SENSUM

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PBP WORLD MEETING

In-line agglomeration estimation in fluid-bed pellet coating processes using **PATVIS** APA

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AIM

Evaluate the performance of visual inspection system **PATVIS** APA (Sensum, Slovenia) for in-line estimation of the agglomerate fraction of pellets throughout the coating process.

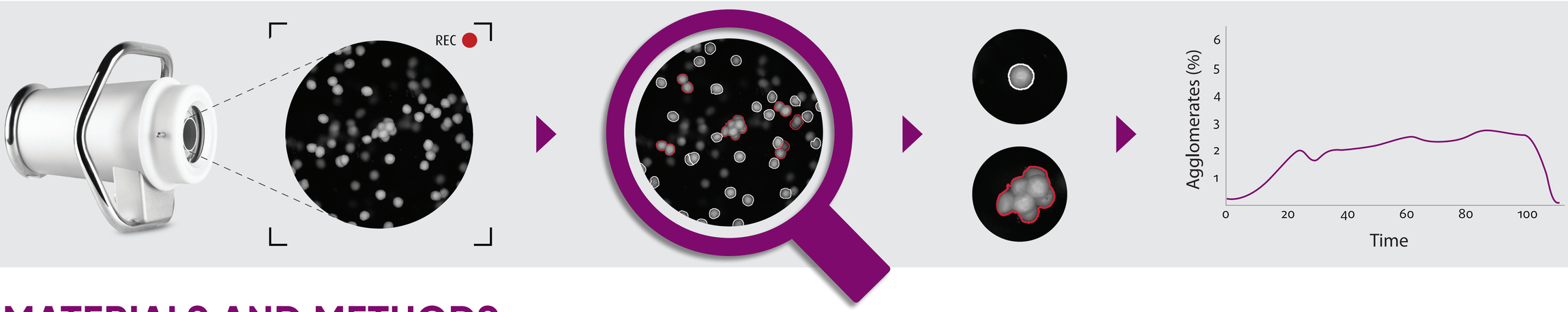
REAL-TIME:
- Acquisition of pellet images
- Recognition of single pellets and agglomerates
- Estimation of agglomerate fraction trends

INTRODUCTION

Agglomeration occurs when a temporary liquid bridge formed between pellets solidifies into a permanent structure. It affects the coating process yield (agglomerates are discarded) and the coat integrity.

Sieve analysis is traditionally used to assess the agglomerate fraction only at the very end of the coating process.

Evaluation by comparison of the final in-line estimated agglomerate fraction to the results of sieve analysis as a reference method.



MATERIALS AND METHODS

PELLETS

- Microcrystalline cellulose pellet cores with a size distribution 700 µm–1000 µm
- Water-based coating dispersion composed of hypromellose (8% w/w), polyethylene glycol (1% w/w) and tartrazine (1% w/w).

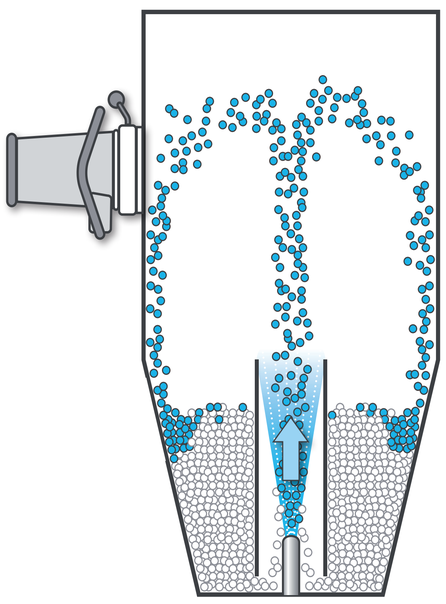
METHODS

COATING

Two coating processes in a laboratory-scale fluid-bed Wurster-type coater (BX-CGD1, Brinox d.o.o., Slovenia) in the bottom-spray configuration (Table 1).

IMAGING SETUP

Image acquisition through the observation window



of the coater using an in-line visual inspection system **PATVIS** APA (Sensum, Slovenia).
Acquisition rate of 100 images per second, average sample size of 250 000 particles in a one minute sampling interval.

IMAGE ANALYSIS

- Detect particle regions.
- Classify as single pellets or agglomerates.
- Estimate agglomerate fraction as the volumetric ratio between the agglomerated pellets and all analyzed pellets.

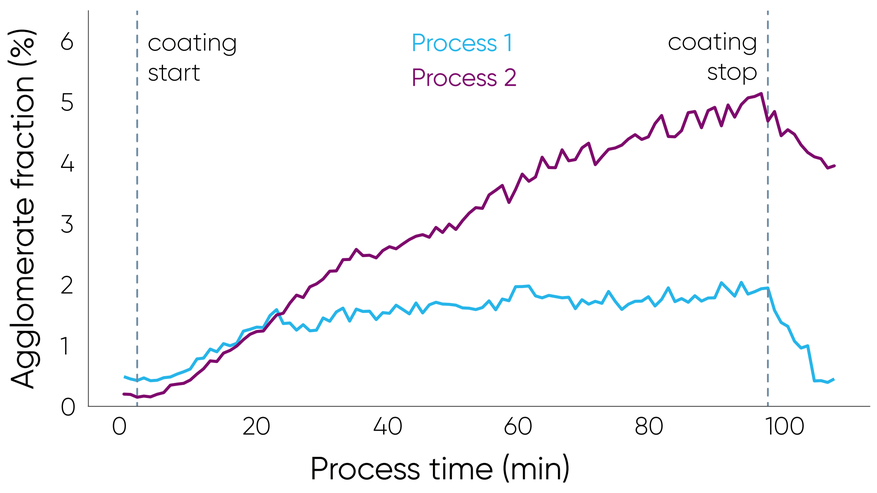
Table 1: Process parameters (T_{in}, Q_{in} – Temperature and quantity of the inlet air; T_{prod} – Product temperature; SR – Spray rate; CD – Column distance; WG – Theoretical weight gain)

Process	Size (g)	T_{in} (°C)	Q_{in} (m^3/h)	T_{prod} (°C)	SR (g/min)	CD (mm)	WG (%)
1	1000	55	130	41-43	11	20	5
2	1000	55	130	41-43	12/11/10	20	5

RESULTS AND DISCUSSION

Table 2: Pellet coating results.

Process	Weight gain (%)	Yield (%)	AGGLOMERATE FRACTION (%) Sieve analysis	AGGLOMERATE FRACTION (%) **PATVIS** APA
1	4.78	98.05	0.21	0.45
2	4.96	94.44	4.0	3.95



Final agglomerate fractions measured with **PATVIS** APA show good agreement with reference to the sieve analysis (Table 2).

Figure 1:
Agglomerate fraction trends for both processes.

Process 2 with high final agglomerate fraction exhibited substantial trend increase already in the early stages (Figure 1), providing means for optimization of process parameters to retain the agglomeration in an acceptable range.

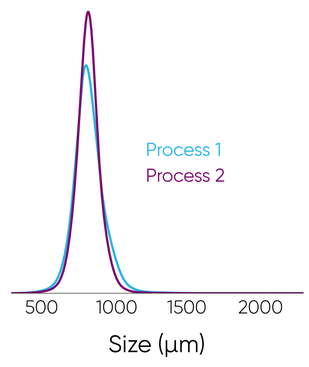


Figure 2:
Size distributions at the beginning of processes.

Similar size distributions can be observed at the begining of both processes (Figure 2).

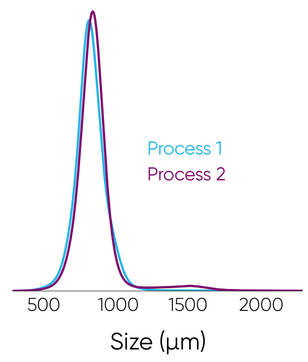


Figure 3:
Size distributions at the end of processes.

Bimodal size distribution can be observed at the end of the Process 2, indicating the presence of agglomerates (Figure 3).

CONCLUSION

Results confirm the ability of using PATVIS APA as a process analytical technology (PAT) tool for pellet agglomeration estimation.
Agglomerate fraction trends give in-depth insights into the dynamics of formation and breakage of agglomerates throughout the processes that are impossible to retrieve by the sieve analysis method.
The timely agglomerate fraction measurements provide unprecedented information for understanding, controlling and optimization of pellet coating processes.