Powder Coating of Ethylcellulose on Pellets in Tangential Spray Fluid Bed: Influence of Curing Conditions

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INTRODUCTION & PURPOSE

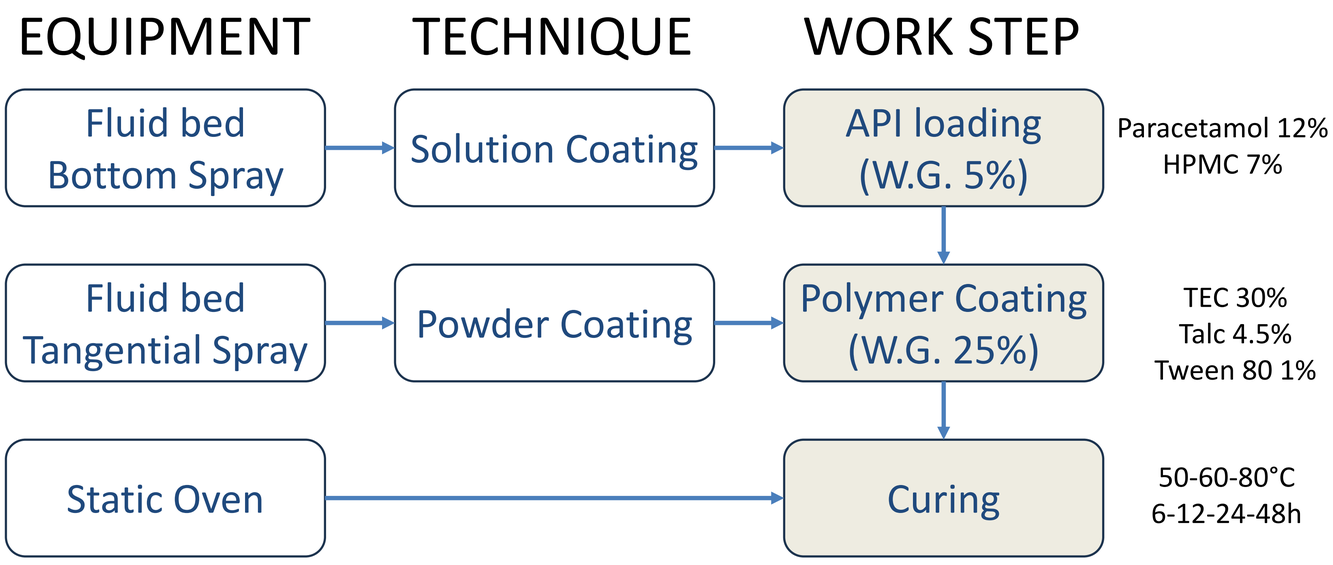
Powder coating has emerged as a promising approach for the production of modified-release coatings, enabling reduced water consumption and shorter processing times compared with conventional spray-coating techniques. Because powder-deposited polymer layers are inherently more porous, an appropriate curing step is crucial to promote particle coalescence, ensure the formation of a continuous film, and achieve stable and reproducible drug-release performance. In this context, curing temperature and duration are critical process parameters influencing film integrity and release behavior.

Accordingly, this study investigated the powder coating of paracetamol-loaded pellets in a tangential-spray fluid-bed system, with the aim of identifying curing conditions that ensure robust film formation and reliable prolonged-release properties.

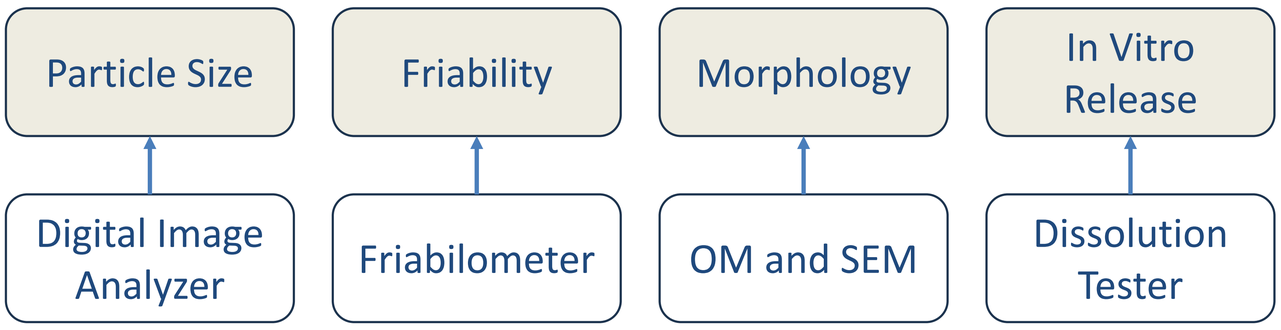
MATERIALS

Sugar spheres Suglets® PF013 16/18 mesh (Colorcon, UK); **Hypromellose** (HPMC) (Vivacoat ®, JRS Pharma, DE); **Paracetamol** (Rhodapap™ powder, Novacyl Pharmaceuticals, RPC); **Triethylcitrate** (TEC) (SigmaAldrich, IT); **Talc** (Luzenac Pharma, CH); **Polysorbate 80** (Tween® 80, SigmaAldrich, IT); **Ethylcellulose** HP (EC) (Ethocel HP™, Colorcon, UK);

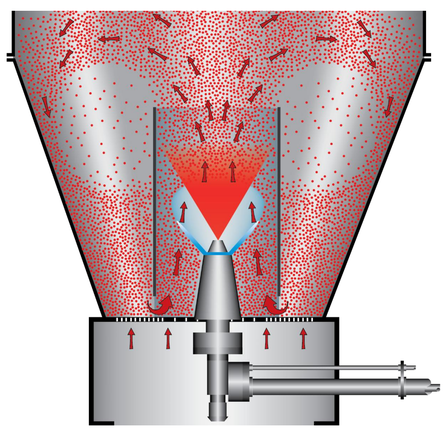
METHODS



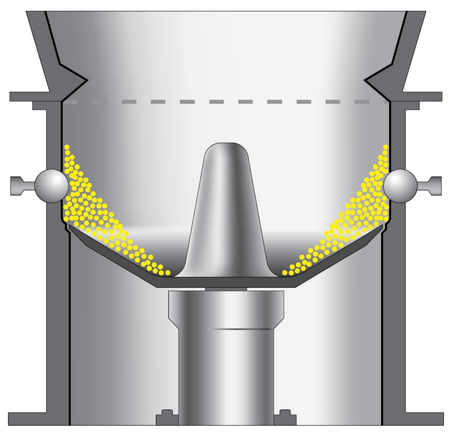
PRODUCT CHARACTERIZATION



FC-LAB 3



Bottom Spray insert

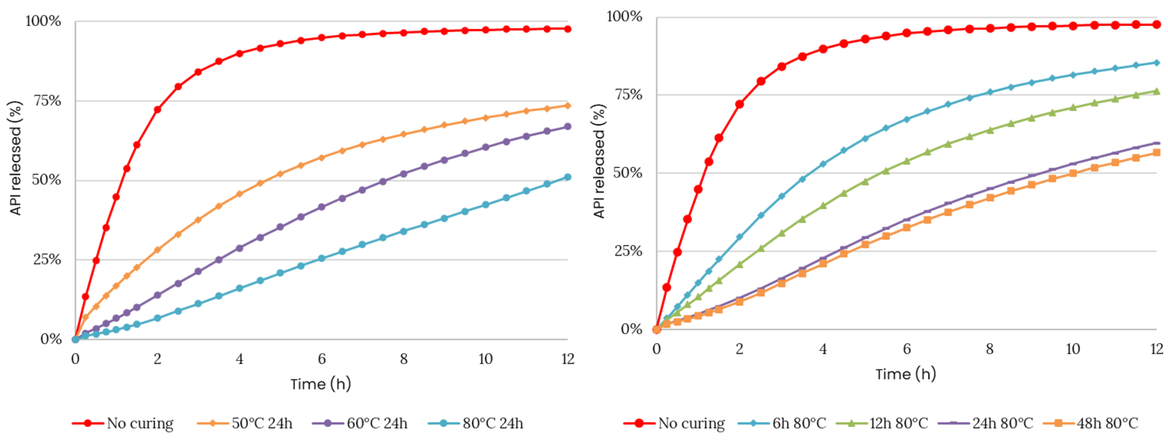


Tangential Spray insert (Granurex®).

Solution Coating (API Loading)						
Batch Size (Kg)	Product Temp. (°C)	Airflow (m³/h)	Atom. Press. (Bar)	Acc. Press. (Bar)	Spray Rate (g/min)	Partition Height (")
6	40	120	1.5	1.5	24	2.5

Powder Layering (Polymer Coating)							
Batch Size (Kg)	Product Temp. (°C)	Airflow (m³/h)	Rotor Speed (rpm)	Atom. Press. (Bar)	Eductor Air Press. (Bar)	Spray Rate (g/min)	Powder Rate (g/min)
3	22	25	200	0.5	1.5	12	12

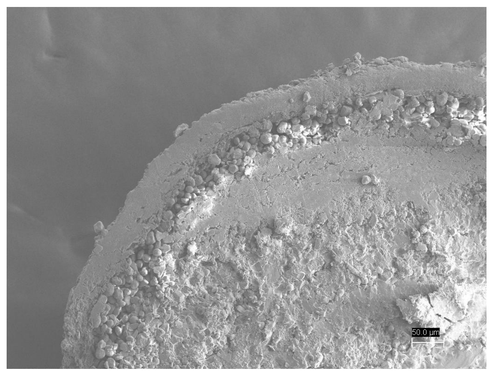
RESULTS



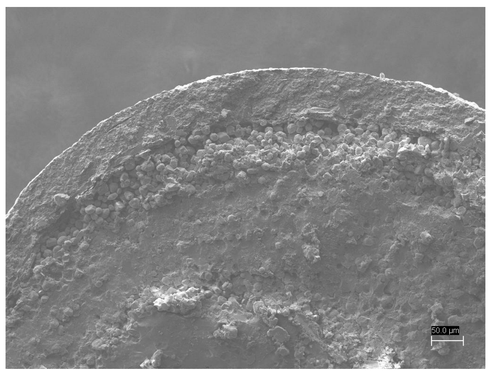
Influence of curing temperature (left) and curing duration (right) on the API release rate

Coated pellets before curing (OM)

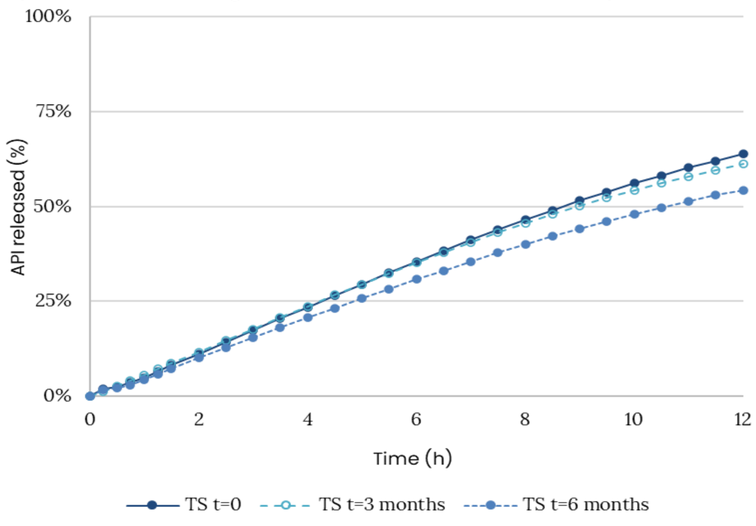
Coated pellets after curing (OM)



Coated pellets before curing (SEM)



Coated pellets after curing (SEM)



Stability at 25°C / 65% RH

CONCLUSIONS

Powder coating of Ethylcellulose in a tangential-spray fluid bed was feasible and efficient. Curing conditions had a decisive impact on film consolidation and release behaviour.

Higher curing temperatures and longer exposure times progressively slowed drug release, with 80°C for 24h identified as the most suitable condition. Stability studies confirmed that pellets cured under these conditions maintained a stable release profile for up to 6 months at 25°C / 65% RH, confirming the robustness and storage stability of the resulting films.

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