Downloaded from orbit.dtu.dk on: Dec 04, 2022

DTU Library

Combustion Behavior of Single Particles of Raw Wood and Pelletized Wood

Masche, M.; Puig Arnavat, M.; Holm, J. K. ; Jensen, P. A.; Ahrenfeldt, J.; Clausen, S.; Henriksen, U. B.

Publication date:
2018

Document Version
Publisher's PDF, also known as Version of record

Link back to DTU Orbit

Citation (APA):
Masche, M., Puig Arnavat, M., Holm, J. K., Jensen, P. A., Ahrenfeldt, J., Clausen, S., & Henriksen, U. B. (2018). *Combustion Behavior of Single Particles of Raw Wood and Pelletized Wood*. Poster session presented at 8th Workshop on cofiring biomass with coal, Copenhagen, Denmark.

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

DTU Chemical Engineering
Department of Chemical and Biochemical Engineering

Combustion Behavior of Single Particles of Raw Wood and Pelletized Wood

M. Masche[1], M. Puig-Arnavat[1], J. K. Holm[2], P. A. Jensen[1], J. Ahrenfeldt[1], S. Clausen[1], U. B. Henriksen[1]

[1] DTU Chemical Engineering, 2800 Kgs. Lyngby, Denmark
[2] Bioenergy and Thermal Power, Ørsted, Nesa Allé 1, 2820 Gentofte, Denmark

What were our motivation and research objectives?

We present a single particle combustion (SPC) study examining the relationship between combustion behavior and particle density.

- There are limited data on the combustion behavior of raw and pelletized wood at suspension-fired conditions.
- Understanding the effect of pelletizing conditions (temperature, pelletizing pressure) on the combustion behavior of pine and beech pellets compared to raw wood in a SPC reactor.
- SPC studies allow to predict the particle combustion behavior in full-scale furnaces.

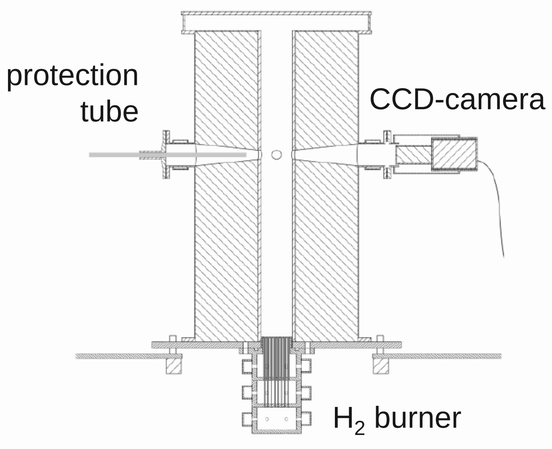
How was the SPC study performed?

Feedstock
Austrian pine
European beech

Pelletizing conditions
- Particle sizes: 0.25-0.50 mm
- Pressure: 100 and 200 MPa
- Temperature: 75 and 125°C

SPC reactor conditions
- Temperature: 1260°C
- Oxygen: 5 % (d.b.)
- Gas velocity: 1.5 m/s

SPC reactor

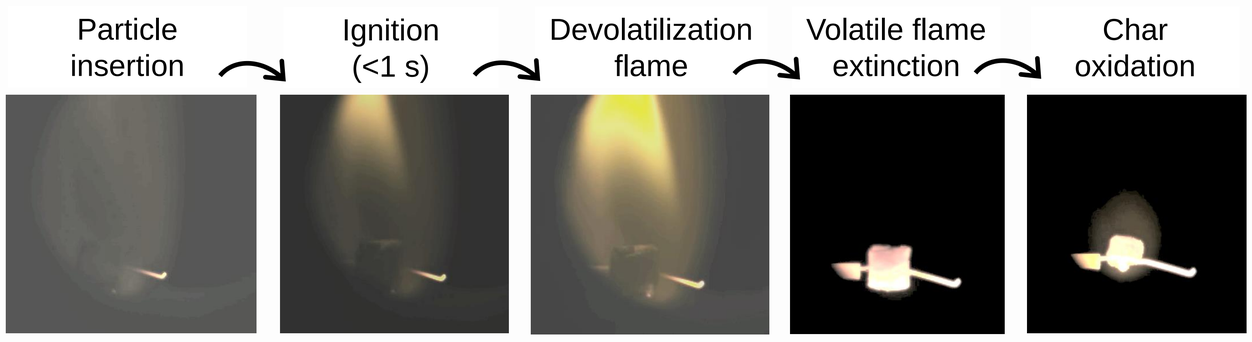


Sample Preparation
i. 3 mm pellets using a heatable cubic die and hydraulic press
ii. 3 mm raw cubes

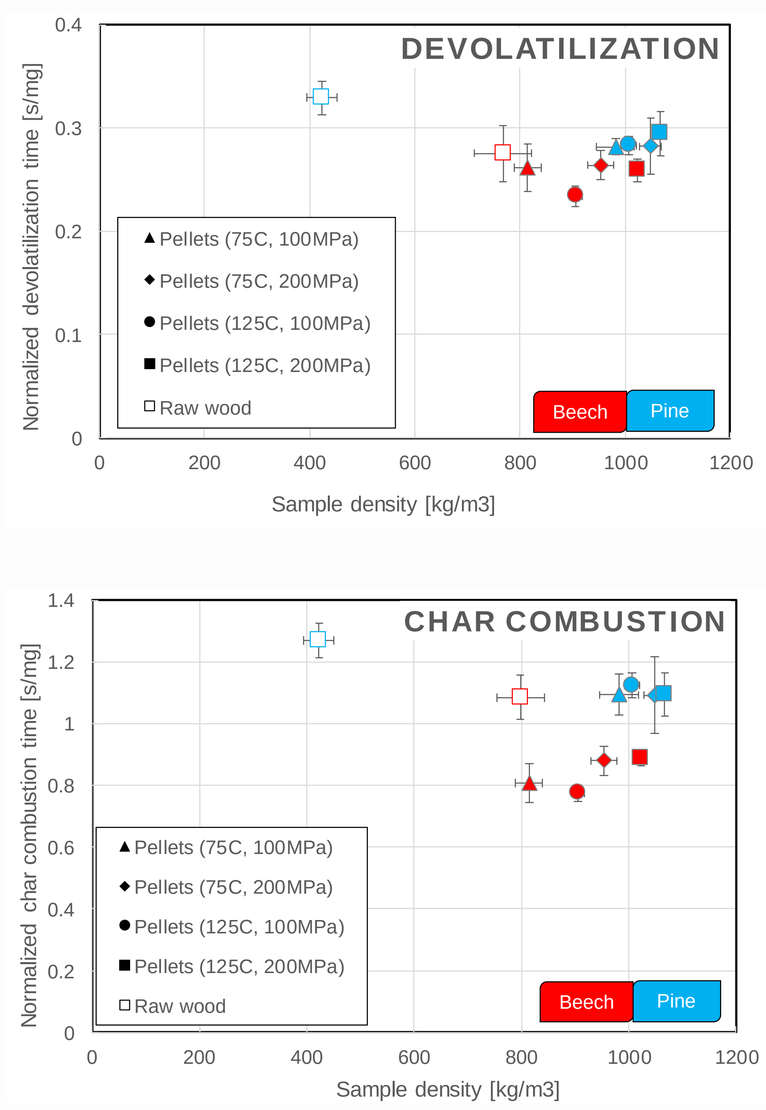
Combustion behavior
- Devolatilization time
- Char burnout time
- Swelling

Particle conversion process

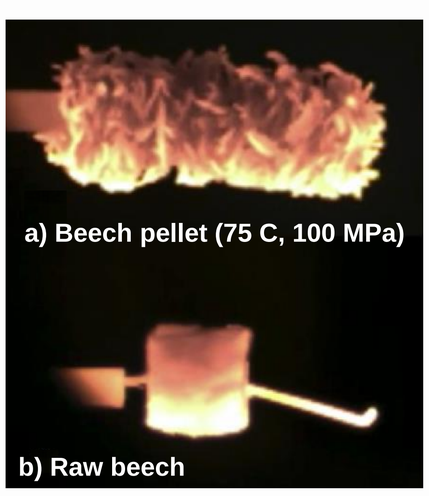
Example: Raw beech cube



Main findings



Swelling during devolatilization



Total conversion of raw beech vs. pelletized beech

Watch video

Total conversion of pelletized pine vs. pelletized beech

Watch video

Conclusions

- Pine can be densified more than beech
- SPC study shows that weak inter-particle bonds in pellets
  - Cause swelling during devolatilization, facilitating faster burnout of internal pellet particles compared to single raw wood
  - Affect the conversion process (i.e., faster char burnout of beech pellets due to weaker particle adhesion than pine pellets)

DTU Chemical Engineering
Department of Chemical and Biochemical Engineering

Acknowledgements

Energinet.dk (Project no.: 12325), Ørsted, Hofor