

In-line Intra-minitablet Coating Thickness Characterization with PATVIS APA

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PURPOSE

- Coating thickness variation can compromise the functionality of the coat and thus the safety and efficiency of the dosage form.
- The band, cap and edge are critical areas of interest for coating thickness characterization on minitablets.
- Visual imaging proved an efficient and accurate method for size-based in-line mean coating thickness measurement of band areas on minitablets.
- We propose a CNN enhanced image analysis approach providing coating thickness measurements over the entire minitablet perimeter thus enabling characterization of the coating uniformity.

METHOD(S)

- Three batches coated in a fluid-bed Wurster-type coater (Figure 1).
- Visual inspection system PATVIS APA used to acquire images of minitablets dispersed in air during the coating processes (Figure 2).
- Average sample size of 100 minitablets in a one minute sampling interval at 100 frames per second.

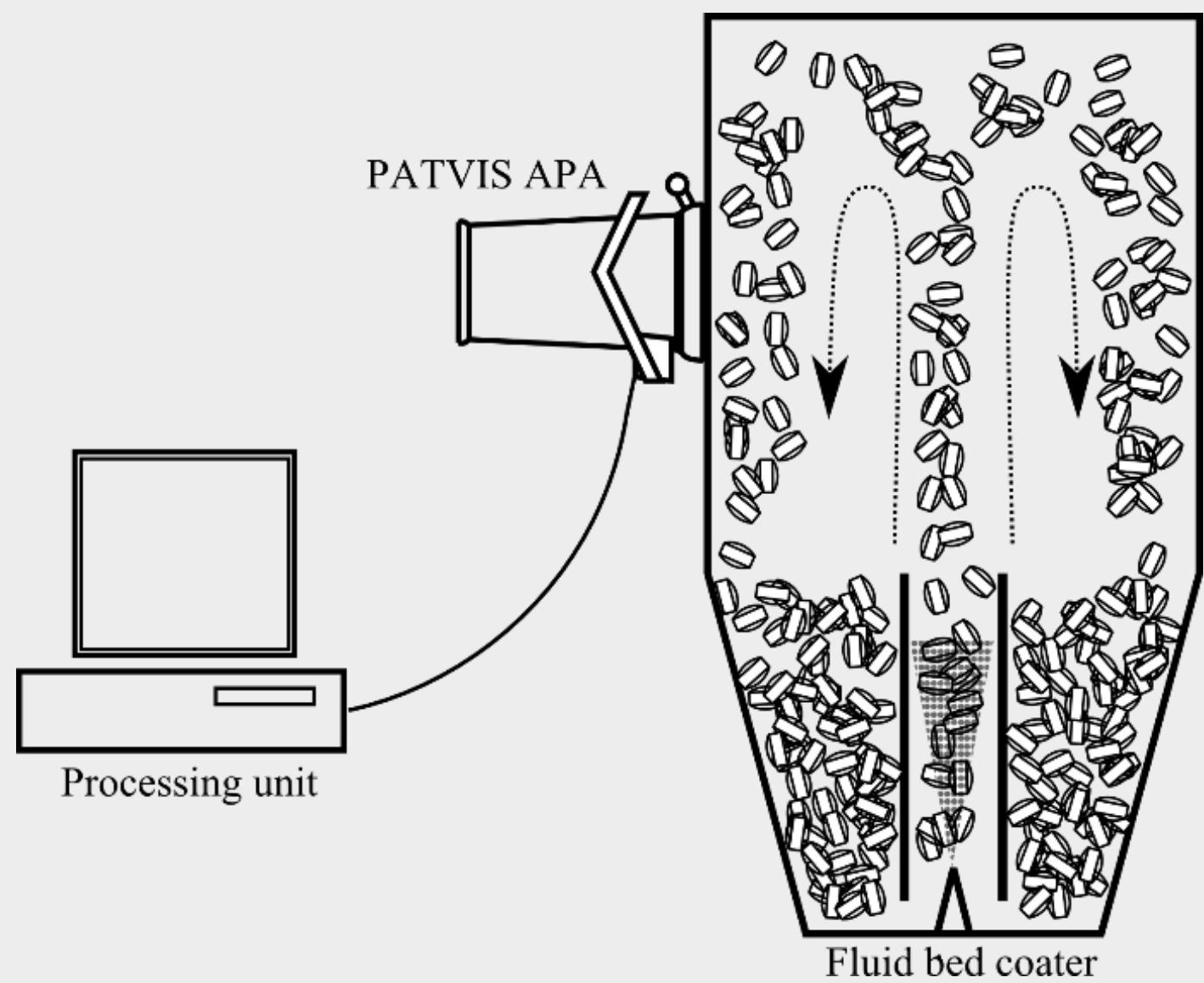


Figure 1: Laboratory-scale bottom-spray fluid-bed Wurster-type coater (CGD1, Brinox, Slovenia).



Figure 2: PATVIS APA (Sensum, Computer Vision Systems, Slovenia).

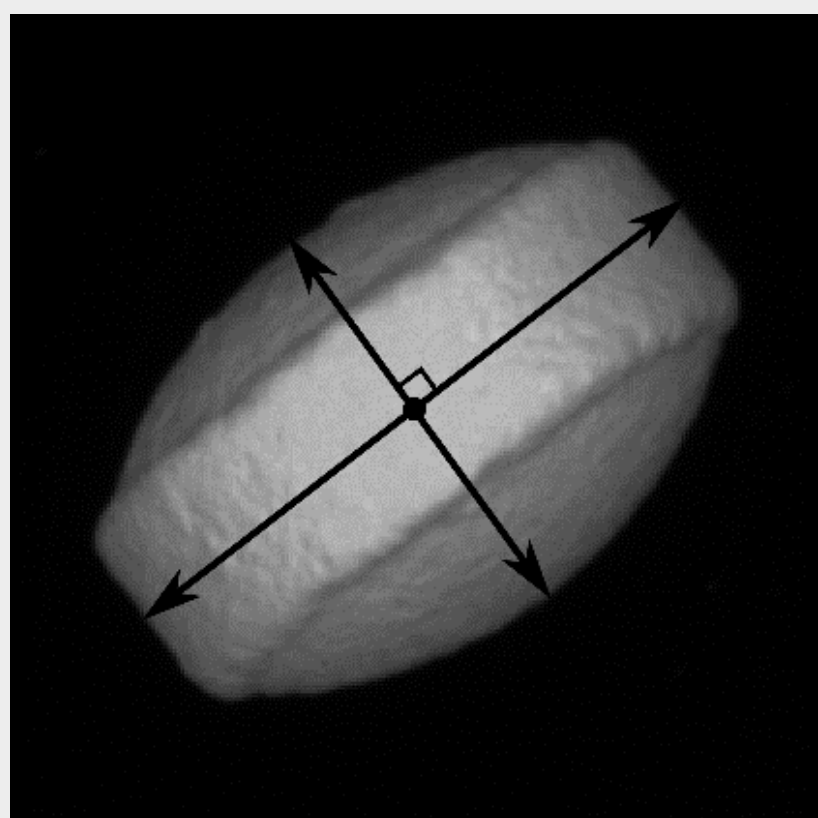


Figure 3: Acquired image of a minitablet.

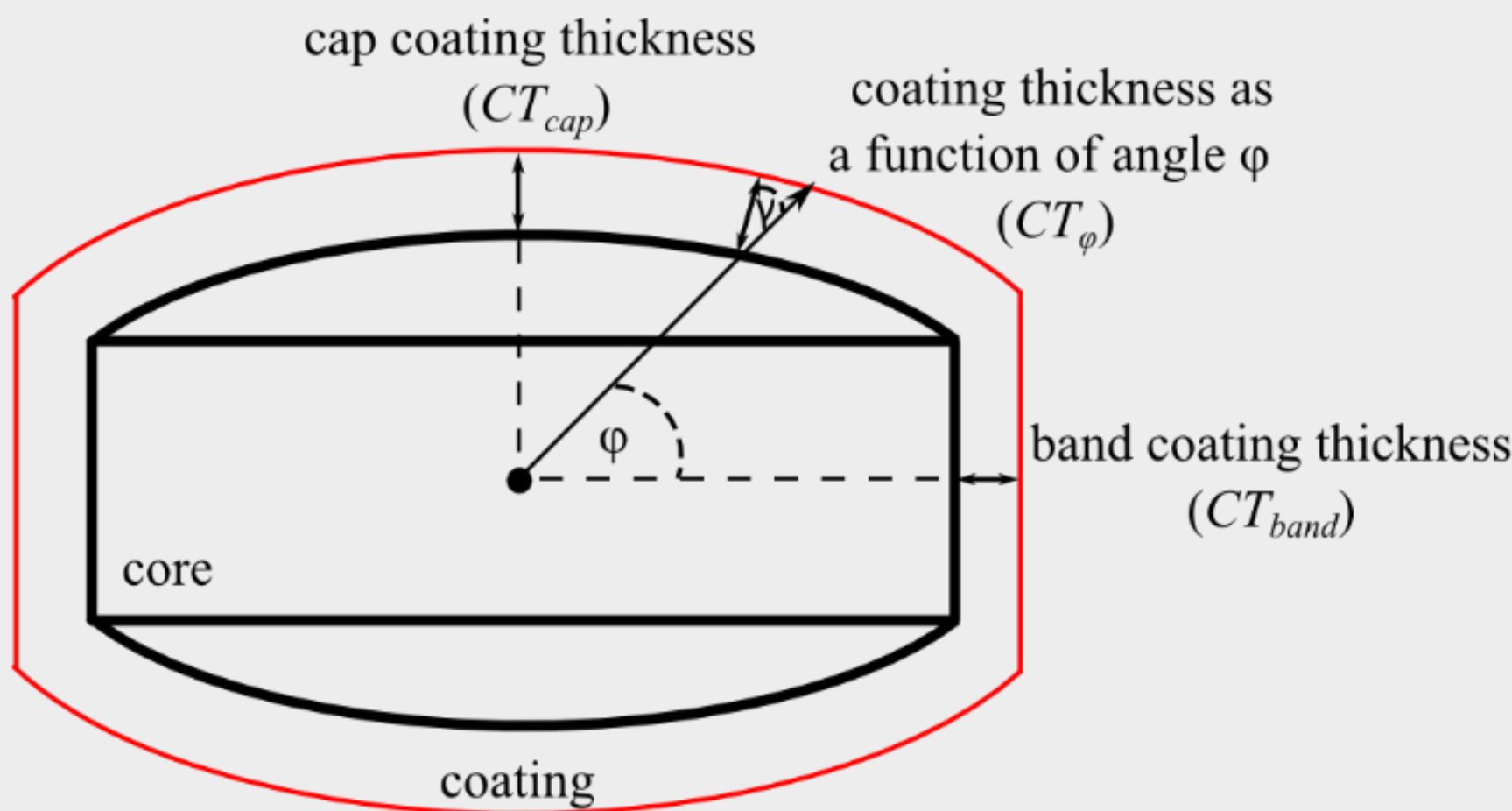


Figure 4: Coating thickness as a function of angle.

- 3D orientations of minitablets estimated with a convolutional neural network. Coating thickness measured as a function of angle (0°-90°) within the perimeter of a minitablet cross-sectional view (Figure 3, 4).
- Obtained coating thicknesses compared to an optical stereomicroscope measurements as a reference method.

CONCLUSION(S)

- A new approach for in-line intra-minitablet coating thickness characterization developed and evaluated on three laboratory-scale batches.
- Results show good overall intra-minitablet coating uniformity and indicate erosion of exposed minitablet core's edges (Figure 5).
- Good agreement found between the proposed in-line and reference off-line method with overall error of 0.5 μm and 3.0 μm for the band and cap areas (Table 1).
- Proposed approach can be used for coating thickness estimation and intra-coating uniformity characterization in minitablet formulation design.

OBJECTIVE(S)

- Development and evaluation of a novel visual imaging-based approach for in-line intra-minitablet coating thickness characterization.

MATERIAL(S)

- Placebo round biconvex cores, 3 mm diameter, 2 mm height, 2.5 mm convex radius, mean weight of 15 mg.
- Enteric coating solution consisting of 56.98 % Eudragit L30 D-55 (Evonik, Germany), 0.85 % glyceryl monostearate 44-50 (Lex, Slovenia), 1.71 % triethyl citrate (Sigma Aldrich, USA), 0.34 % Polysorbate 80 (Sigma Aldrich, USA) and 40.12 % purified water.

RESULT(S)

Table 1: Coating and coating thickness measurement results.

	Batch 1	Batch 2	Batch 3
Product mass before coating (g)	700.0	700.0	700.0
Product mass after coating (g)	764.2	763.8	760.2
Coating dispersion sprayed (g)	600	600	600
Coating time (min)	45.5	42.0	42.5
Process yield (%)	82.6	84.9	81.5
$\overline{CT}(\text{microscope})_{\text{band}} (\mu\text{m})$	42.5	45.3	44.5
$\overline{CT}(\text{microscope})_{\text{cap}} (\mu\text{m})$	43.7	46.7	45.3
$\overline{CT}(\text{PATVIS APA})_{\text{band}} (\mu\text{m})$	42.9	45.3	45.5
$\overline{CT}(\text{PATVIS APA})_{\text{cap}} (\mu\text{m})$	41.5	42.1	43.1
$\overline{CT}(\text{PATVIS APA})_{\text{edge}} (\mu\text{m})$	40.3	37.1	37.6

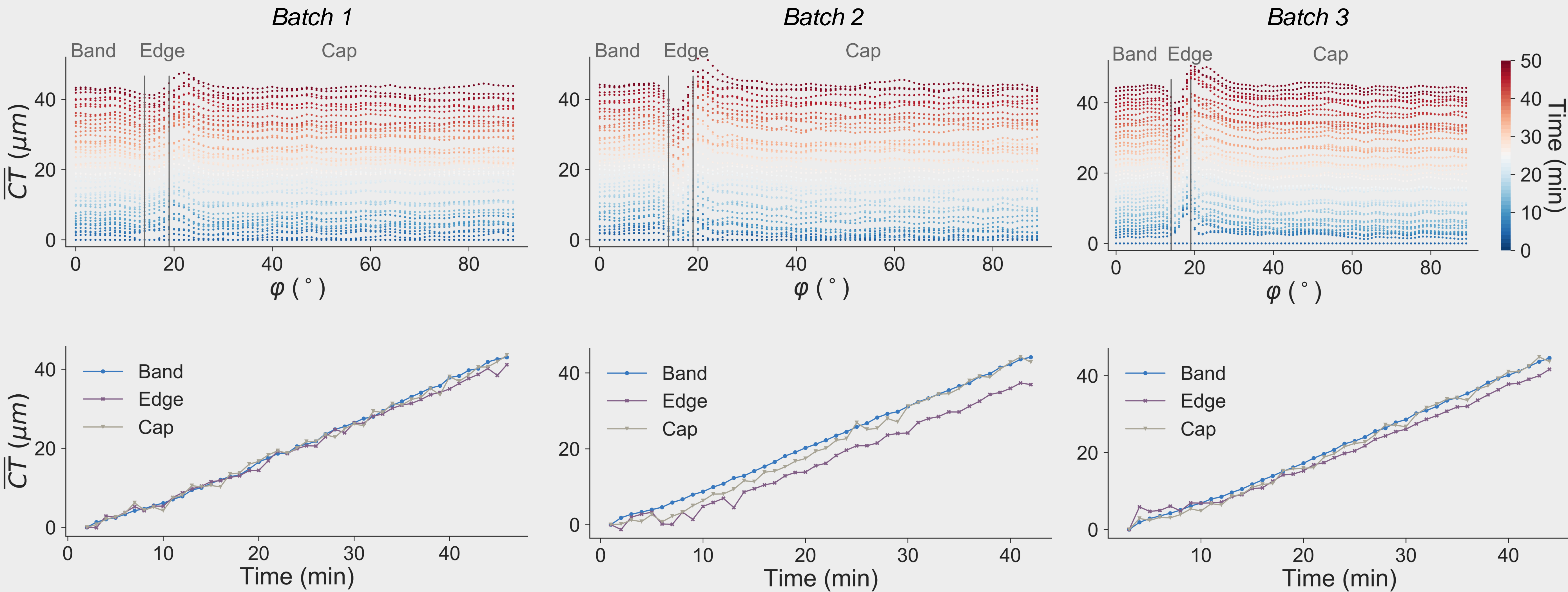


Figure 5: Intra-minitablet coating thickness uniformity and mean coating thickness trends.