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The role of fuel mixing on char conversion in a dual fluidized bed gasifier

Louise Lundberg
Chalmers University of Technology; Dept. Energy and Environment , Sweden, louise.lundberg@chalmers.se

Antonio Soria-Verdugo
Carlos III University; Dept. Thermal Engineering and Fluid Mechanics, Spain

Robert Johansson
Chalmers University of Technology; Dept. Energy and Environment , Sweden

David Pallarès
Chalmers University of Technology; Dept. Energy and Environment , Sweden

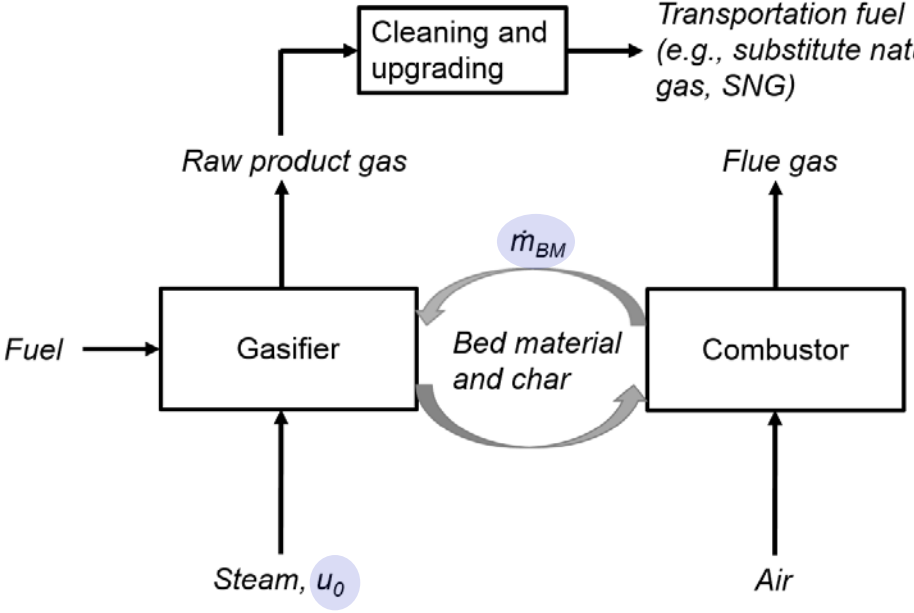
The role of fuel mixing on char conversion in a fluidized bed

Louise Lundberg[1], Antonio Soria-Verdugo[2], David Pallarès[1], Robert Johansson[1], Henrik Thunman[1]

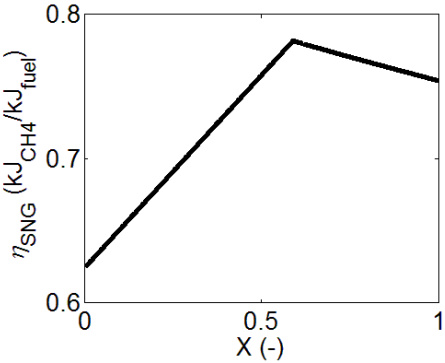
[1]Dept. of Energy and Environment,
Chalmers University of Technology
[2]Dept. Thermal Engineering and Fluid Mechanics,
Carlos III University

May 26th, 2016
Fluidization XV – Fairmont Le Chateau Montebello
Quebec, Canada

Background: Dual Bed Systems



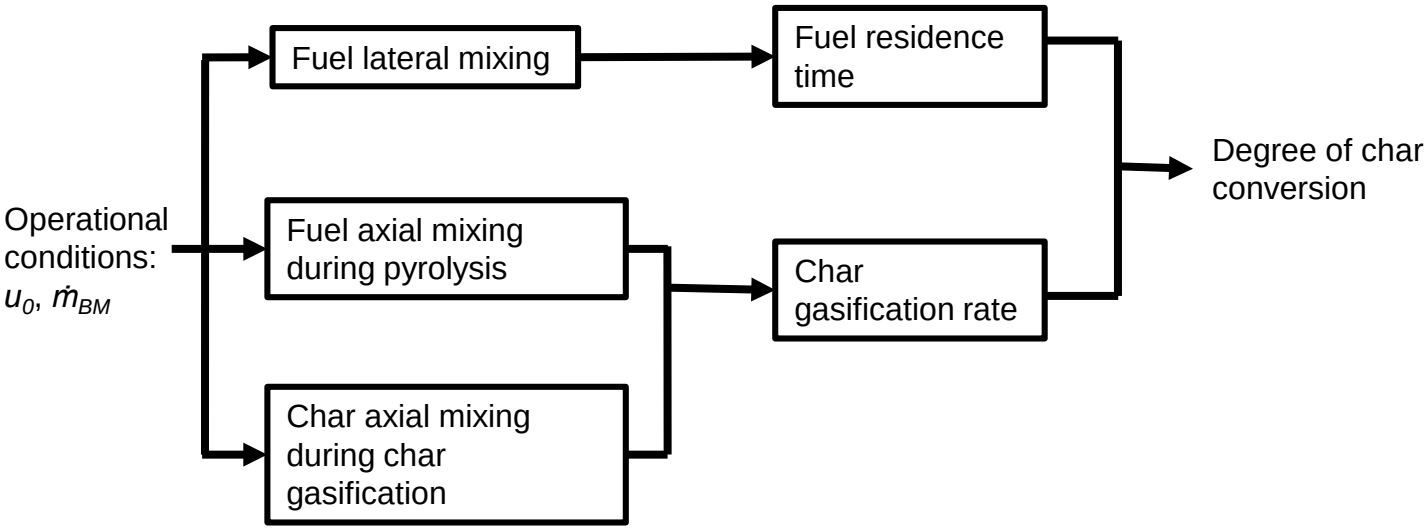
- Chemical-looping combustion
- Indirect gasification
- …



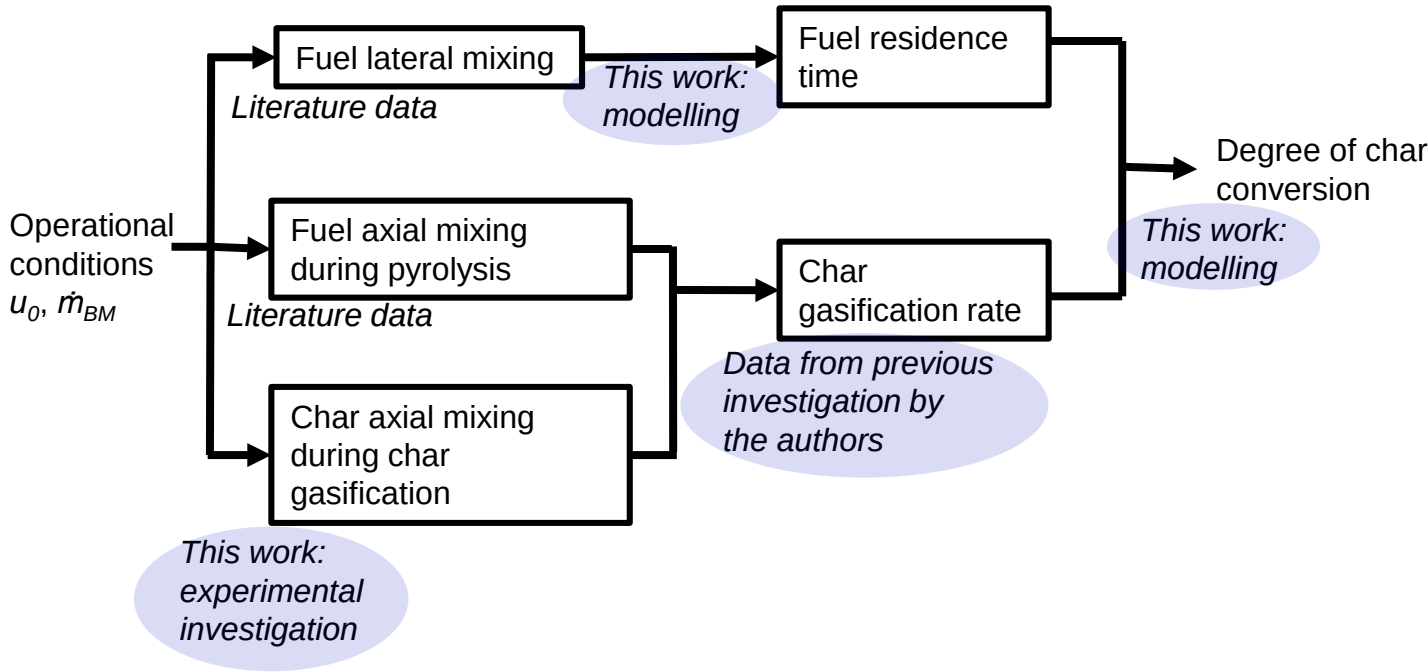
Chalmers 2–4-MW indirect gasifier

Example: Wood pellets to SNG

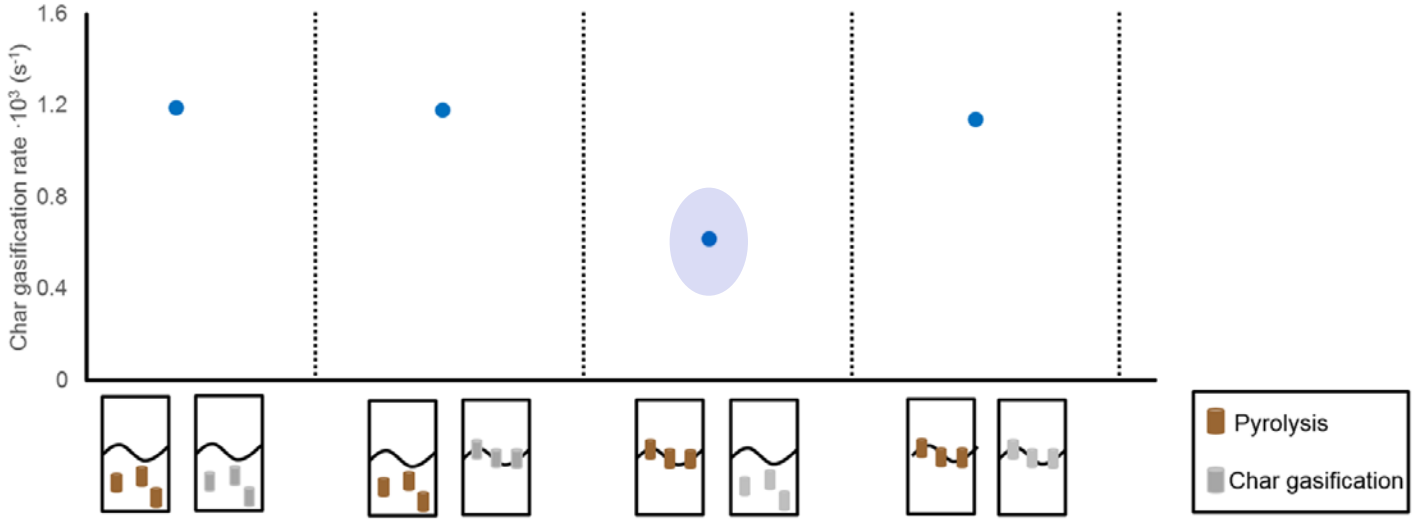
Background: Fuel mixing



Aim and Method

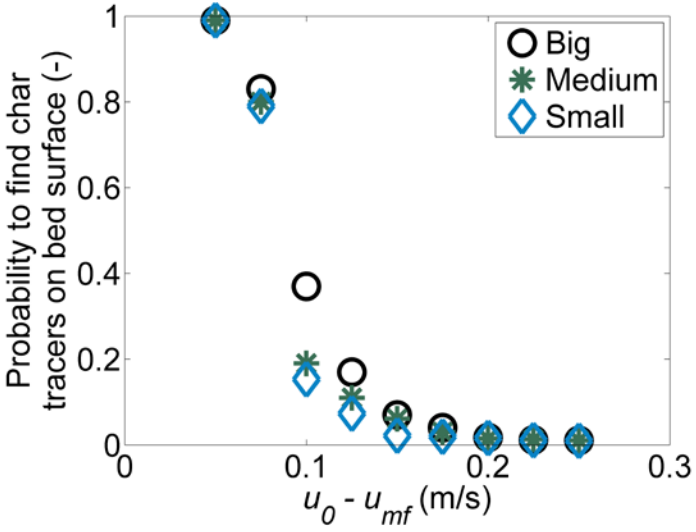


Previous Investigation: Fuel Axial Location –Effect on Char Gasification Rate



L. Lundberg, P.A. Tchoffor, D. Pallarès, R. Johansson, H. Thunman, K. Davidsson, Influence of surrounding conditions and fuel size on the gasification rate of biomass char in a fluidized bed, Fuel Processing Technology, 144 (2016) 323-333

Experimental Results: Axial Mixing –Char Segregation

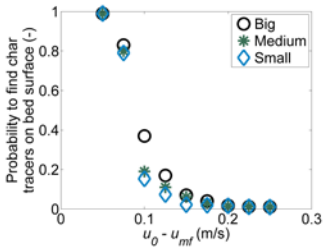


$$\rho_F = 250\ kg/m^3$$

	d (mm)	l (mm)
Big	8.1	23
Medium	7.2	21
Small	7.0	19

Literature data for axial mixing of fuel during pyrolysis as $f(u_0, \dot{m}_{BM})$

+



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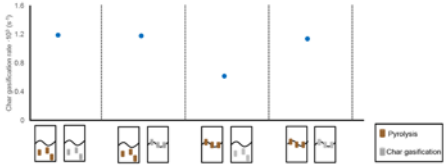
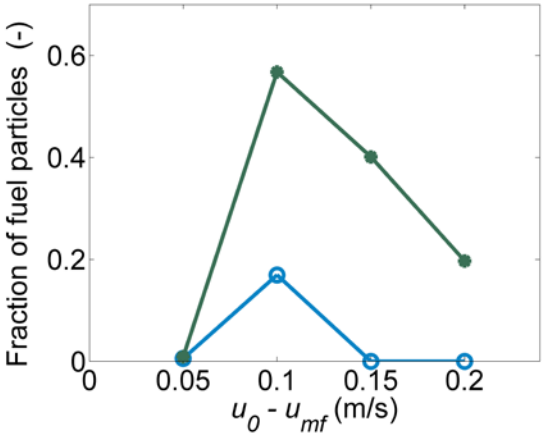
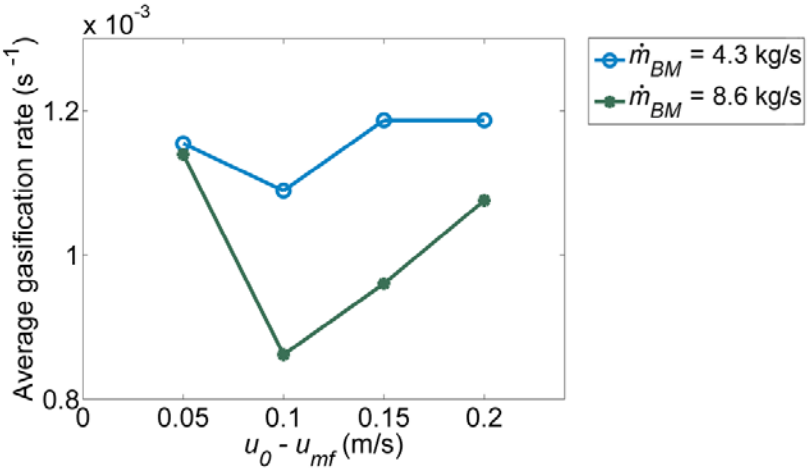
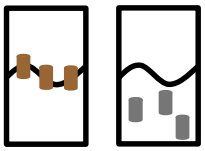


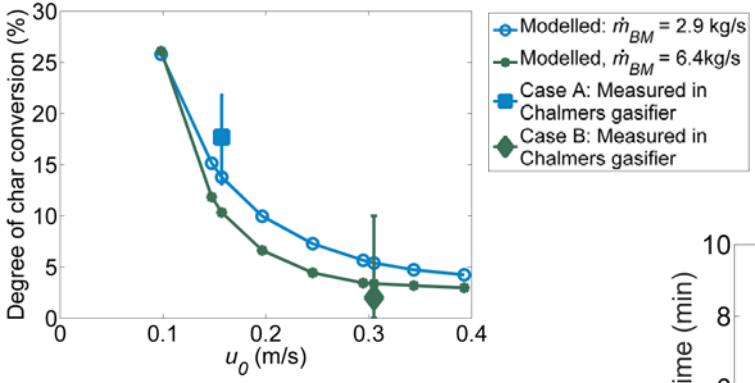
Modelling Results:
Axial Mixing –Char Gasification Rate

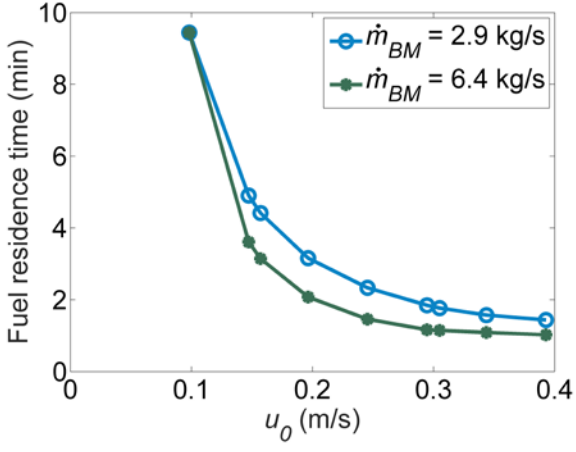




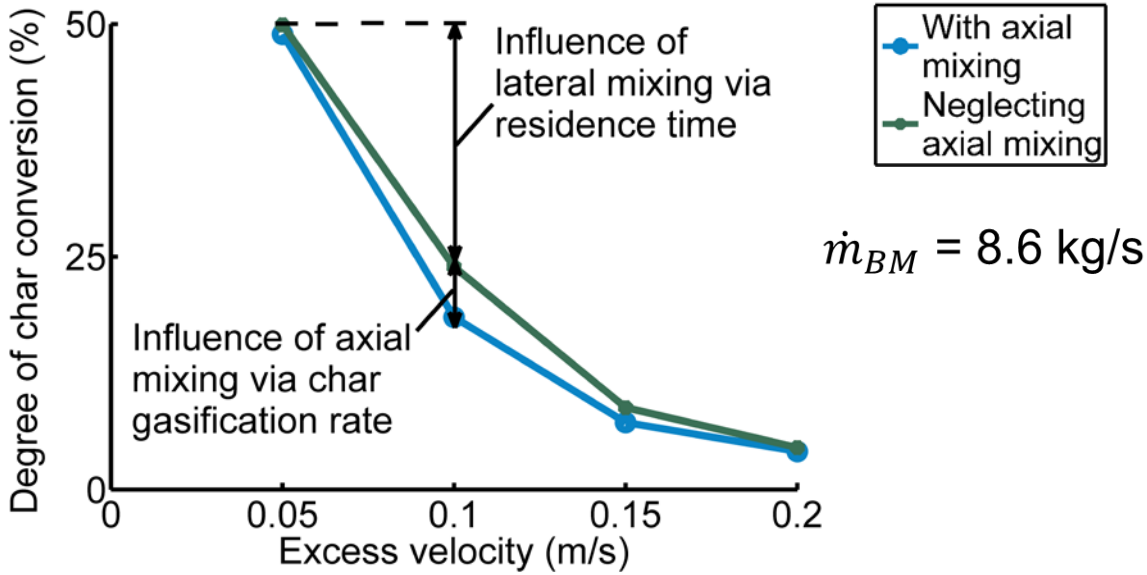


Modelling Results:
Lateral Mixing –Residence Time





Modelling Results: Lateral vs. Axial Mixing



$\dot{m}_{BM}$ = 8.6 kg/s

Conclusions

- Z_{BS} strongly decreases as $u_0 - u_{mf}$ increases.
- X decreases strongly as u_0 increases, due to an decrease in τ_F.
- Neglecting fuel axial mixing → X up to 1.3 times higher than when accounting for it.
- Effect of lateral mixing >> than effect of fuel axial mixing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