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

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

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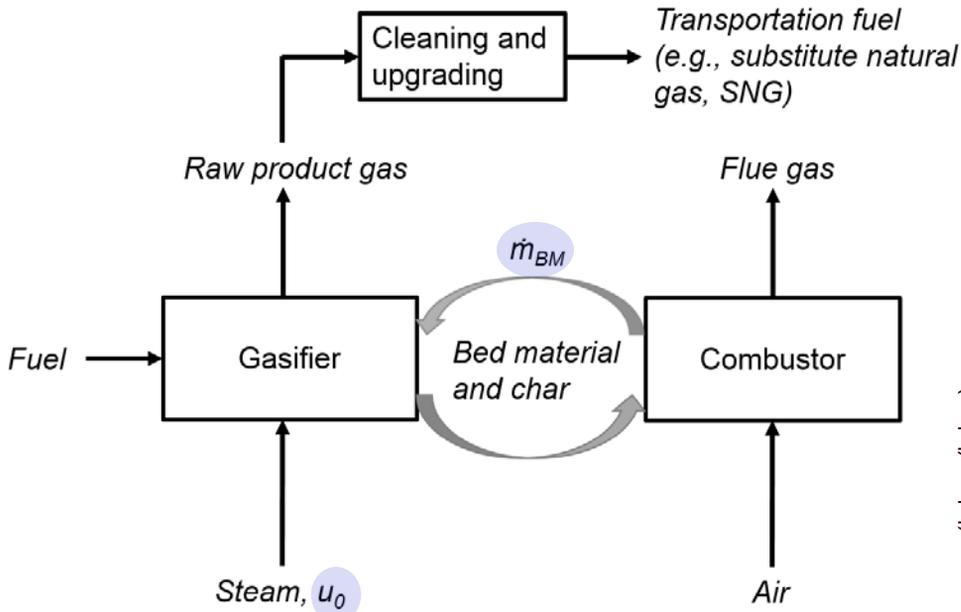
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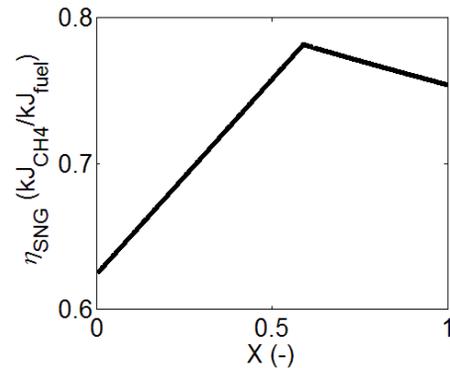
May 26th, 2016

Fluidization XV – Fairmont Le Chateau Montebello
Quebec, Canada

Background: Dual Bed Systems



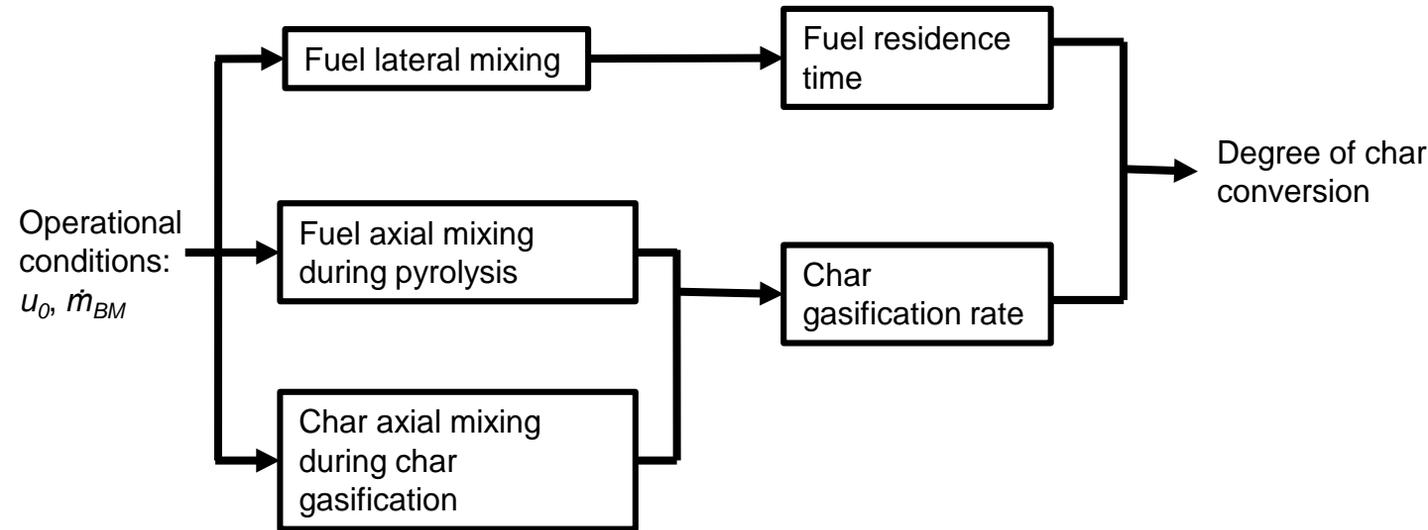
- Chemical-looping combustion
- Indirect gasification
- ...



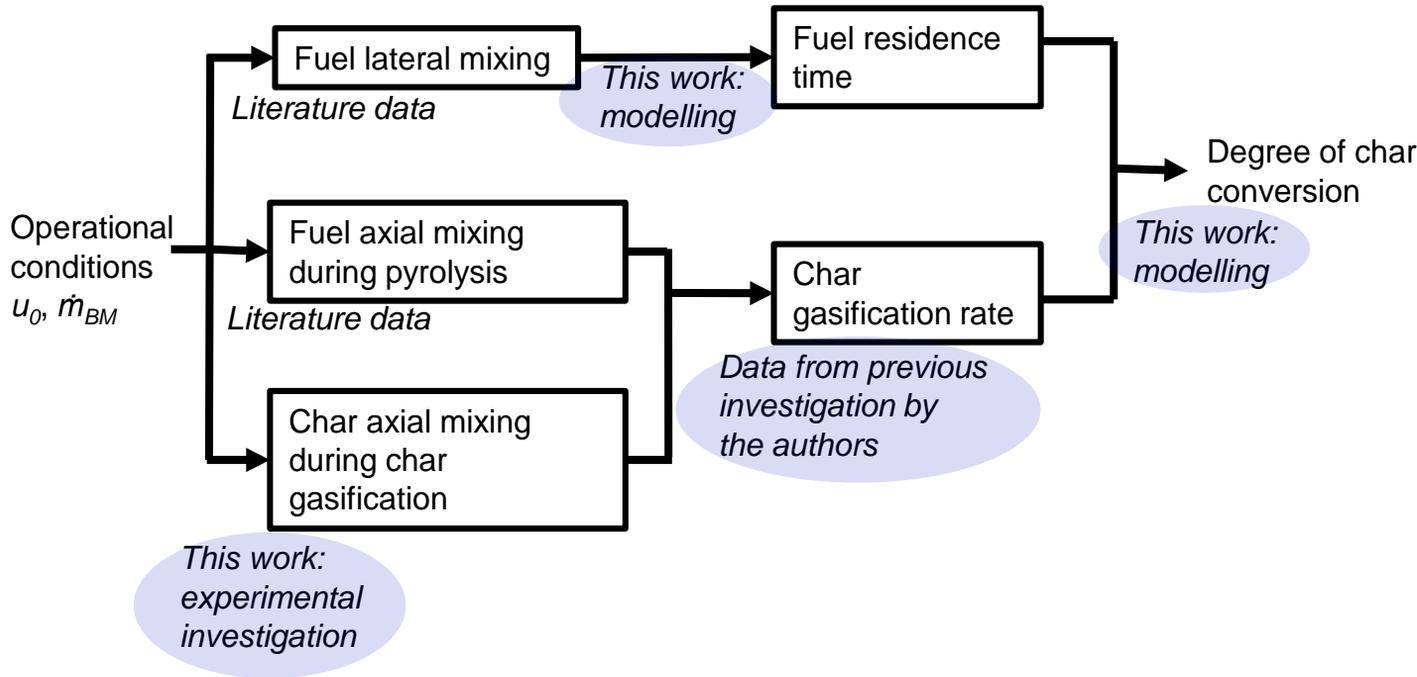
Chalmers 2–4-MW indirect gasifier

Example: Wood pellets to SNG

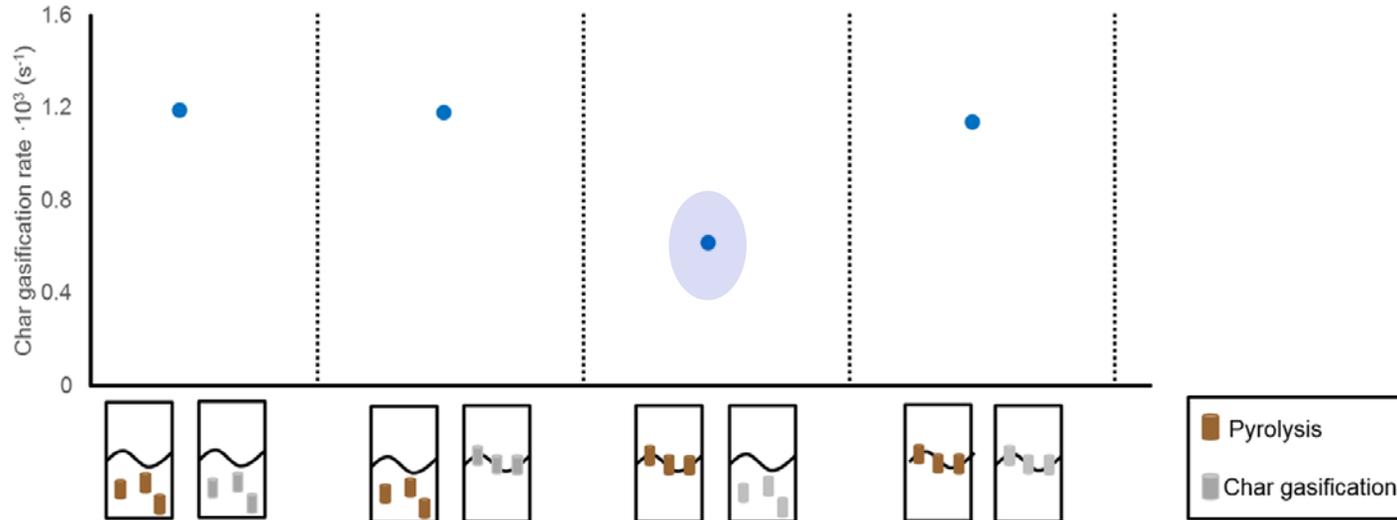
Background: Fuel mixing



Aim and Method

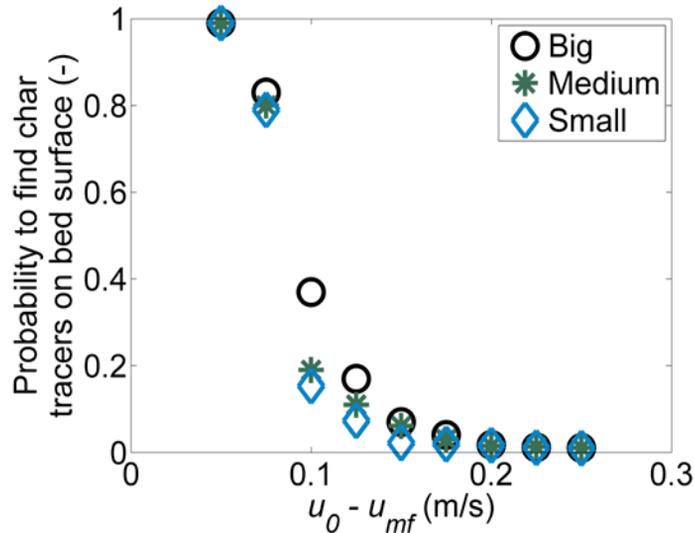


Previous Investigation: Fuel Axial Location – Effect on Char Gasification Rate



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

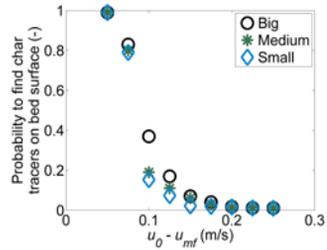


$$\rho_F = 250 \text{ kg/m}^3$$

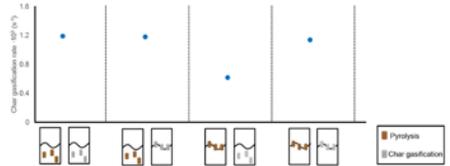
	d (mm)	l (mm)
Big	8.1	23
Medium	7.2	21
Small	7.0	19

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

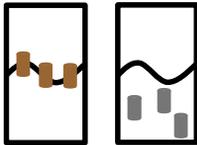
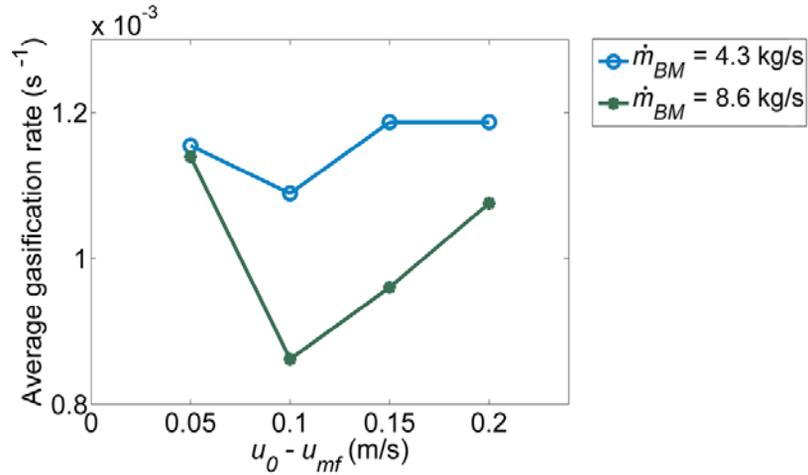
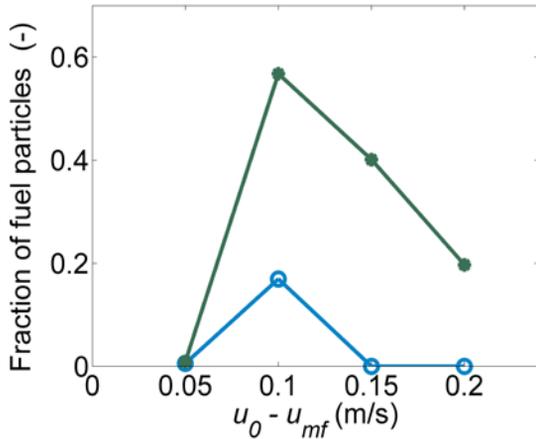
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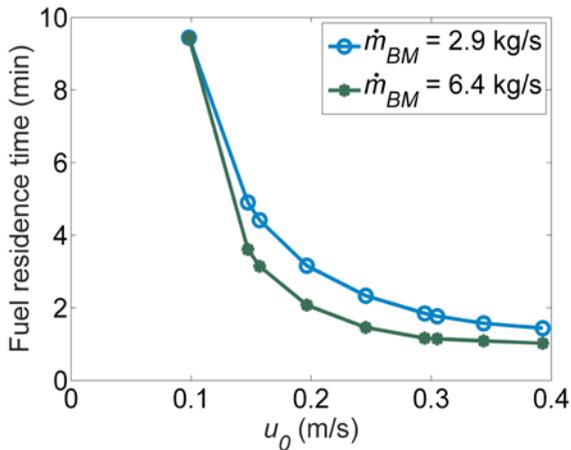
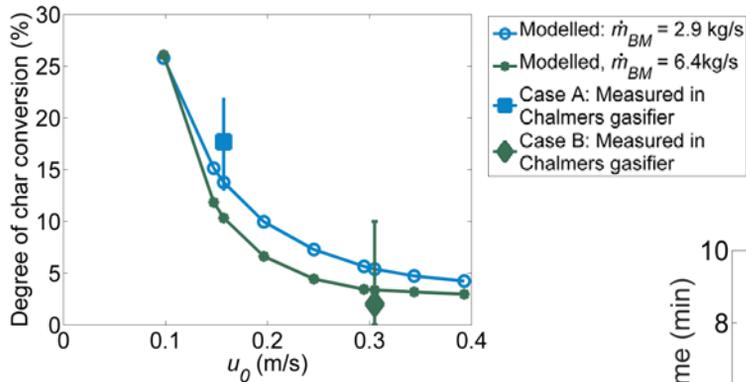
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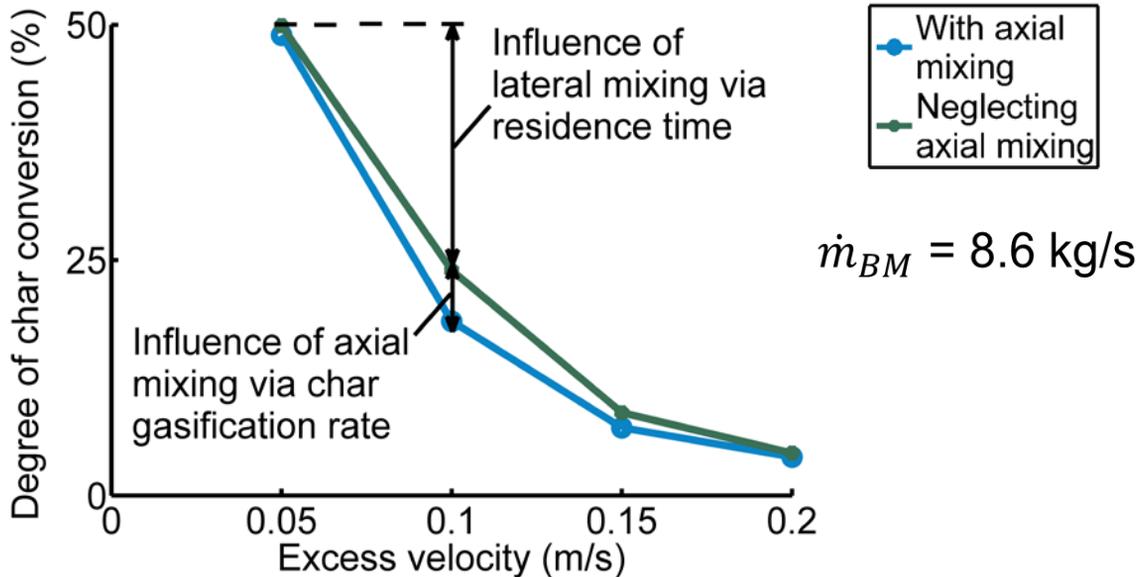
Modelling Results: Axial Mixing –Char Gasification Rate



Modelling Results: Lateral Mixing – Residence Time



Modelling Results: Lateral vs. Axial Mixing



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 $\rightarrow X$ up to 1.3 times higher than when accounting for it.
- Effect of lateral mixing \gg than effect of fuel axial mixing

