

NEW PROCESS FOR THE PRODUCTION OF PERMEATE POWDERS WITHOUT SPRAY DRYER

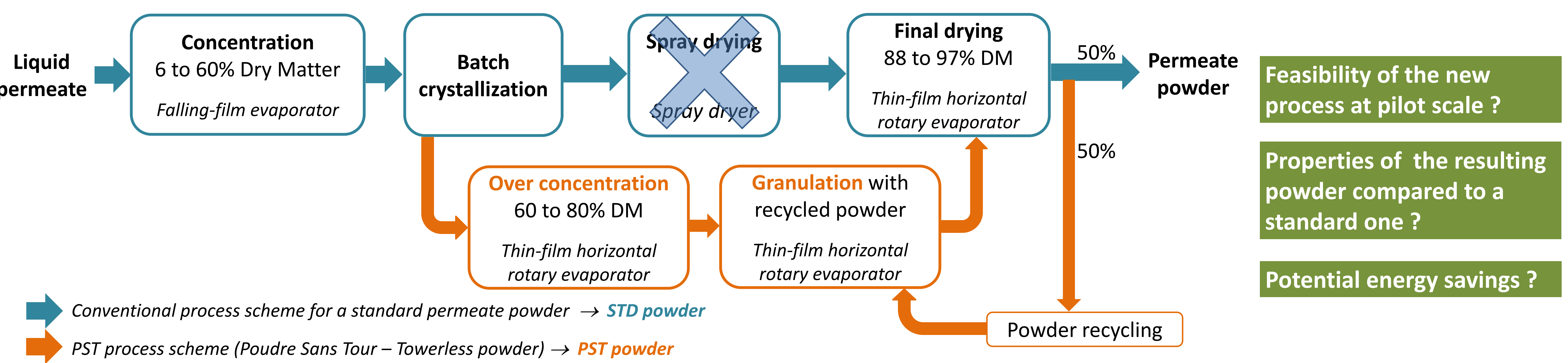
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Context

In the dairy powder manufacture process, spray-drying is about 10 times more energy-consuming than falling-film evaporation (5,256 and 418 kJ.kg⁻¹ of removed water respectively). An effective way to reduce the energy cost of the whole process is to feed the dryer with a concentrate at the higher dry matter content as possible. However, **the maximum dry matter content achievable in a falling-film evaporator is limited mainly by the viscosity of the concentrate**: the higher the dry matter, the higher the viscosity, and the more difficult to pump and extract it.

Objectives

- We tested an **innovative process for the production of permeate powders** from highly concentrated products and at pilot scale
- New process based on a device able to handle highly viscous concentrates, the viscosity of the product being controlled by a vigorous mechanical treatment that maintains it in a fluid state.
- The same technology, a **thin-film horizontal rotary evaporator**, is used for the three steps of the process
- No spray-dryer is used for the production of powders**



Results

- A permeate powder was prepared at pilot scale according to the PST process scheme and from pre-concentrated permeate at 32% w/w DM

	PST powder	STD powder
Dry matter (g.kg ⁻¹)	979.1	977.5
Water activity at 25 °C (-)	0.20	0.23
Rate of lactose crystallization (%)	85	62
Hygroscopicity (%) at 43% HR	0.9	2.7
Hygroscopicity at 85% HR	16.3	14.5

Table 1: physical properties of the powders

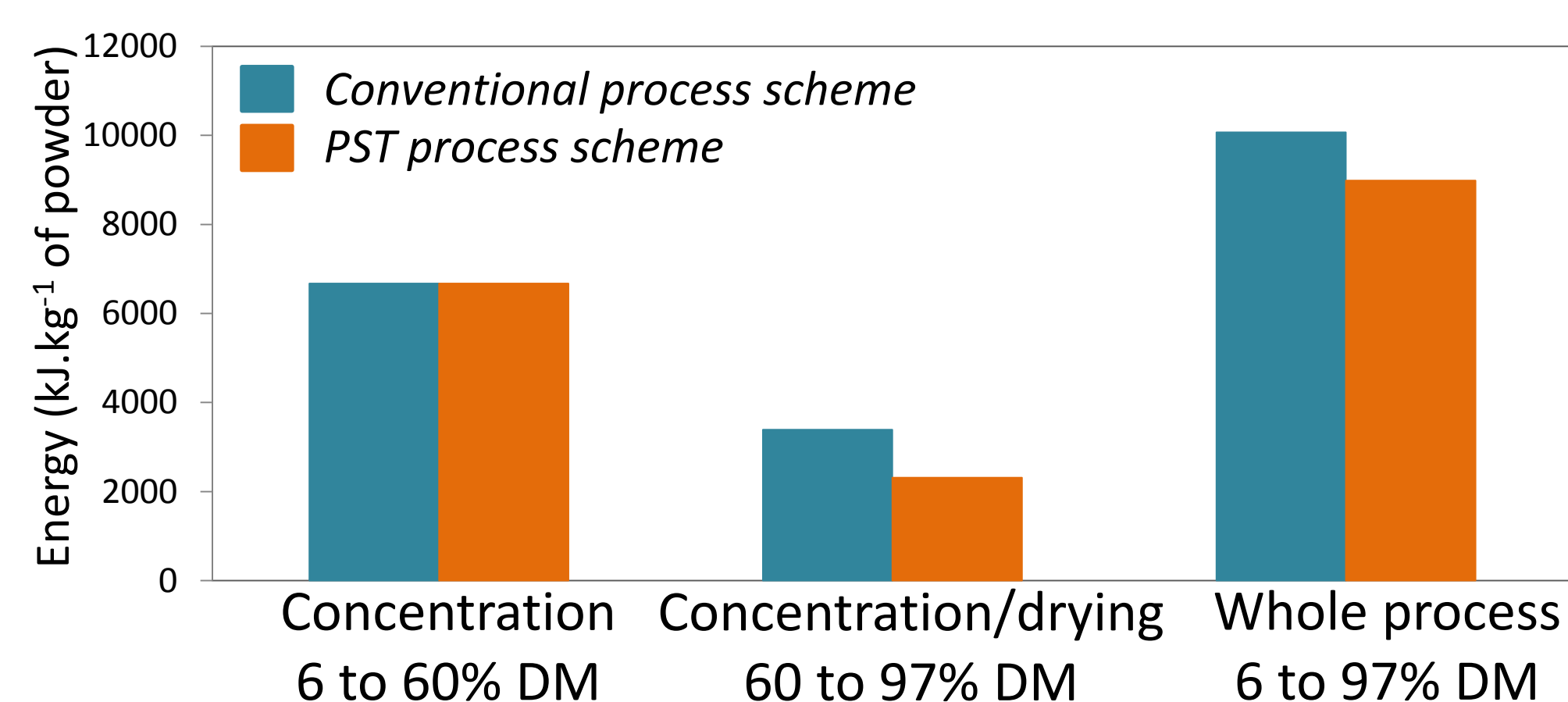


Figure 2: Comparison of energy costs for both processes

- Similar quality of PST powder compared to a standard one with regard to densities and rehydration properties
- Larger particles of PST powder compared to a standard powder → it might be inherent to granulation

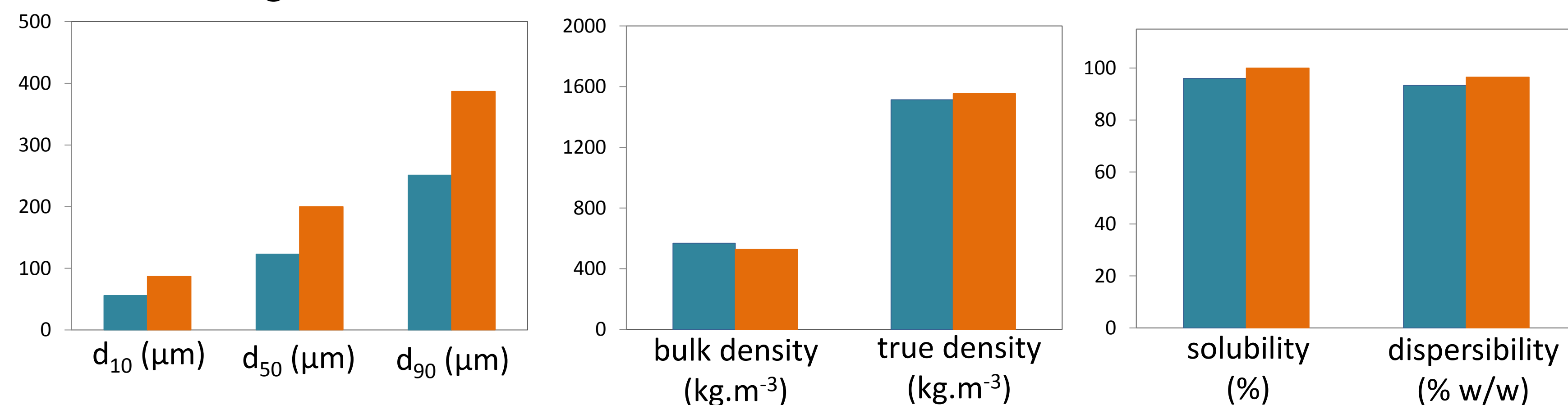


Figure 1: particle size, densities and rehydration properties of the powders; ■ STD powder, ■ PST powder

Estimation of energy costs on the sole basis of the energy required for removal of water, (i.e. investments and operating costs are not taken into account) and comparison of energy costs for both processes for the production of 1,701 kg.h⁻¹ of permeate powder at 97% DM from 30,000 kg.h⁻¹ of liquid at 5.5% DM:

Whole process :
PST vs STD : - 11%

Step 60 to 97% DM :
PST vs STD : - 32%

Conclusions

- Demonstration of the feasibility of the new process at pilot scale for the production of permeate powder
- Satisfactory properties of the resulting powder

VALIDATION

REDUCTION

- Estimation of the energy savings on the sole basis of the energy required for water removal: from 10 to 30%
- Building savings estimated at 40%

- Sustainability
- Technological breakthrough
- Potential new products

INNOVATION

