Development and trials of a small-capacity pilot flash dryer for cassava-derived products

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Small-scale flash dryers: issues and challenge

Sun drying, 2 t/day (Colombia)
Drying time: 6 hours

- **Sun drying has many limitations**:
  - **Land** requirement
  - **Product quality**: contamination + drying time
  - **Economic risk**: dependence on weather conditions

→ Increasing capacity requires a more reliable process

Small-scale flash dryers: issues and challenge

Flash drying, 400 t/day (Thailand)
Drying time: 2 seconds

- **Artificial drying** is **energy-intensive** and **costly**
  - 70-80% of energy use
  - Up to 30% of processing cost

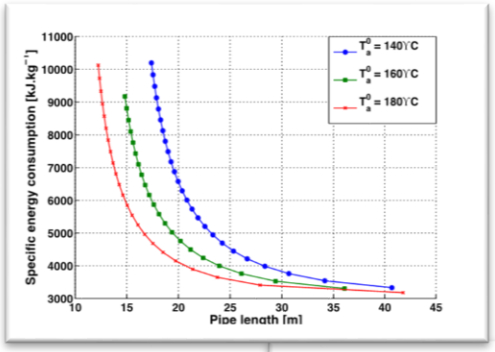
→ To be profitable, it must be energy-efficient

Approach to downscaling flash drying technology

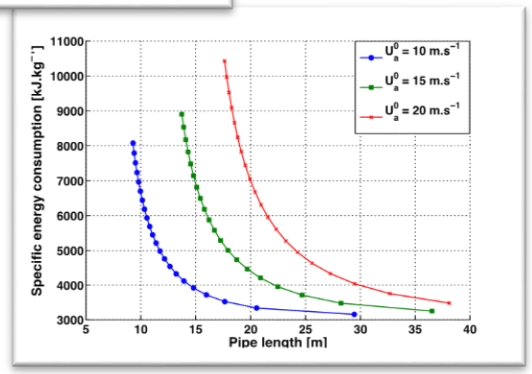
- **No consensus on the design** of flash dryers: Diversity of shapes and operating conditions
- Most **small-scale flash dryers** in are **inefficient**

Approach to downscaling flash drying technology

- **MODELLING AND SIMULATIONS**



Validated with data from industrial dryers



A. Chapuis et al., (2017), *Drying Technology* 35:4.

- **DESIGN GUIDELINES**

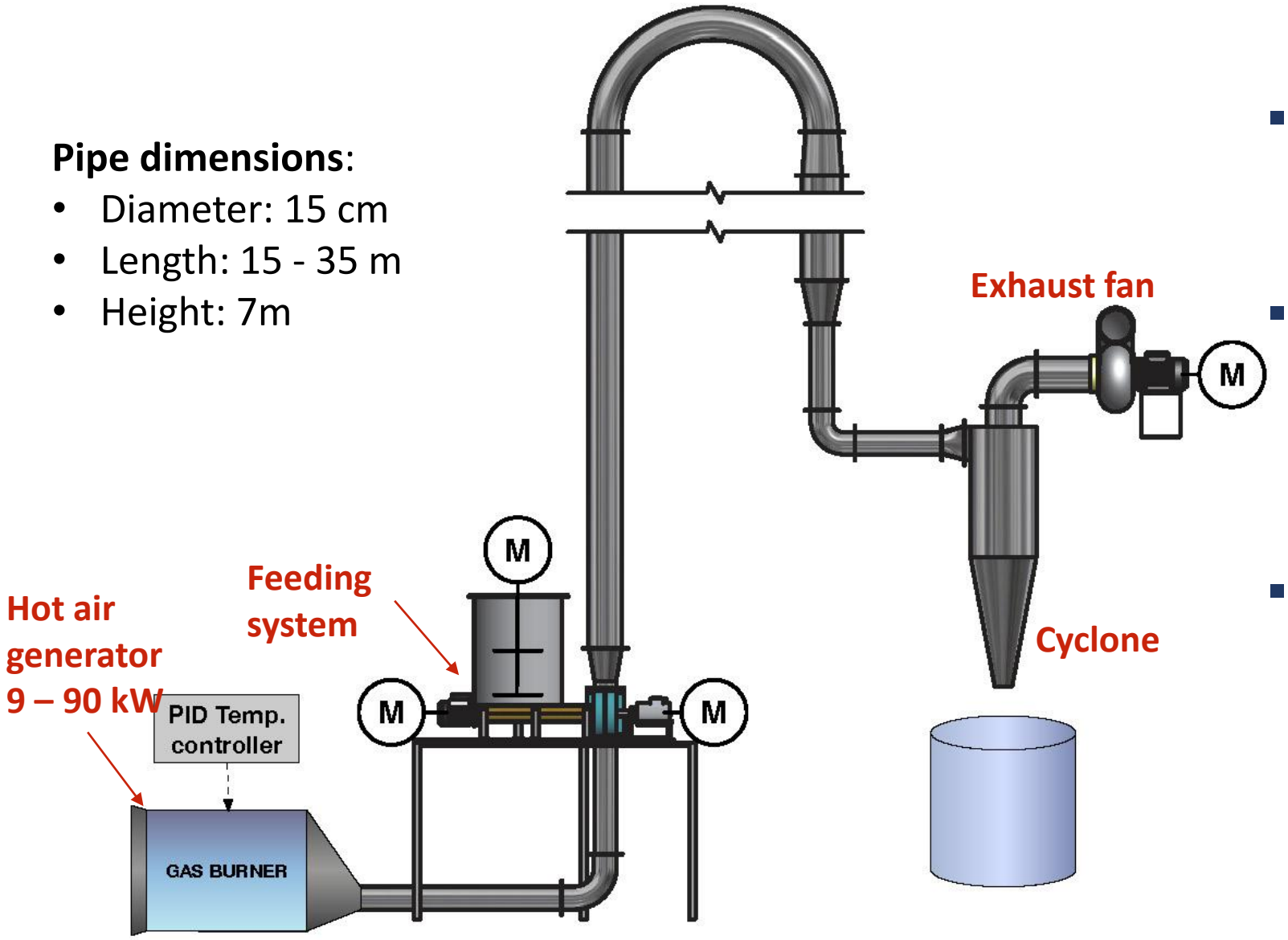
for an **energy-efficient** flash dryer

↗ **Pipe length**	**> 20 m**
↘ **Air velocity**	**10 – 15 m/s**
↗ **Air temperature**	**180 °C**
Air / Starch ratio	**9 – 11**

Development of a pilot flash dryer

Pipe dimensions:

- Diameter: 15 cm
- Length: 15 - 35 m
- Height: 7m



TECHNICAL SPECIFICATIONS

- **Drying capacity : 50-100 kg/h dry starch**
- **Product moisture :**
  - Inlet: 35-40% w.b.
  - Outlet: 12-13% w.b.
- **Operating conditions :**
  - Air velocity: 10-25 m/s
  - Air temperature: 130-200°C
  - Pipe length: 16-35 m

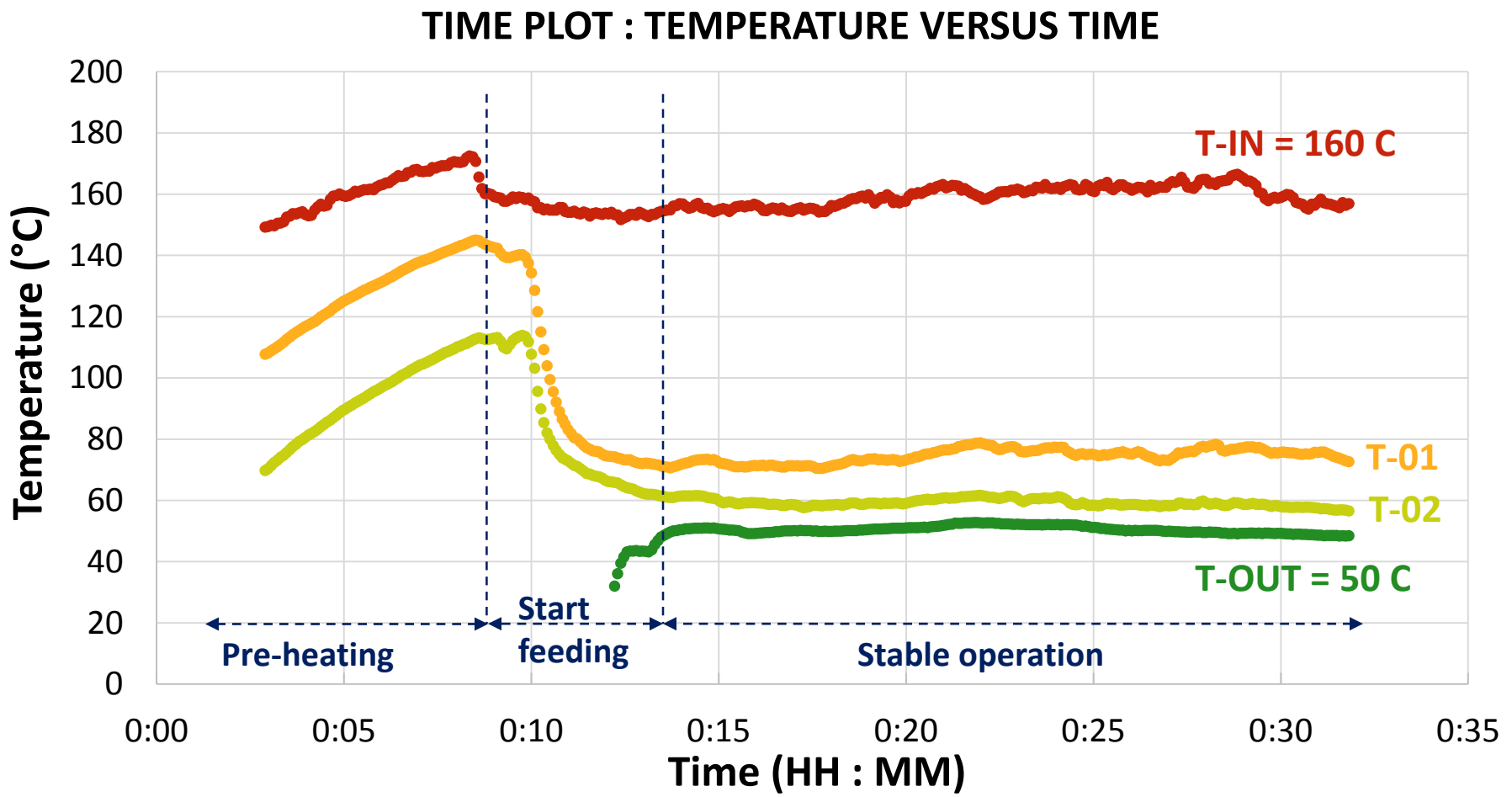
Drying experiments: trials description

- **Drying material:**
  - **Native cassava starch** from a local cassava processor
  - **Pre-drying** in the **sun** to reach **35 – 40% moisture content**

- **9 trials, screening of operating conditions :**
  - Air velocity: **12 to 20 m/s**
  - Air temperature: **140 to 180°C**
  - Dying length: **19 m and 29 m**
  - Feed rate: **50 – 150 kg/h**

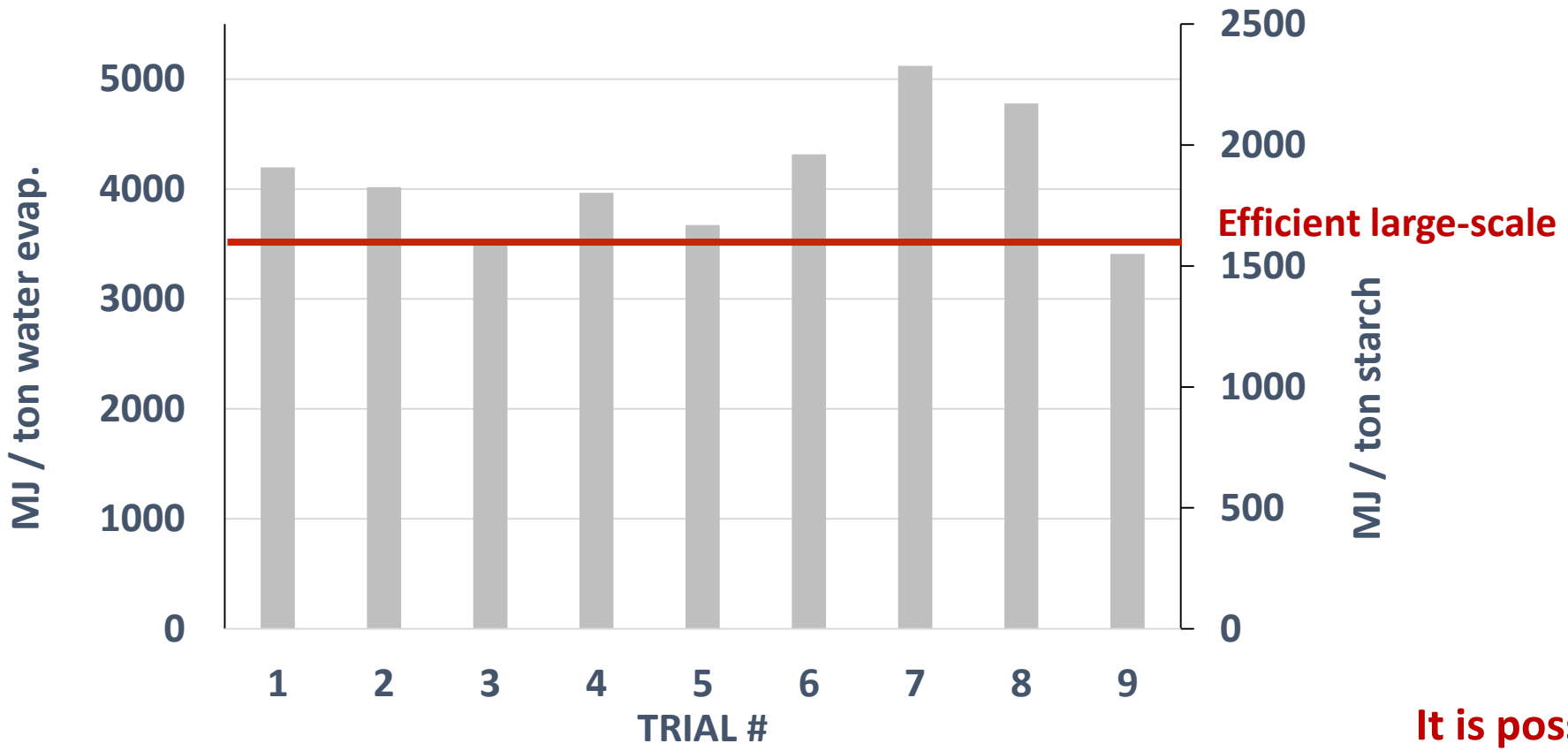
Drying experiments: results

- **Stability of operation**



Drying experiments: results

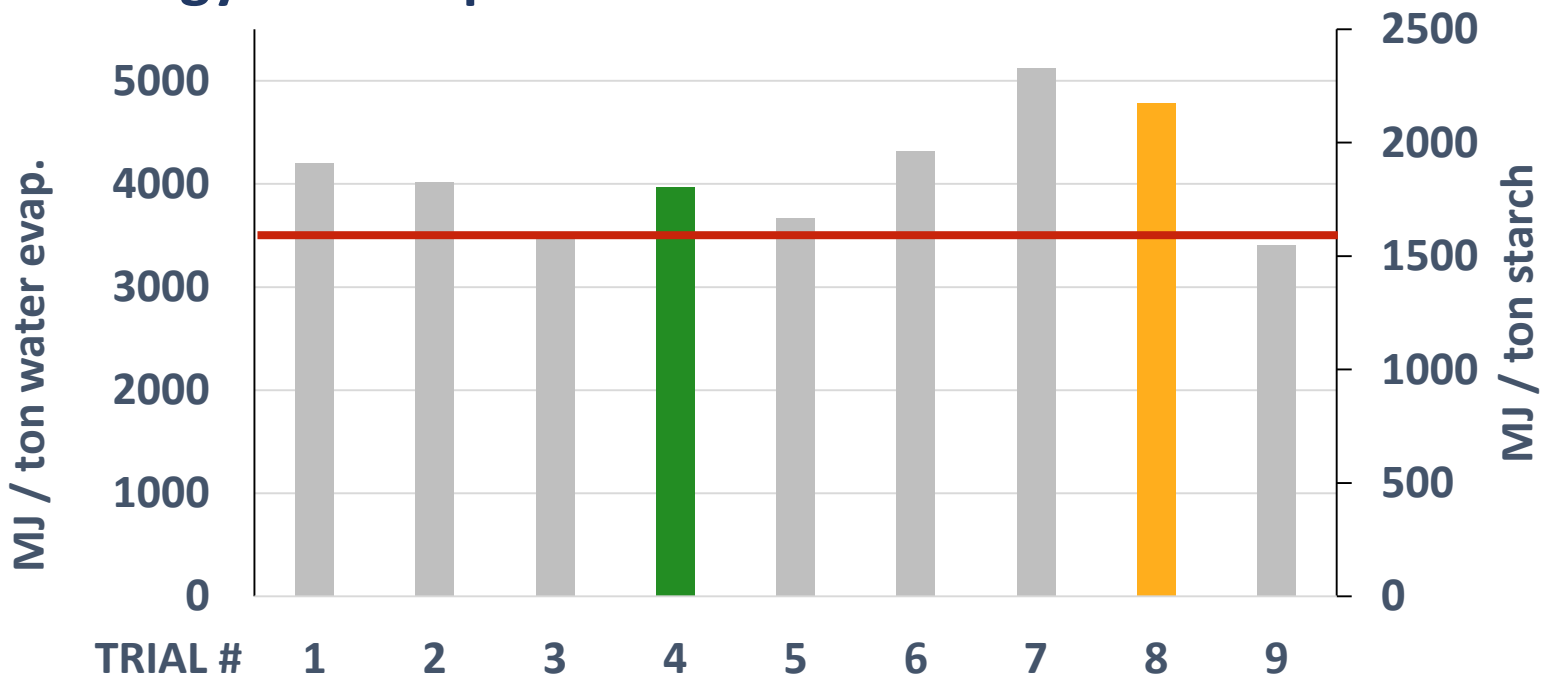
- **Energy consumption**



It is possible to build small-capacity flash dryers with high efficiency !

Drying experiments: results

- **Energy consumption**



Pipe length	19 m	29 m
Feed rate	78 kg/h	52 kg/h
Temperature	180 C	135 C
Output moisture	11.5%	14 %

GELATINIZATION < 1%

Research and development perspectives

- **Scaling project**: **3 pilot sites** in DRC, Nigeria and Uganda
  - **Partnership** with local **cassava processors** and **equipment manufacturers**
  - **Co-design**, construction and installation of **flash dryers**
  - **Capacity building** of stakeholders and **performance follow-up**

Supported by the **RTB Scaling Fund !**

- **Research and innovation topics :**
  - Mechanical **dewatering**
  - **Renewable energy supply:** biogas, solid biomass
  - **Drying other powder products** : other starches and flours, peels, fibers

Thank you !

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