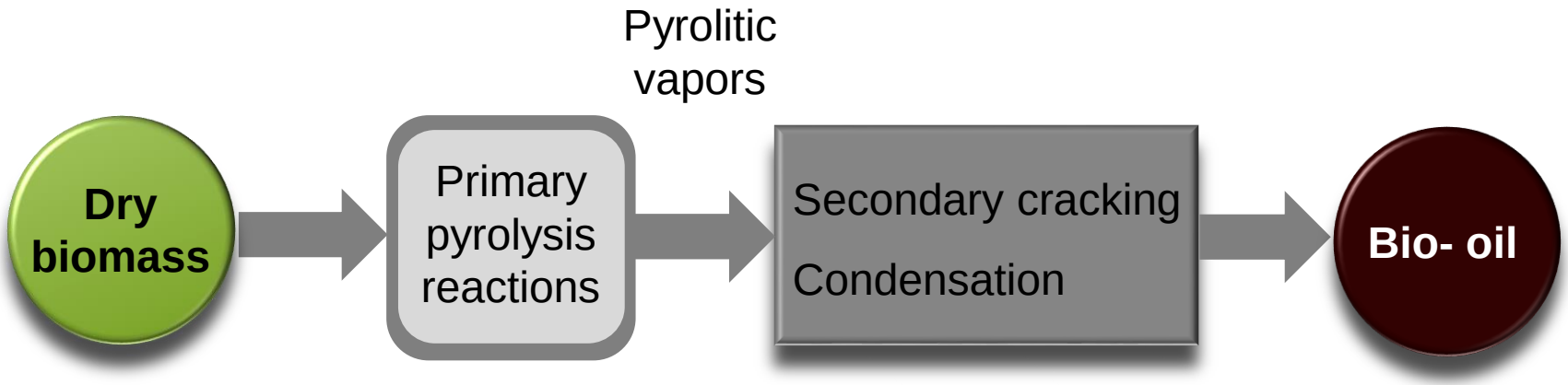
Sugarcane biomass residues	Availability, ton/ton crushed cane (Use)	Surplus available
Bagasse + trash in sugar mill	**32 %** (Steam supply and power generation)	**15-20%**
Trash left in field	**17%** (Improve soil quality)	**?**
Trash separated in cane cleaning centers	**11%** (Power generation)	**40%**

Fast pyrolysis concept



Bridgwater, A.V. **2012**. Review of fast pyrolysis of biomass and product upgrading. Biomass and Bioenergy, 38, 68-94

Influence of inorganic biomass constituents



Inorganic biomass constituents, especially AAEM

Changes in yield and chemical composition

Eom et al. **2012**. Effect of essential inorganic metals on primary thermal degradation of lignocellulosic biomass. Bioresource Technology, 104(0), 687-694.

General objective: to exam the effect of demineralization by leaching on the biomass ash content and on the biomass degradation kinetics (TGA/DTG).

- TGA/DTG
- Biomass analysis

Feedstock preparation prior to leaching

SCT

Preparation of original biomass samples

SCB

Drying
- Ambient atmosphere during 3 days

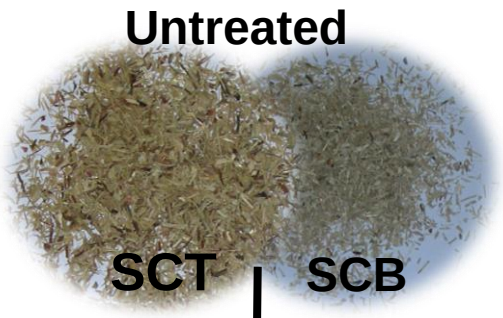
Grinding
- 1 kg in a small cutter mill

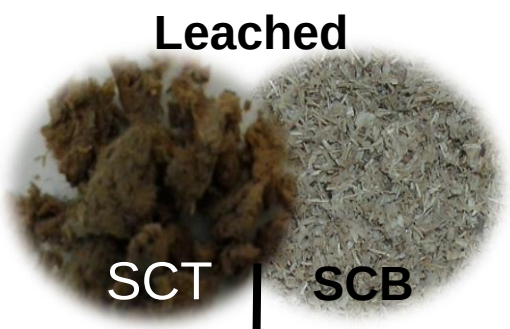
Classifying
- 0.45 kg particle size range 1-2 mm

Leaching at 25 ºC/1 h: Water
HCl, (5M)
H_2SO_4, (5M)
Citric acid (CA), (1M)

SCT: sugarcane trash
SCB: sugarcane bagasse

Analysis of untreated and leached sugarcane bagasse and trash





Proximate and ultimate analysis

- Moisture, volatile matter, ash and fixed carbon content
- CHNO content

Inorganic content

- Alkali metals (Na and K)
- Alkaline earth metals (Mg)
- Other inorganics (Al, Fe and Si)

TGA/DTG

- Thermal decomposition by pyrolysis in He atmosphere

Characterization of untreated samples

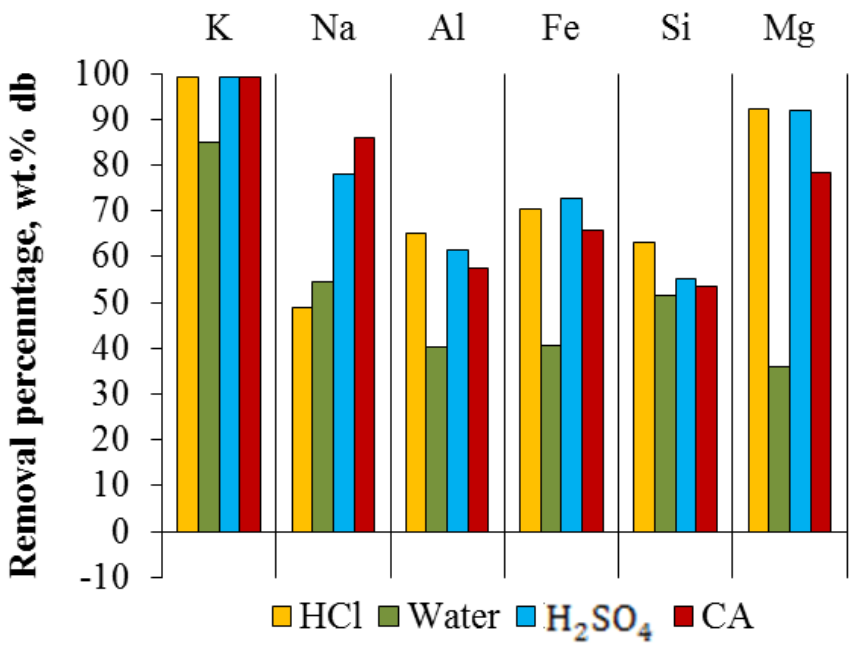
	Proximate analysis (wt.% db)			Ultimate analysis (wt.% daf)	
	SCB	SCT		SCB	SCT
Moisture	6.7	7.1	Carbon (C)	44.1	40.0
Volatile	79.8	73.9	Hydrogen (H)	6.0	5.2
FC	17.1	19.2	Nitrogen (N)	0.2	0.4
Ash	**1.8**	**5.3**	Oxygen (O)[a]	49.6	54.1

Ash of pine wood: 0.33 wt.% db

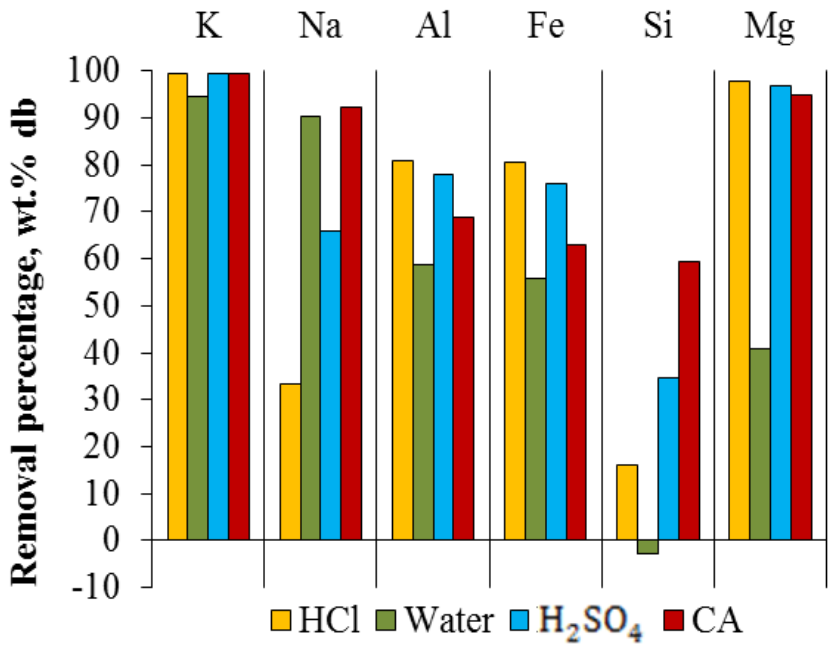
FC: Fixed carbon
a: Calculated by difference

Removal of inorganic species after leaching at 25 ºC/1 h

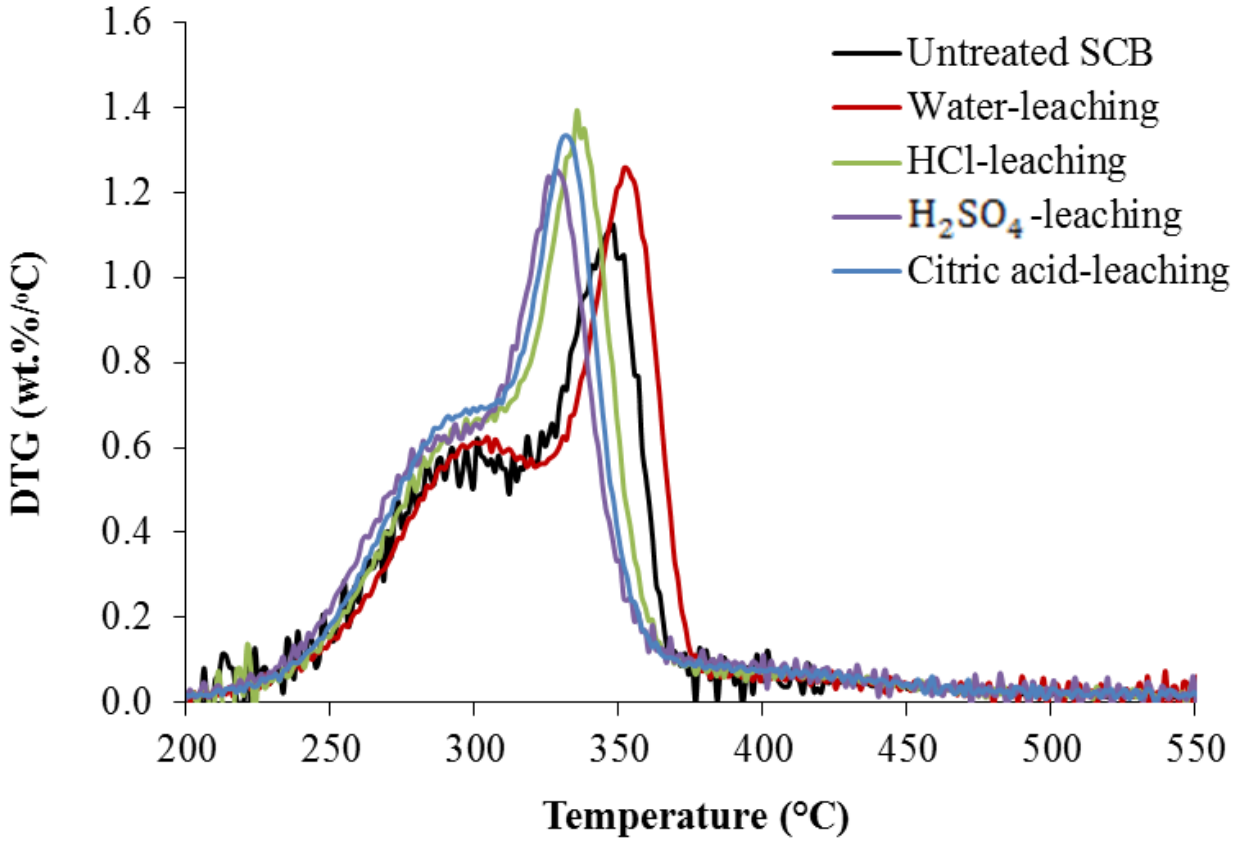
Sugarcane bagasse



Sugarcane trash

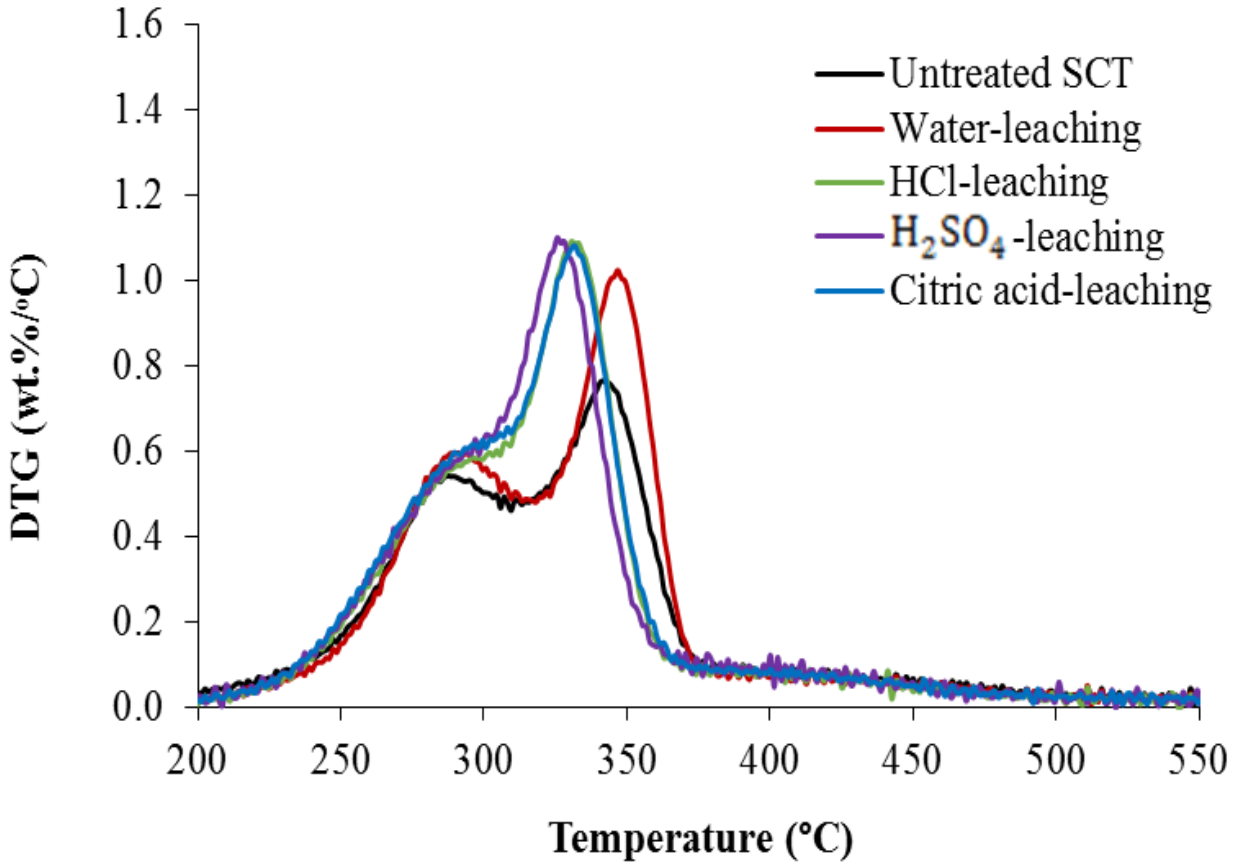


DTG curves of untreated and leached SCB at 25 ºC/1 h



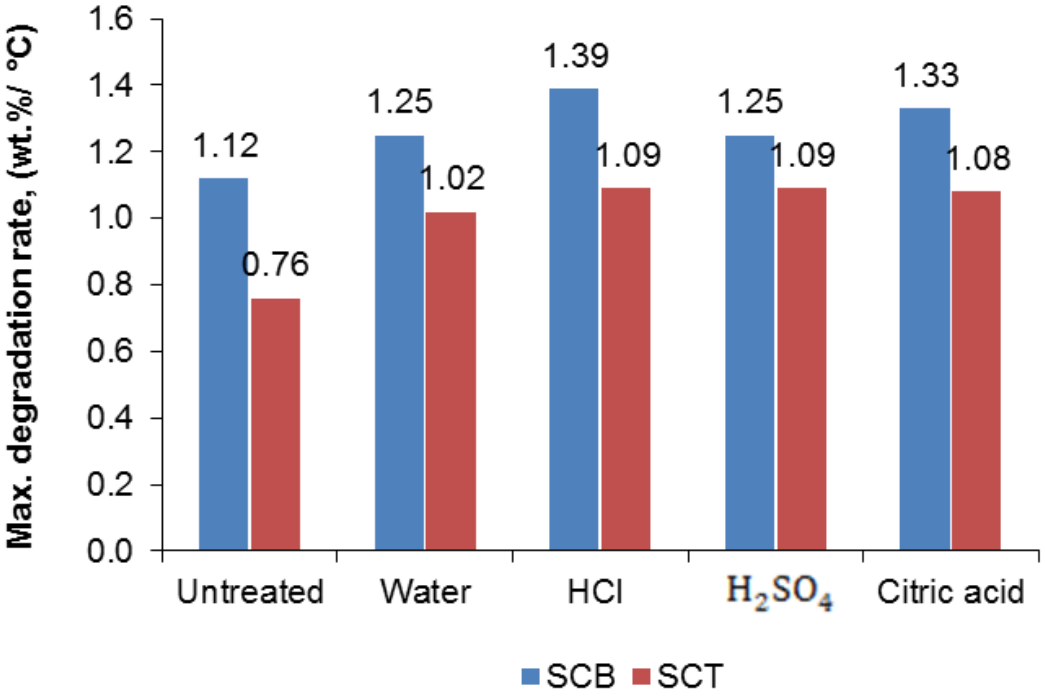
Ash content (wt.% db)	
Leaching	SCB
Untreated	**1.8**
Water	**1.3**
HCl	1.1
H_2SO_4	1.1
Citric acid	1.0

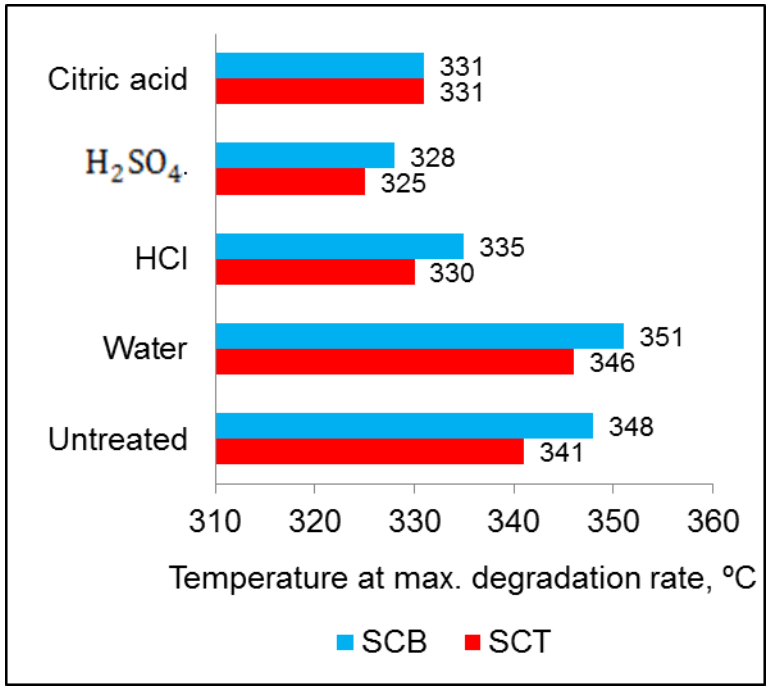
DTG curves of untreated and leached SCT at 25 ºC/1 h



Ash content (wt.% db)	
Leaching	SCT
Untreated	**5.3**
Water	**4.2**
HCl	3.6
H_2SO_4	3.6
Citric acid	3.7

Characteristic parameters of DTG analysis for SCB and SCT at 25 ºC/1 h





Conclusions

- The acid-leaching at 25 ºC/1 h has almost similar effect on SCB ash removal independently of the strength.
- The inorganic acids have higher removal of ash than the organic acid when SCT is leached at 25 ºC/1h.
- TGA and DTG revealed that maximum degradation temperatures rose slightly after water-demineralization and decreased after acid-demineralization.
- The effect of acid hydrolysis is more dominant in thermal degradation behavior that the catalytic effect of inorganic biomass constituents.

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lizetr@uclv.edu.cu