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Young Researcher's Prize

Nov 25, 2015

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ÖSTERREICHISCHE VEREINIGUNG FÜR DAS GAS- UND WASSERFACH

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Michael Balland

Biomass ash fluidized-bed agglomeration: hydrodynamic investigations

Demonstration Project GAYA

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2G Biomethane Production

The GAYA R&D Project

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Gaya

- **Project Goal**
  - To develop an efficient 2G Biomethane production process

    → ***Demonstration plant*** *in Saint-Fons (France, Lyon)*

2G Biomethane production pathway

1. **Biomass** (lignocellulosic)

2. **Gasification** 700-1000°C → Fluidized-Bed Technology
3. **Purification**
4. **Methanation**
5. **Upgrading**
6. **Bio-SNG***

* *Synthetic natural gas* → *Grid injection*

Gasification Operational Problem

Ash Melting & Bed Agglomeration

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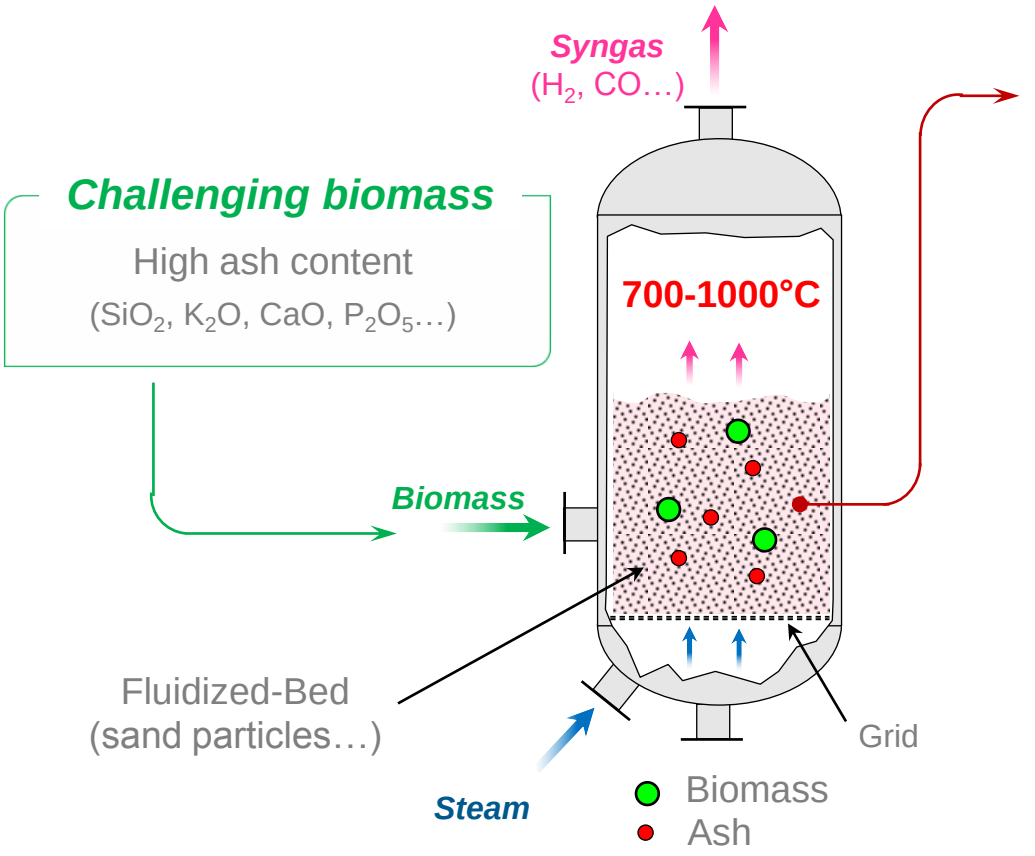
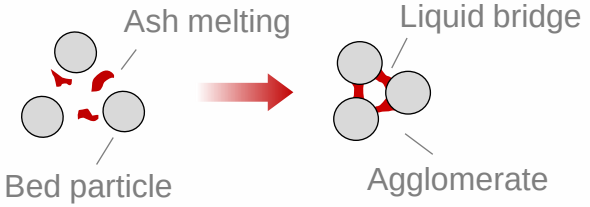


Fluidized bed gasification reactor

In-bed ash melting

Liquid phase accumulation
(molten salts or silicate)

Bed agglomeration



Hydrodynamic disturbances

Bed defluidization

Shutdown of the plant

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Hydrodynamic Investigation
Experimental Approach

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Bed-agglomeration due to liquid formation ?

Real materials

- T = 700-1000°C
- Small-scale

Simulant materials

- T = 20°C
- Medium-scale

Phenomenology

Biomass gasification

- Real conditions
- Pilot-scale

Hydrodynamic Investigation

One specific result …

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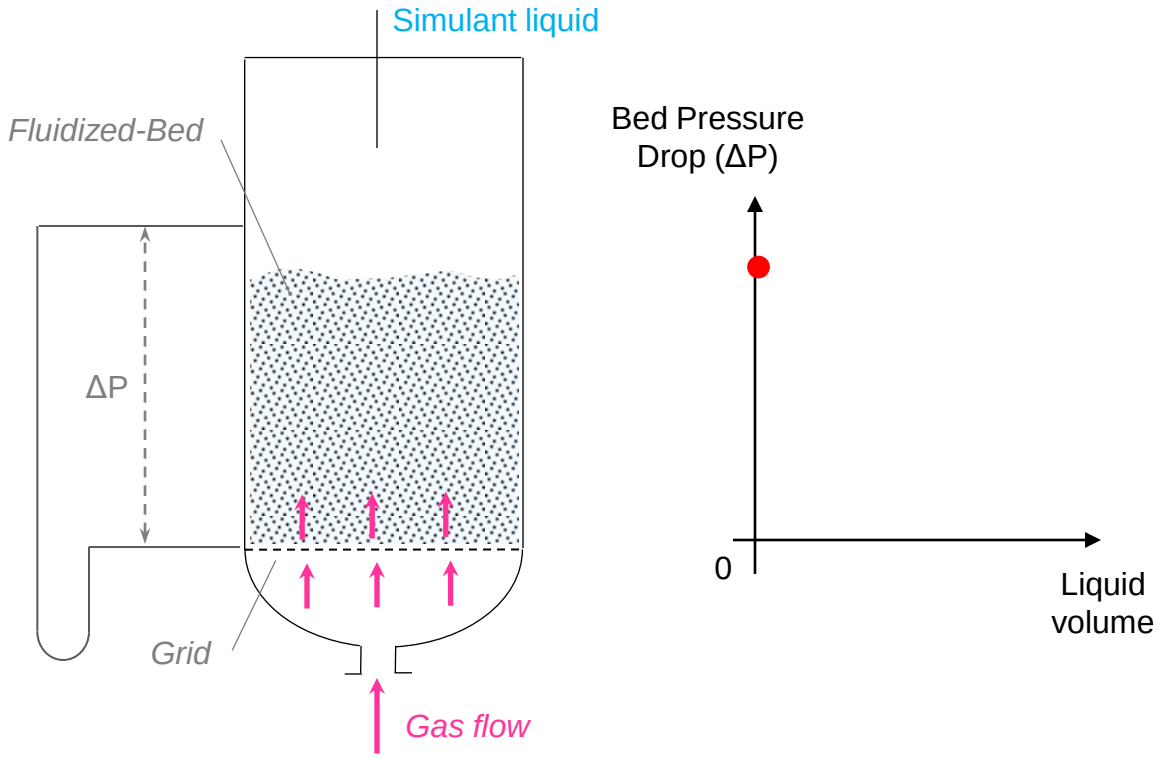
Visualization of the bed agglomeration process *(simulant materials)*



Hydrodynamic Investigation

One specific result …

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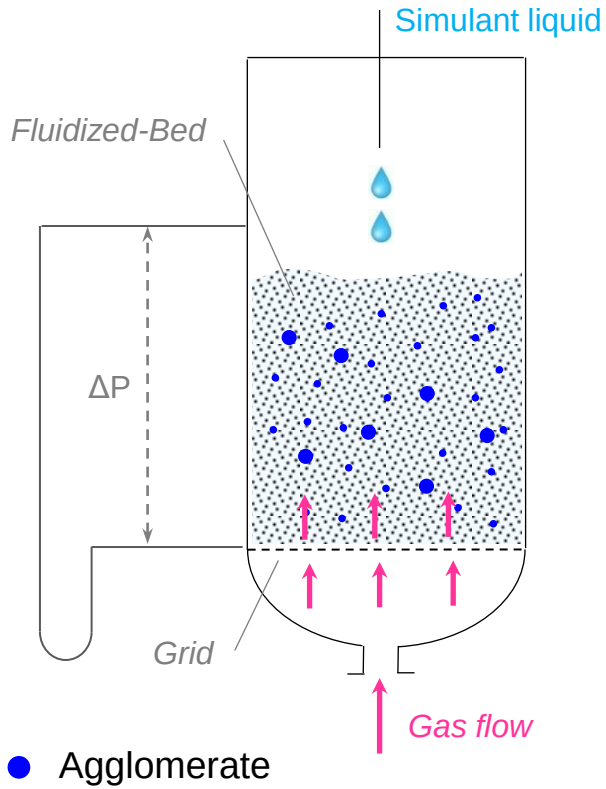

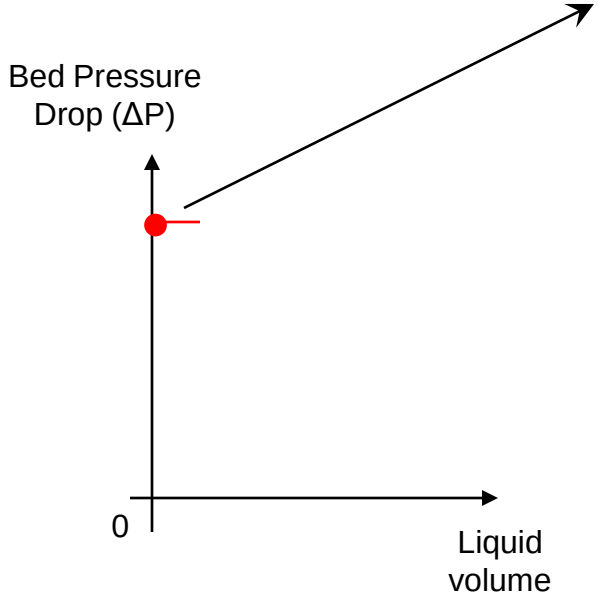

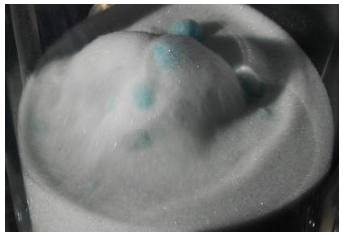

Hydrodynamic Investigation

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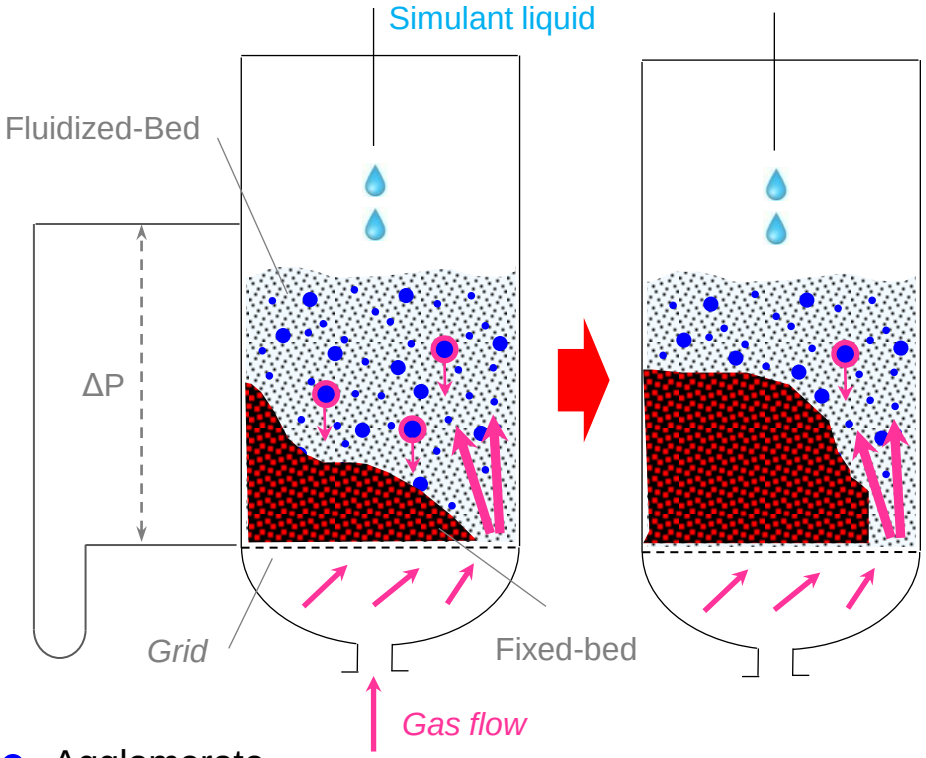

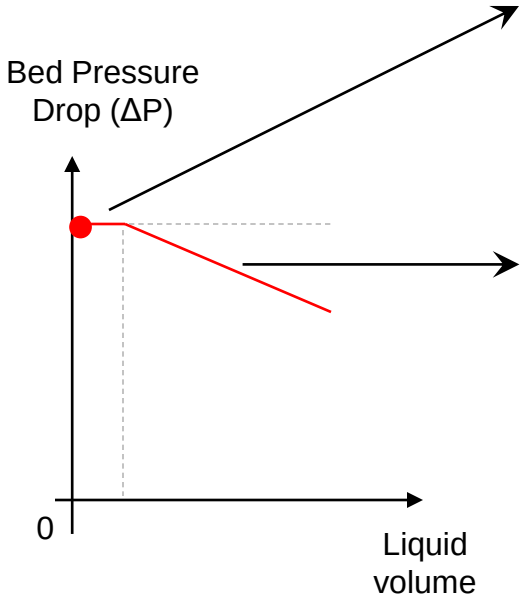

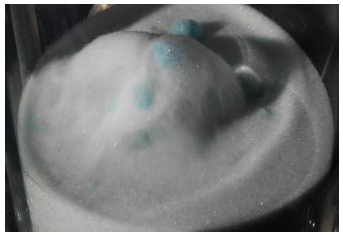

- Agglomerate

Hydrodynamic Investigation

One specific result …

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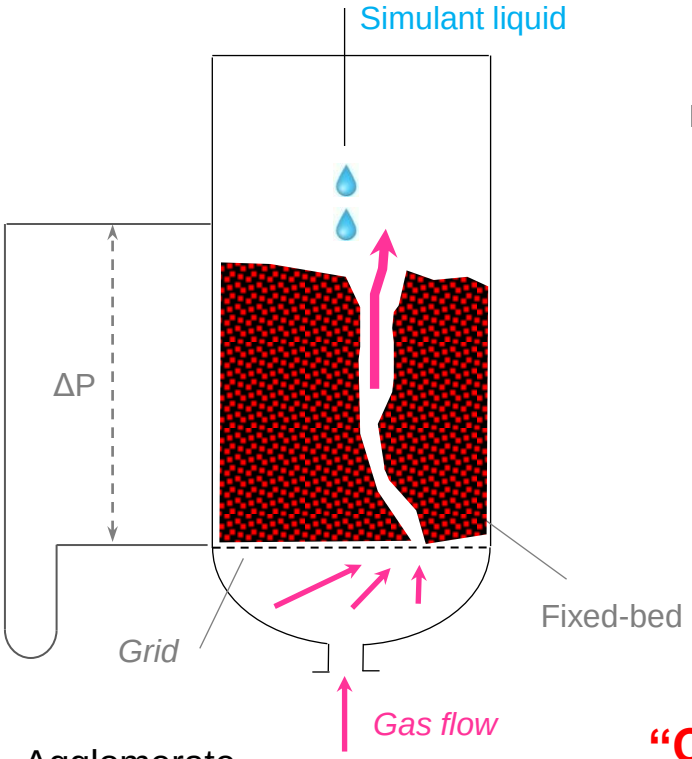

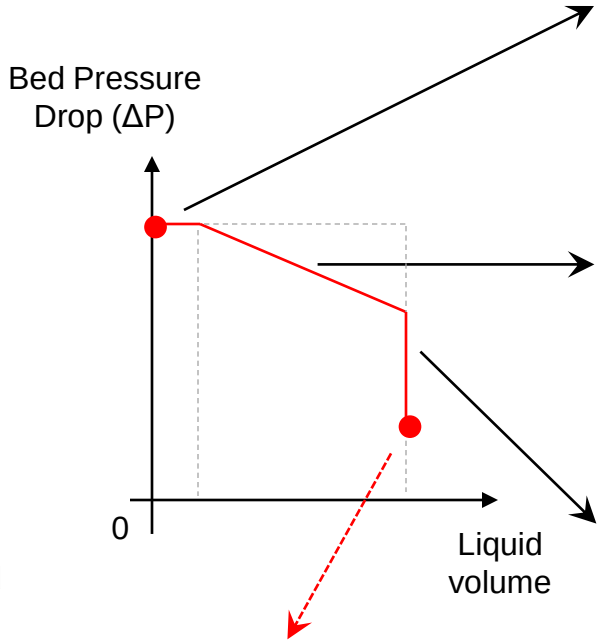

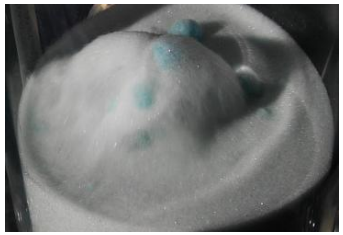

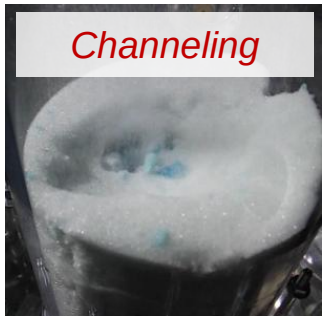

“Critical” liquid amount
➔ *few %vol. of bed*

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Conclusion

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- ***Improvement in the profitability of 2G Biomethane production will involve:***
  - The increasing use of cheaper biomass (with higher ash content)
  - The **increasing risk of bed agglomeration** during gasification operation

→ ***Better comprehension of the bed agglomeration problem for a better operating management***