KTH ROYAL INSTITUTE OF TECHNOLOGY

Experimental lifetime evaluation of ex-situ catalytic fast pyrolysis of biomass performed in a fluidized bed and fixed bed-setup

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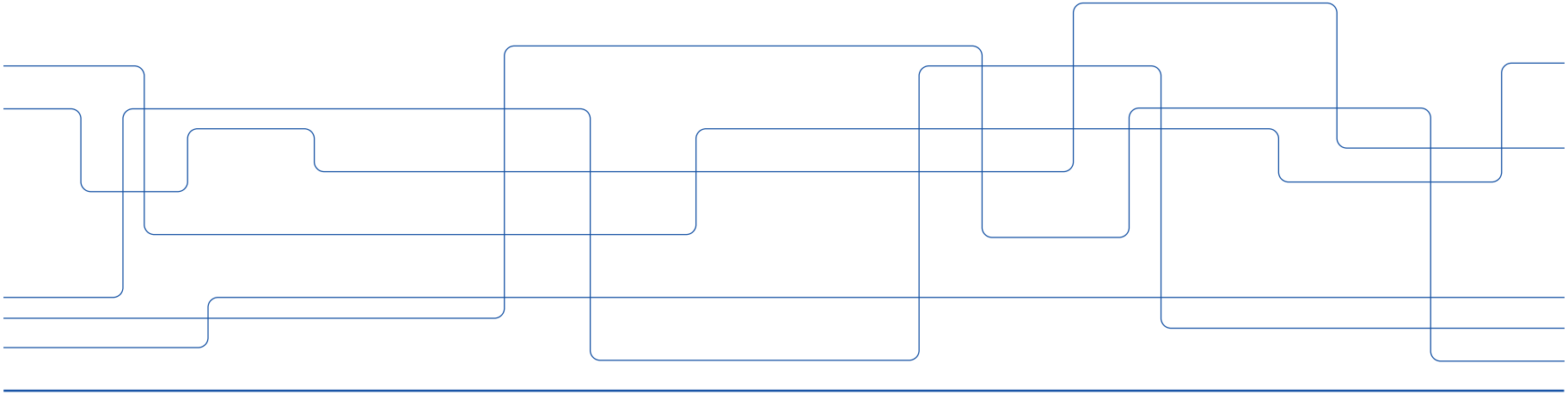
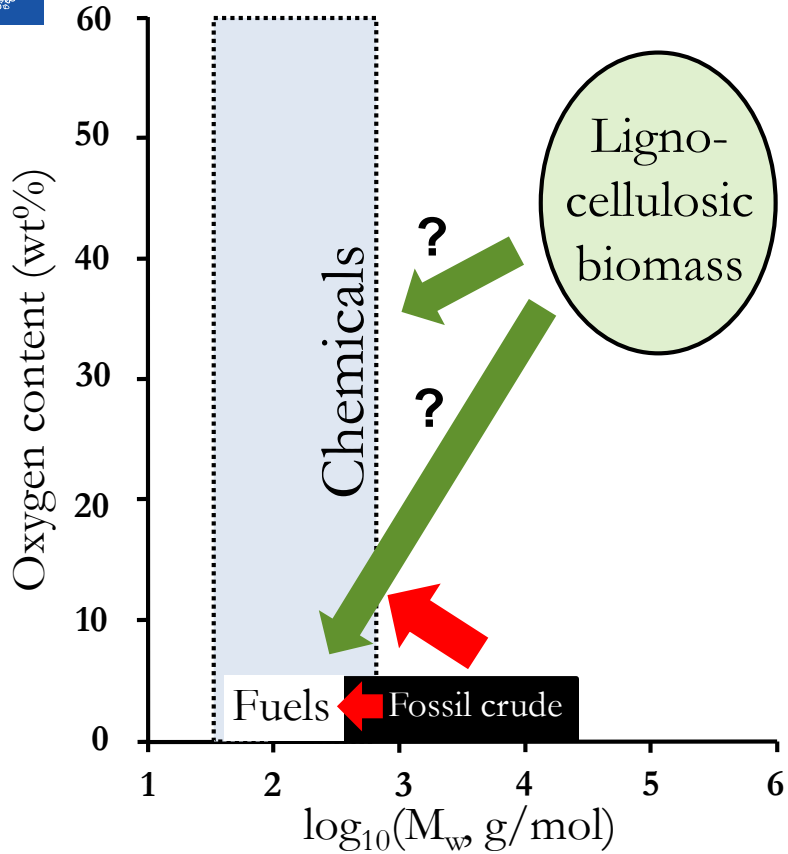


Outline of presentation

- Introduction
- Experimental setup
- Materials & Methods
- Results & Discussions
- Conclusions

Production of renewable chemicals and fuels



What is needed *(from a technology perspective)* to bring biomass liquefaction processes to larger-scale/market?

Tailor-made experimental investigations

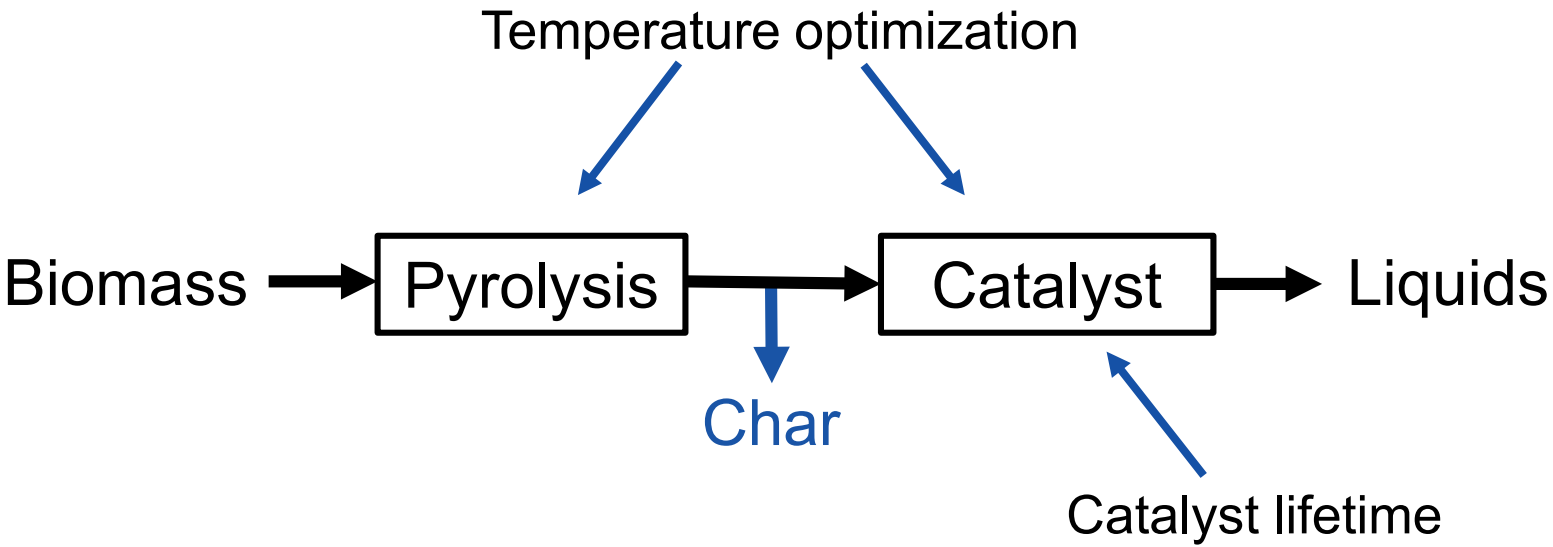
Reliable extensive techno-economic analysis

Biomass-derived liquids to market?

Experimental data for system analysis studies

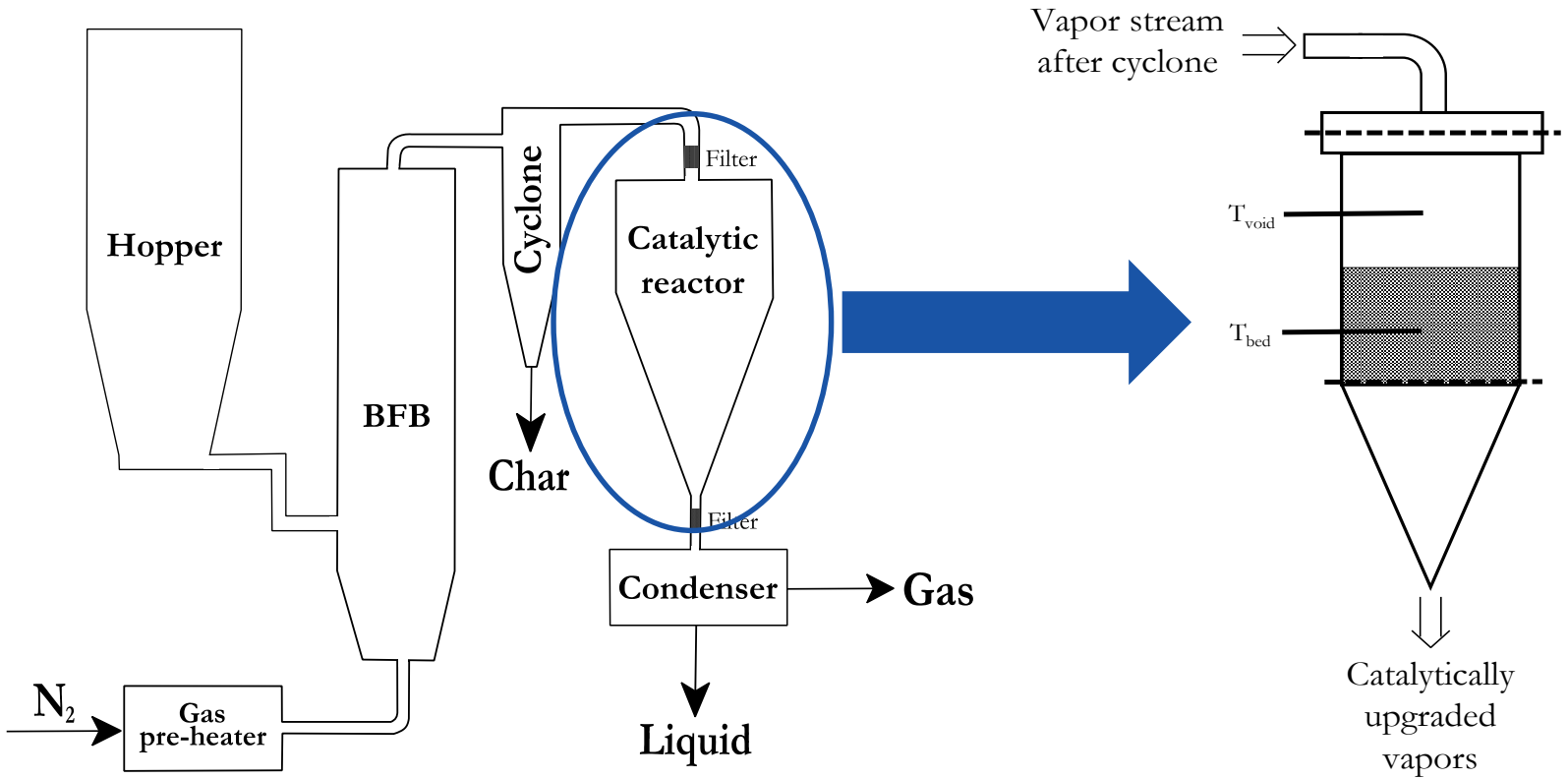
- Experiments at scale
- Continuous operation
- Online time-on-stream analysis
  - Deactivation
  - Fluctuations
  - Accumulation
- Parameter studies

Ex-situ catalytic fast pyrolysis



- Limited works on continuous ex-situ catalytic fast pyrolysis at scale

Experimental process setup and conditions



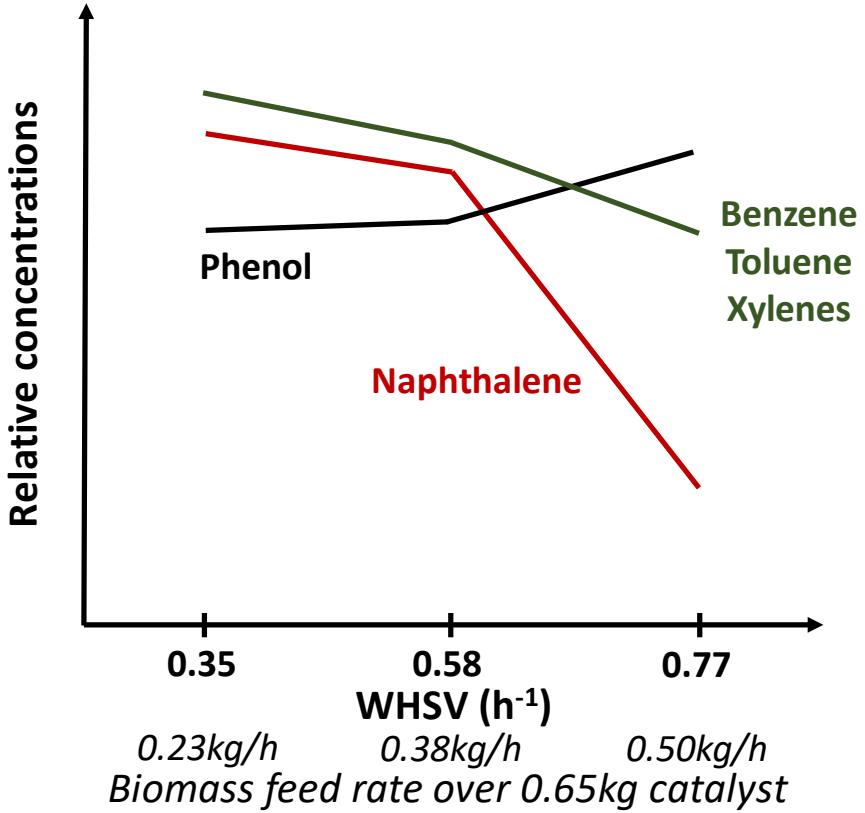
Materials and methods

- Biomass feedstock
  Softwood (spruce/pine) sawdust mixture 1-1.4 mm
- Catalyst pellets
  HZSM-5 (SiO_2:Al_2O_3 30:1)
  d_{pellet}: 3 mm ρ_{bed}: 629 kg/m^3 Φ_{bed}: 0.44

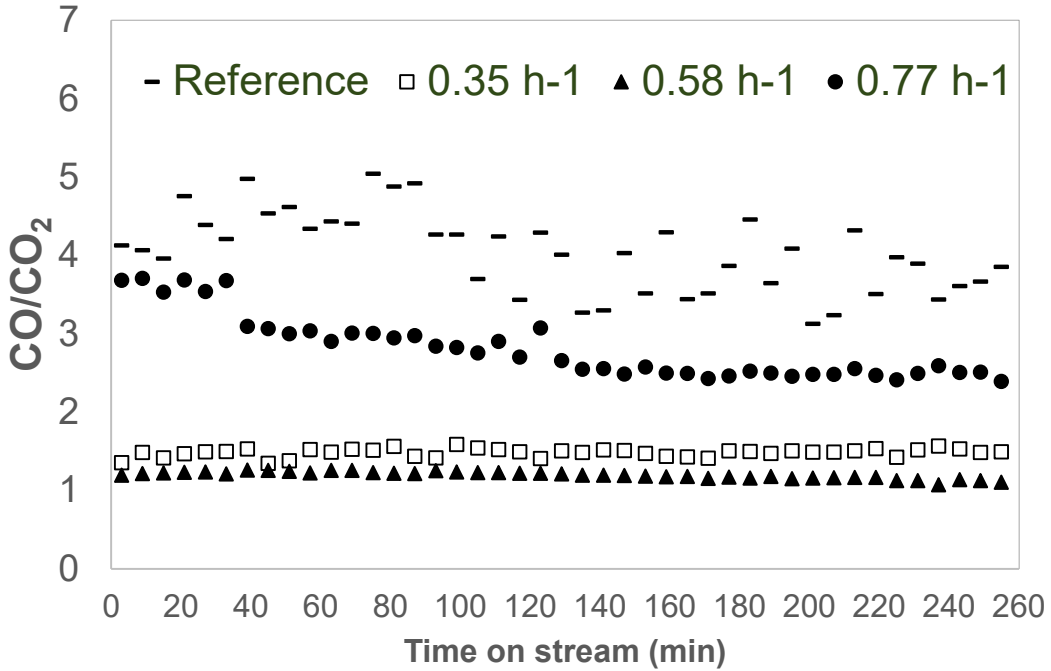
Biomass feed rate (kg/h)	**Catalyst amount (kg)**	***WHSV*** ***(h^{-1})***
0.23	0.65	*0.35*
0.38	0.65	*0.58*
0.50	0.65	*0.77*

Results: Upgraded liquid composition

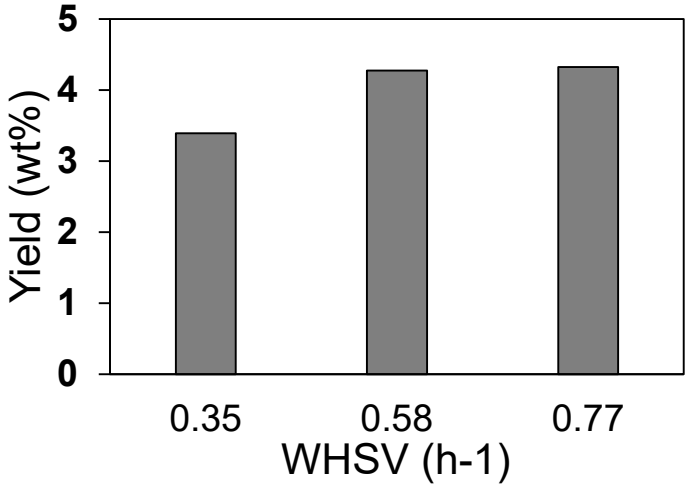
	0.35 h^{-1}	0.58 h^{-1}	0.77 h^{-1}
C	79.5	77	71
H	6.9	6.6	6.8
N	<0.1	<0.1	<0.1
S	<0.05	<0.05	<0.05
O*	13.6	16.3	22
TAN	*6.2*	*9.2*	*7.6*



Results:
On-line gas analysis & catalyst deactivation



- Enhanced CO_2 selectivity at lower vapor loading



Main Conclusions

- Online analysis of catalyst activity and deactivation during pyrolysis vapor upgrading

- Influence of WHSV on catalytic conversion of vapors
  - Higher WHSV ⟶ Reduced biomass-to-aromatics
    Higher catalyst coking

- No significant catalyst deactivation observed

Thanks for your attention!

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Questions?

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