2015

Production of Activated Carbons from Pyrolytic Biochar

Anastasia Colomba
ICFAR - Western University

Franco Berruti
ICFAR - Western University

Cedric Briens
ICFAR - Western University

Ajay Dalai
University of Saskatchewan

Rambabu Nedunury
University of Saskatchewan

See next page for additional authors

Authors
Anastasia Colomba, Franco Berruti, Cedric Briens, Ajay Dalai, Rambabu Nedunury, Alberto Colomba, Silvia Fiore, and Giuseppe Genon

Institute for Chemicals and Fuels from Alternative Resources
Western University

icfar

Western

University of Saskatchewan

Politecnico di Torino

Production of Activated Carbons from Pyrolytic Biochar

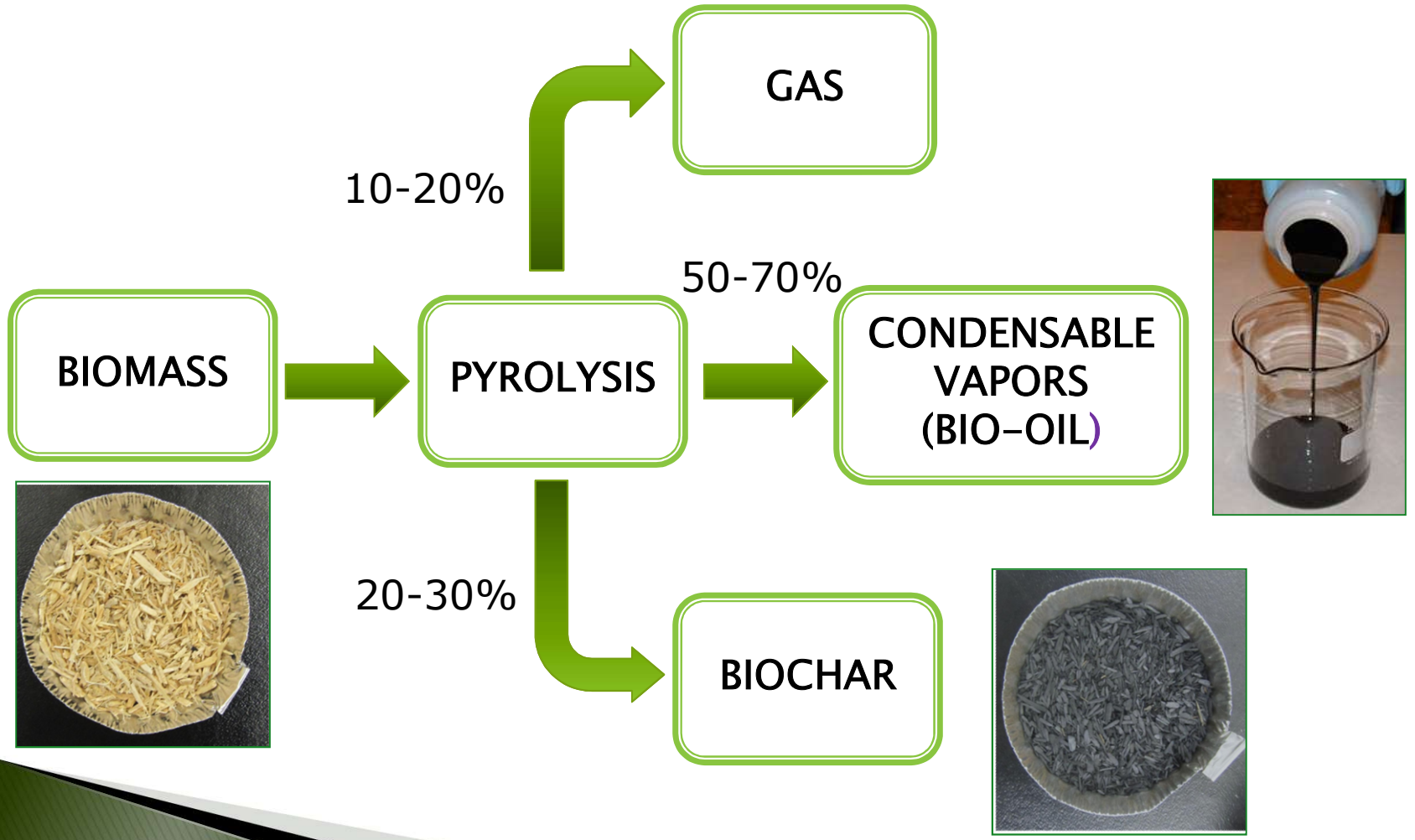
Anastasia Colomba[1], Franco Berruti[1], Cedric Briens[1], Ajay Dalai[2], Rambabu Nedunury[2], Alberto Colomba[3], Silvia Fiore[3], Giuseppe Genon[3]

[1]ICFAR, Western University, London, Ontario CANADA

[2]University of Saskatchewan, Saskatoon, Saskatchewan, CANADA

[3]Politecnico di Torino, Torino, ITALY

Biomass pyrolysis



BIO-CHAR production

Objectives of our Research

- **Bio-Char production** from a variety of **biomass residues and wastes** using different technologies and under different operating conditions followed by **activation**

- **Characterization**

- Studies on the **potential use for adsorption of selected pollutants**

Biomass selection: 13 biomasses

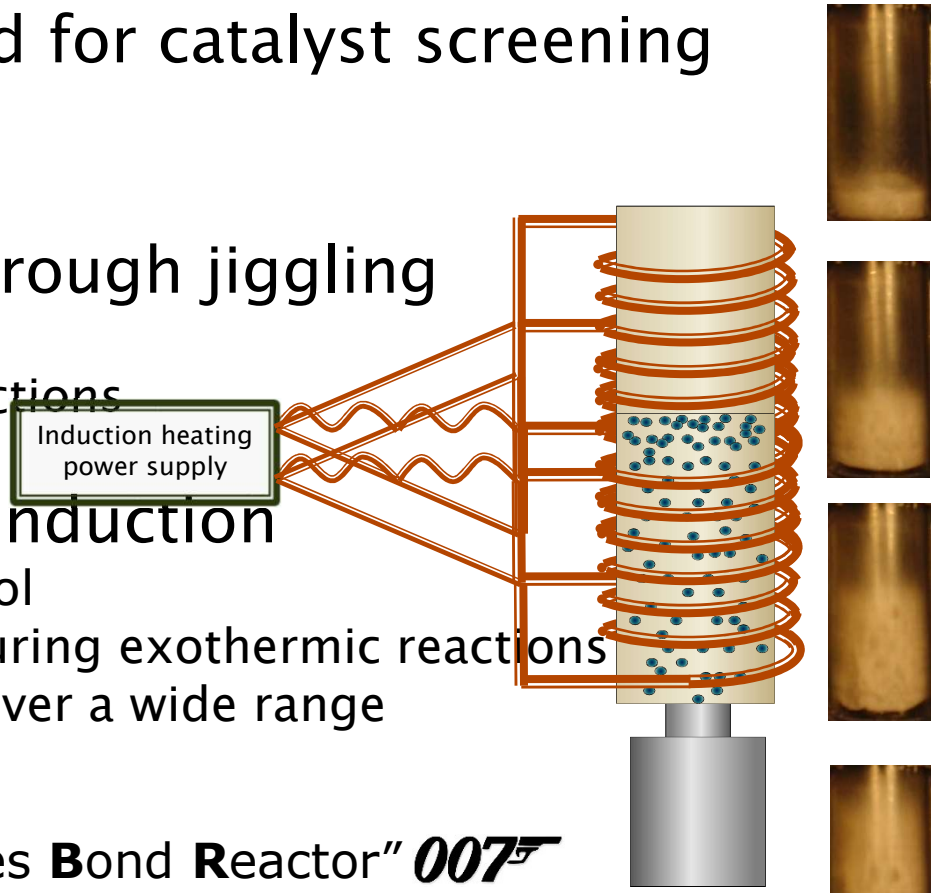
Energy crops	Crop residues	Seeds	Milling residues
Willow	Wheat Straw	Sorghum	Olive Residue
Miscanthus	Corn Stover	Sunflower Husks	Bagasse
Switchgrass	Canola Straw		Birch Bark
			Lignin
			Maple wood

The "Jiggle Bed" Reactor (JBR)*

- Micro-reactor developed for catalyst screening

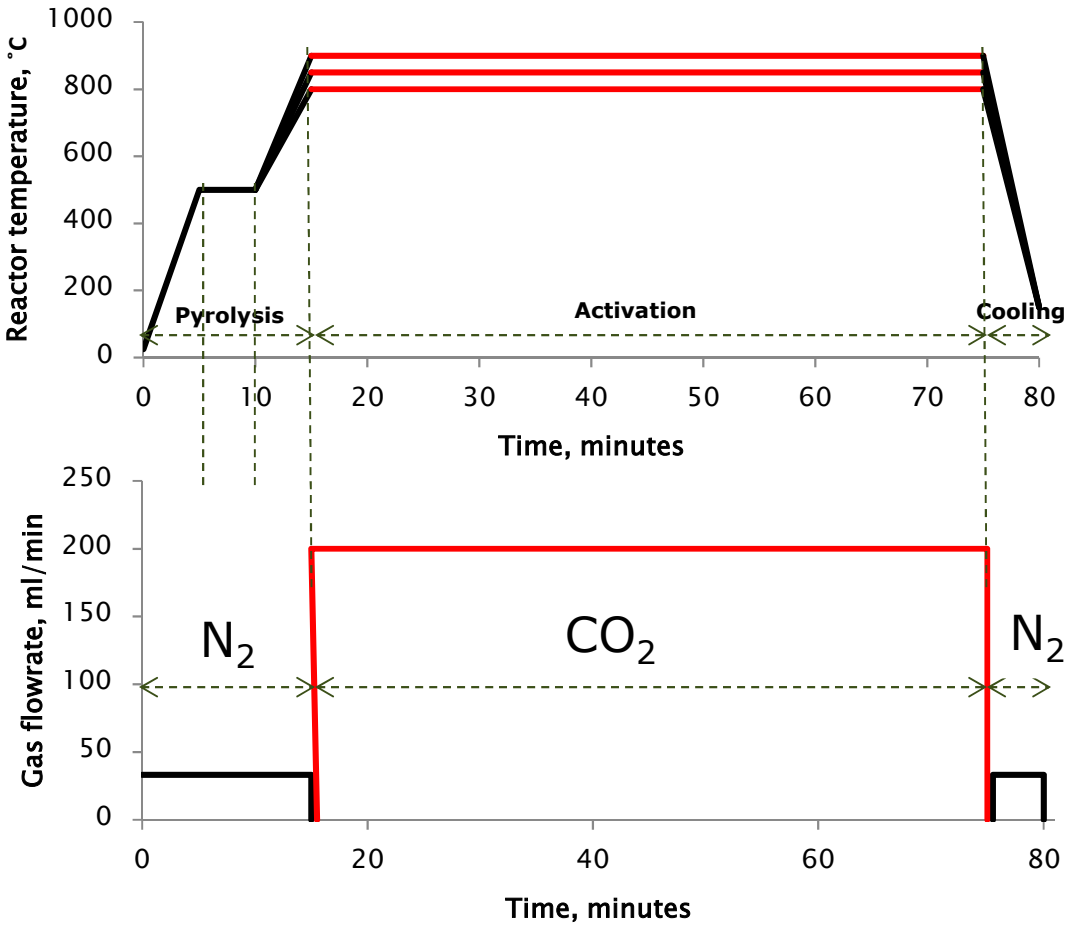
- Fluidization achieved through jiggling
  - No fluidization gas
  - Ideal to study gas-solid reactions

- Heat provided through induction
  - Excellent temperature control
  - Fast response to changes during exothermic reactions
  - Heating rate can be varied over a wide range



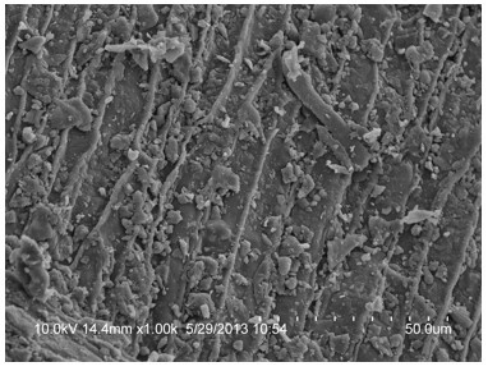
*...also designated as the "**J**ames **B**ond **R**eactor" 007

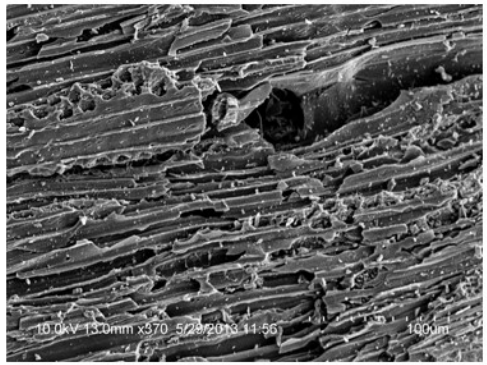
Experimental procedure: PYROLYSIS and ACTIVATION



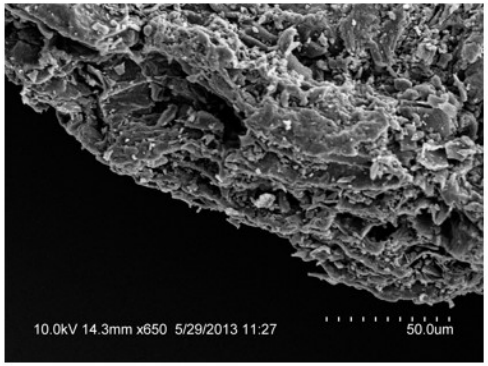
Institute for Chemicals and Fuels from Alternative Resources
Western University
icfar

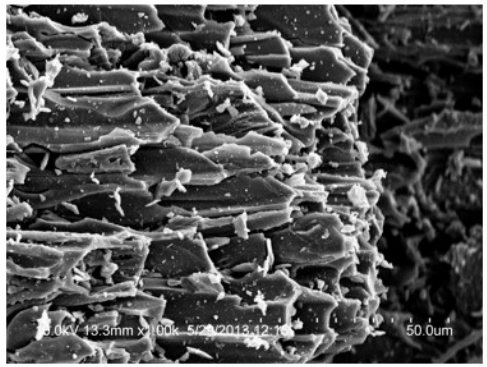
Bio-Char Activation





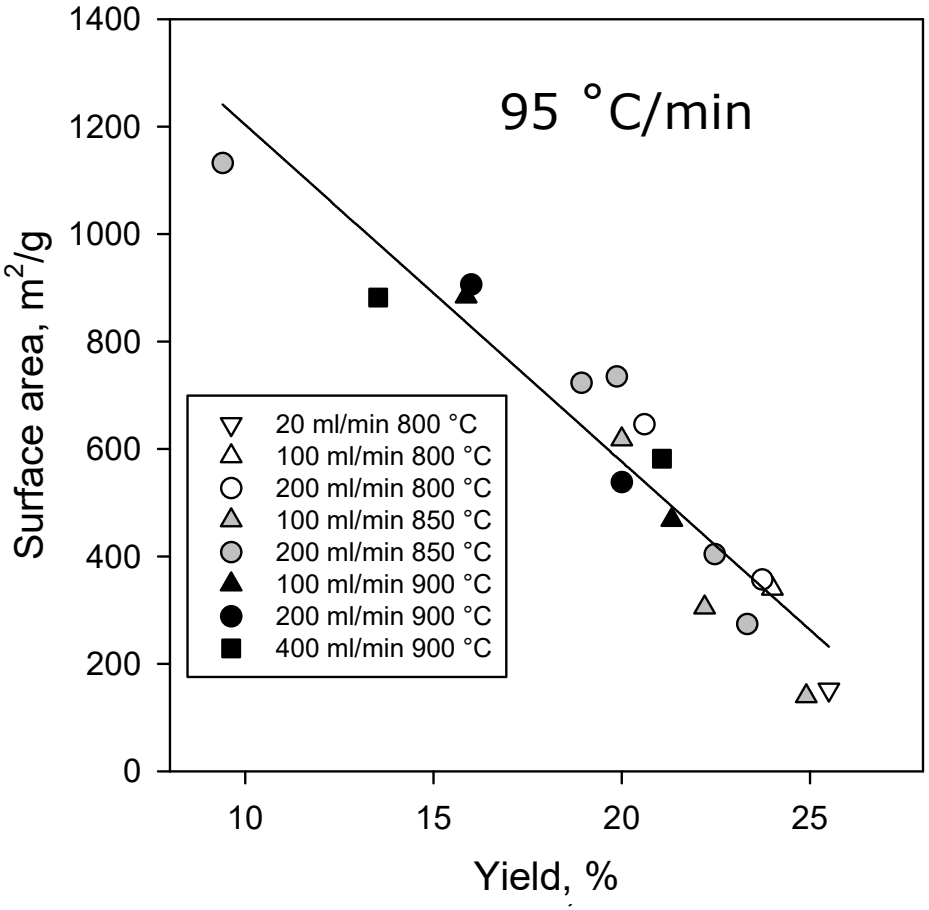
Surface overview for non activated and activated biochar from birchwood





Surface detail for non activated and activated biochar from birchwood

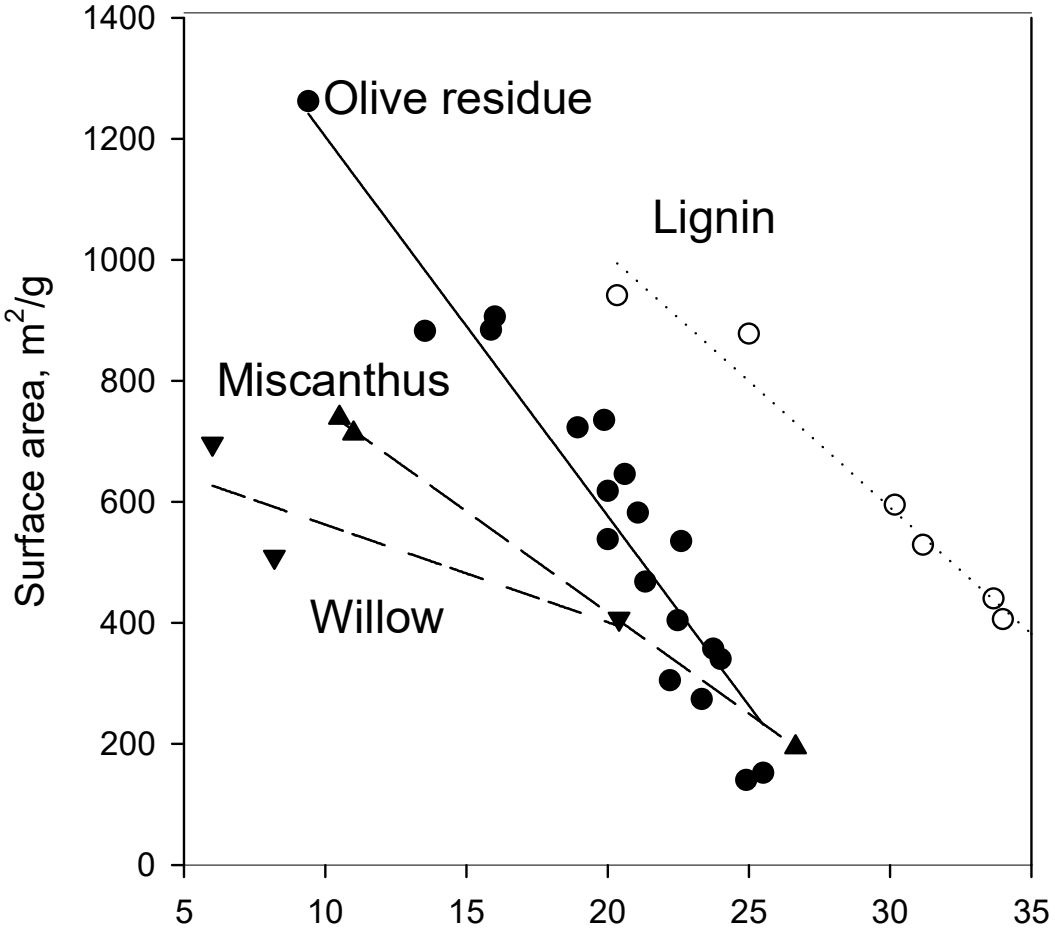
Slow Pyrolysis + Activation
(olive residue)



Institute for Chemicals and Fuels from Alternative Resources
Western University

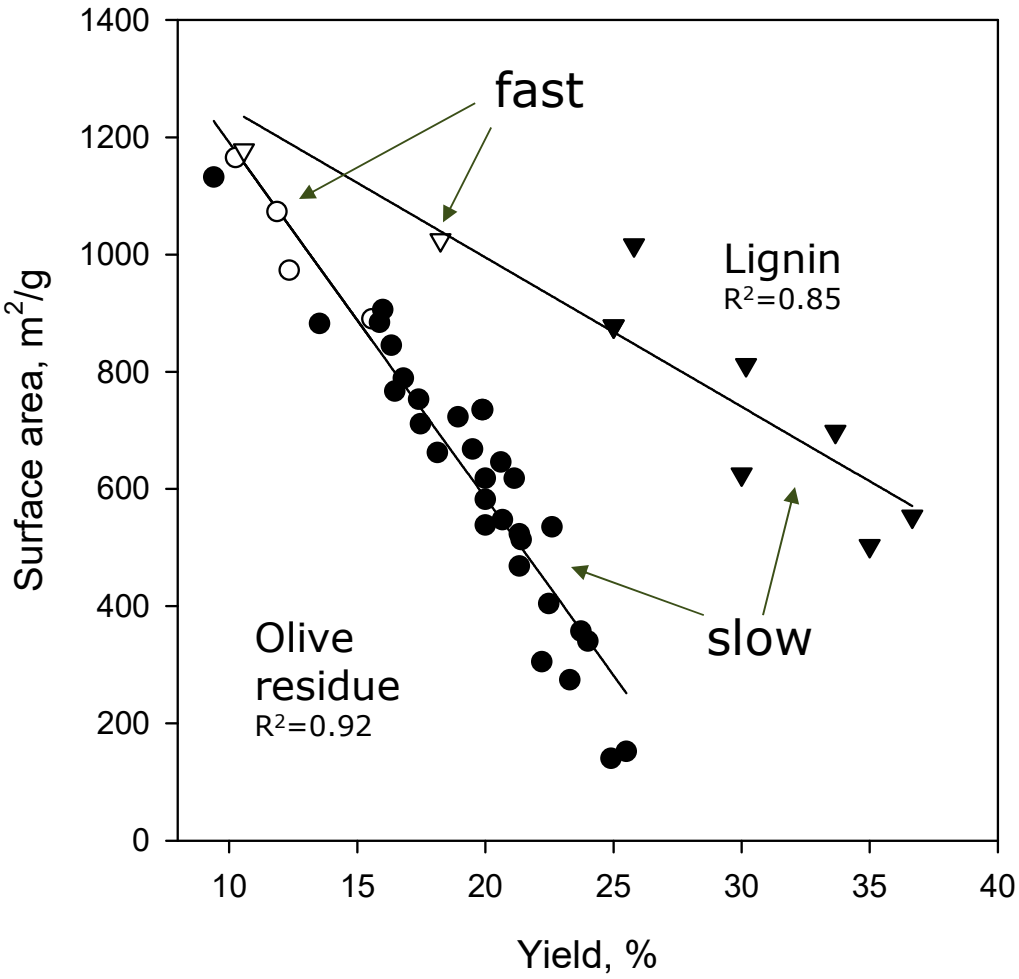
icfar

Feedstocks comparison

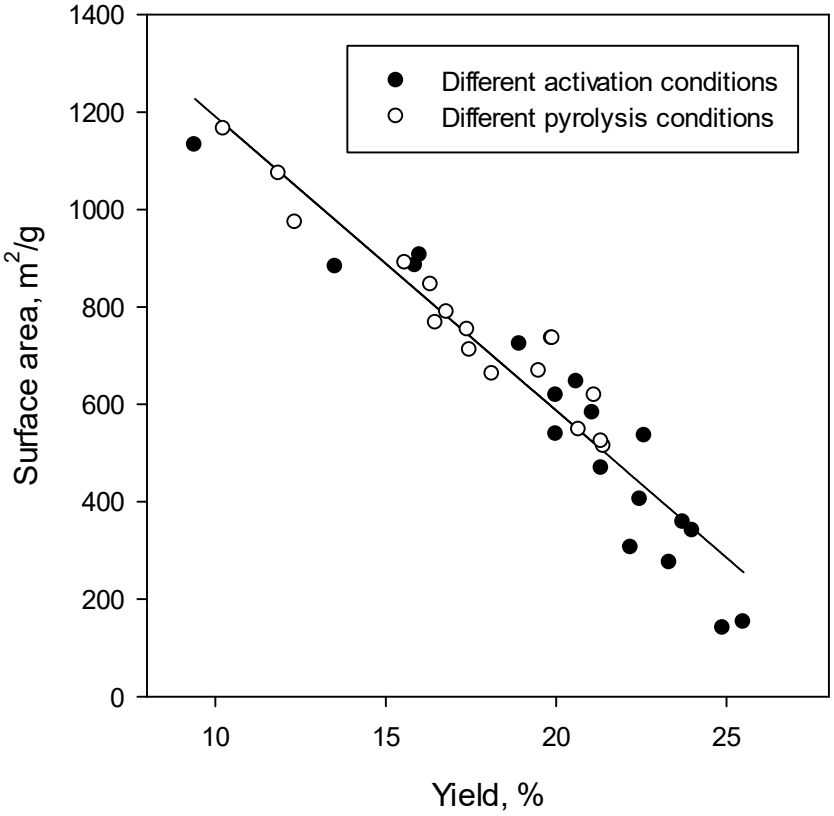


from Alternative Resources
Western University

Slow and fast pyrolysis

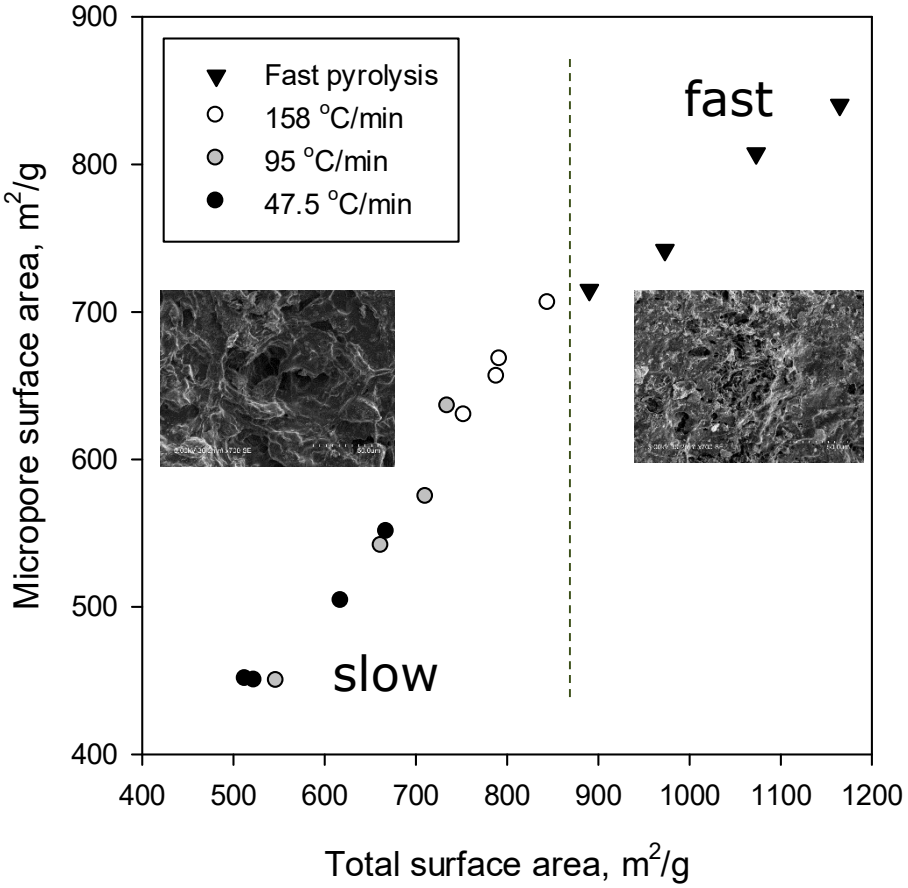


Universal relationship (olive residue)



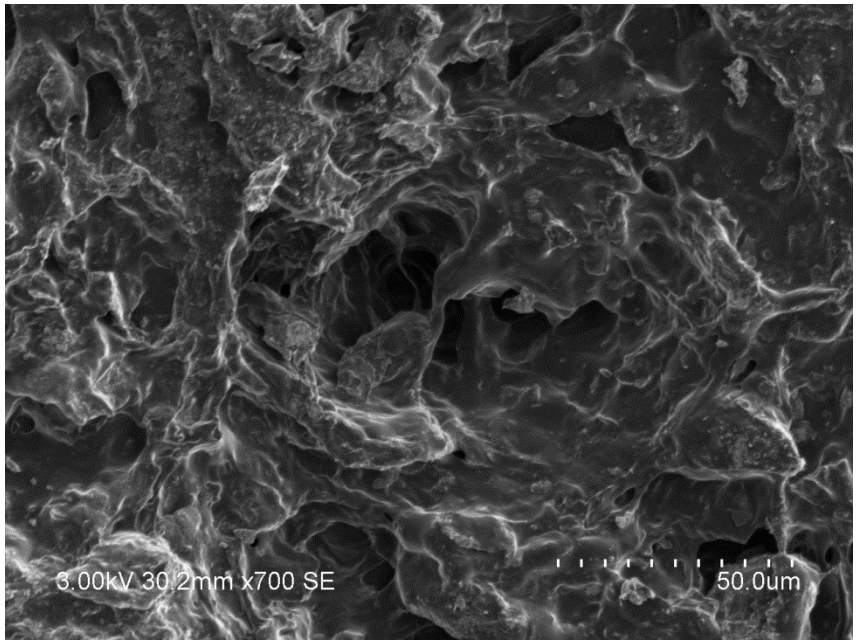
For every feedstock, a unique relationship exists between total surface area and yield!

Impact of pyrolysis conditions on the porous structure (olive residue)

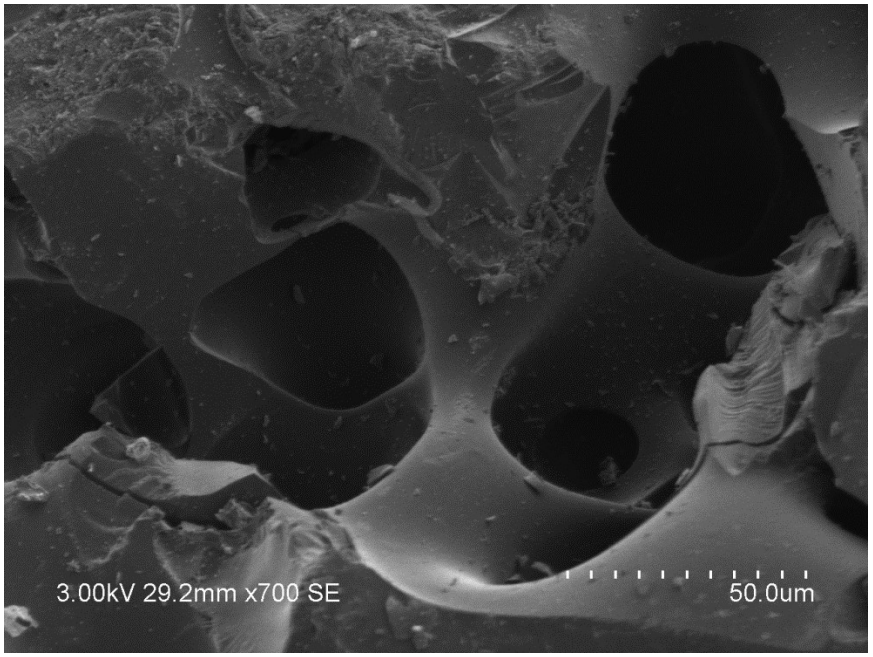


The distribution of micropores and mesopores depends on the pyrolysis conditions

Comparison of activated charcoal from different feedstocks

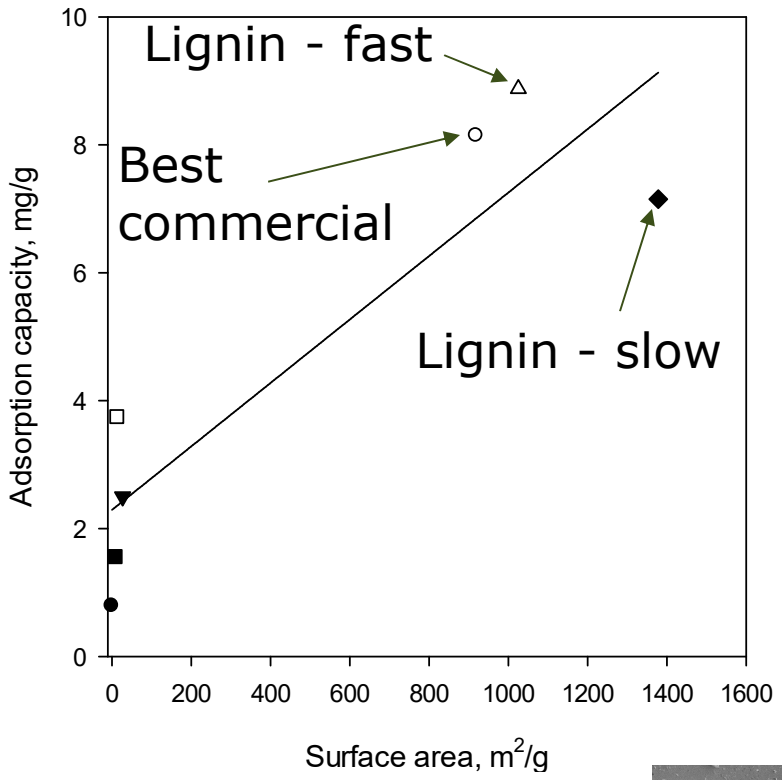


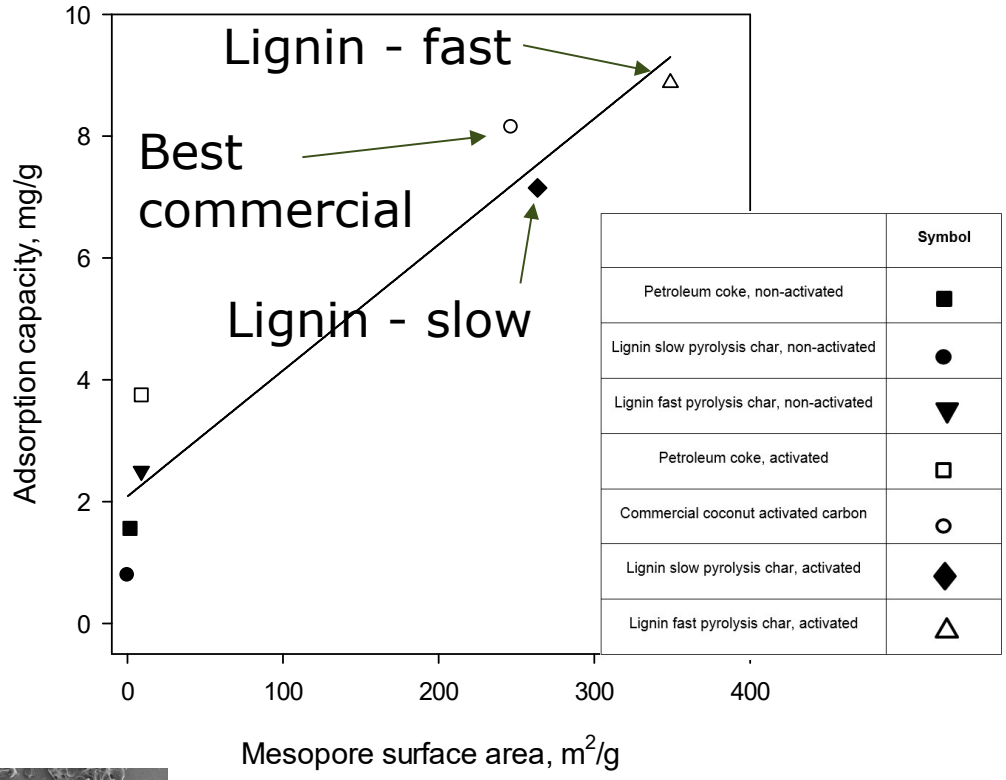
Olive residue
(more **micropores**)

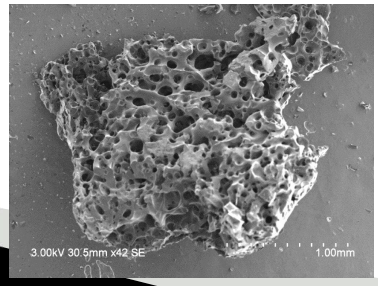


Lignin
(more **mesopores**)

Adsorption of Naphthenic Acids







Activated lignin bio-char

Key conclusions

- Bio-Char is a valuable co-product of pyrolysis of residual biomasses and wastes
- In order to increase its value, it can be successfully be activated
- Activation can reduce significantly the mass and increase significantly the porosity: for every feedstock a unique relationship exists between yield and surface area
- Activated Bio-char is an effective adsorbent

Acknowledgments

RÉSEAU BIOFUELNET CANADA

NSERC CRSNG

LIGNOWORKS
The NSERC Biomaterials and Chemicals Network

Institute for Chemicals and Fuels from Alternative Resources
Western University

icfar

ECI

Celebrating 53 years of international, interdisciplinary engineering conferences

5th International Congress on Green Process Engineering (GPE 2016)

An ECI Conference

June 19-24, 2016
Fairmont Tremblant Hotel
Mont Tremblant, Quebec, Canada

Timeline

Deadline for 7-page Abstracts Submission:	**December 15, 2015**
Abstracts Reviews and Selection of Presentations:	**February 15, 2015**
Submission of Revised Extended Abstracts:	**April 15, 2016**
Call for Free-Forum Posters:	**Ongoing until May 15, 2016**