# Refining Rotary Press Parameters for Consistent Tablet Quality during Product Transfer

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## Goal

The goal of this study was to develop a fast and material-sparing method to optimize compaction and die filling processes for tablet manufacturing at high-speed production.

## Materials and Methods

| | |
|---|---|
| Material | ColdSwell 1111A (KMC Deutschland, Melle, Germany) |
| Press model | STYL'One Evo (Medelpharm, Beynost, France) |
| | KORSCH XL 400 MFP (KORSCH AG, Berlin, Germany) |
| | KORSCH X 5 MFP (KORSCH AG, Berlin, Germany) |
| Tooling | 8 mm R12 EU B and XDF (I Holland, Nottingham, UK) |
| Tablet tester | Kraemer LAB.line P5 (Kraemer Elektronik GmbH, Darmstadt, Germany) |
| Target tablet weight | 150 mg |

$$\text{In - Die } ER = \frac{Th - (D_{min} + 2 \times H_{cup})}{(D_{min} + 2 \times H_{cup})}$$

*Th*: the punch distance was taken at which the pressure approaches zero
$D_{min}$: minimal distance between punches
$H_{cup}$: cup height in mm

$$\text{dwell time} = \frac{60 \times 1000 \times H_{cup}}{S \times T_d \times 3.14}$$

$H_f$: head flat [mm]
$S$: speed [rpm]
$T_d$: turret diameter [mm]

$$\text{filling time} = \frac{O_a}{R_s \times 60}$$

$O_a$: feeder opening angle [°]
$R_s$: rotational speed [°/min]

## Results

### FORMULATION COMPRESSION CHARACTERISTICS

#### Knowledge of processing during pre compression

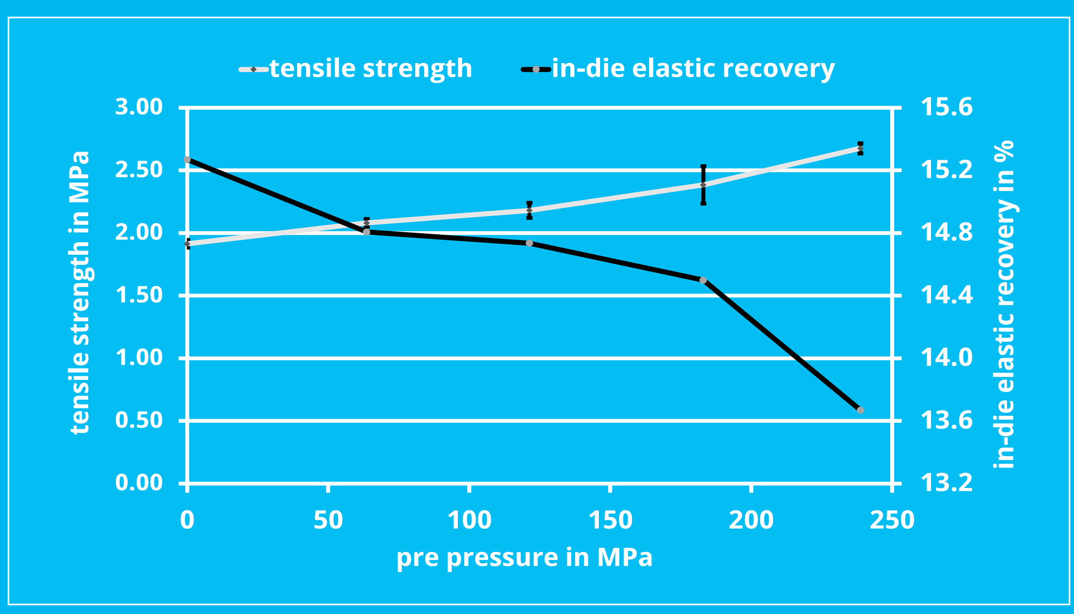


Figure 1: Pre compression pressure-tablet tensile strength (white) and in-die elastic recovery plot (black). Simulated compression speed (XL 400) fixed at 37,500 tab/h. Main pressure kept at 239 MPa. n=3

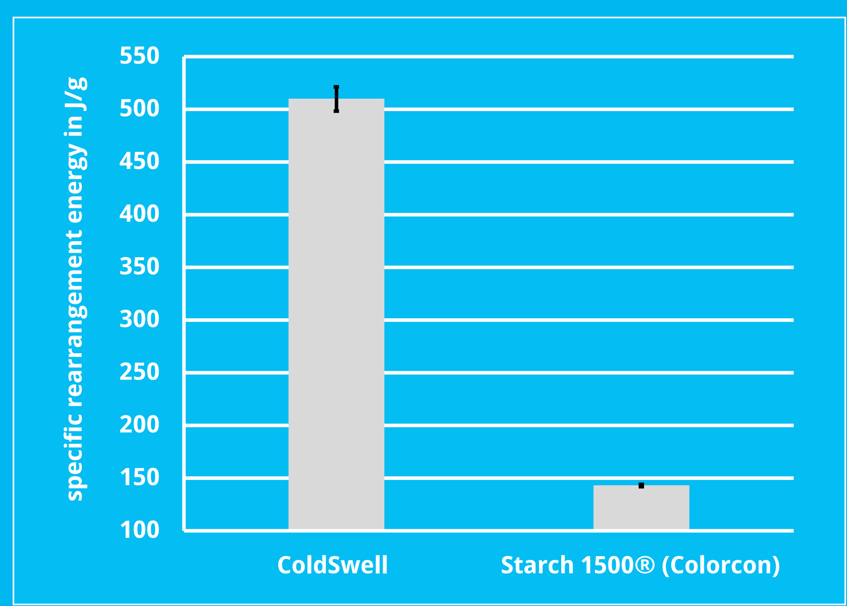


Figure 2: Rearrangement energy pre compression per g tablet weight. Simulated compression speed (XL 400) fixed at 37,500 tab/h. Pre compression force 13-15 kN. n=3

#### Understanding the impact of tableting speed

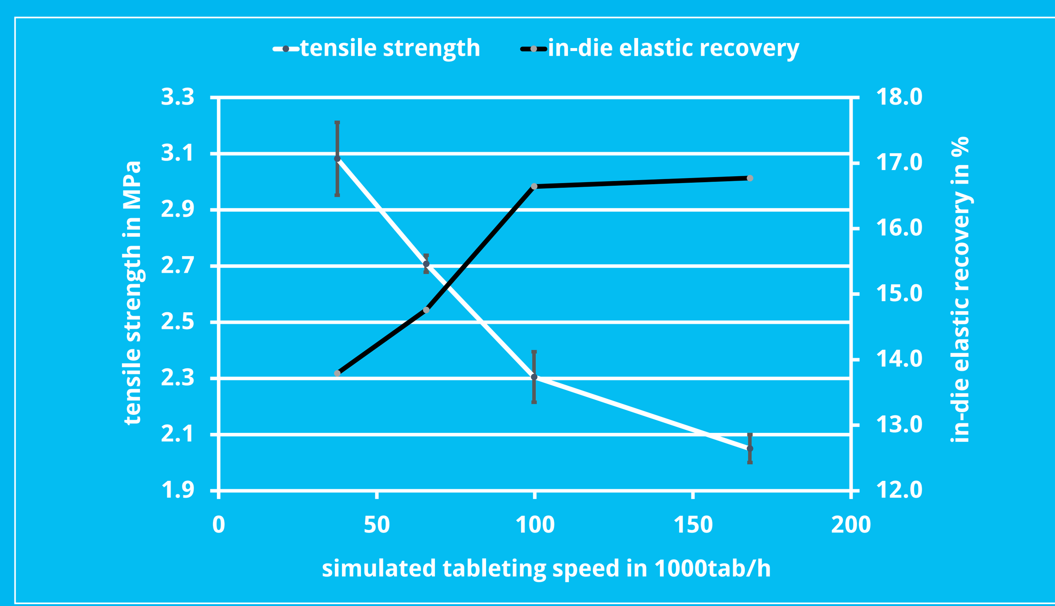


Figure 3: Tableting speed – tablet tensile strength (white) and elastic recovery plot (black). XL 400 as simulated machine with pre and main compression force fixed at 13-14 kN. n=3

Dwell time dependent/ High rearrangement energy

Main andpre force optimization

### TOOLING

D XDF: 20.0 mm | D: 12.8 mm | B XDF: 15.0 mm | B: 9.5 mm

Figure 4: Image of B and D XDF punch heads

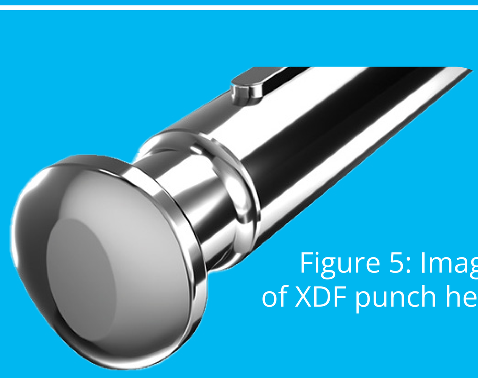

Figure 5: Image of XDF punch head

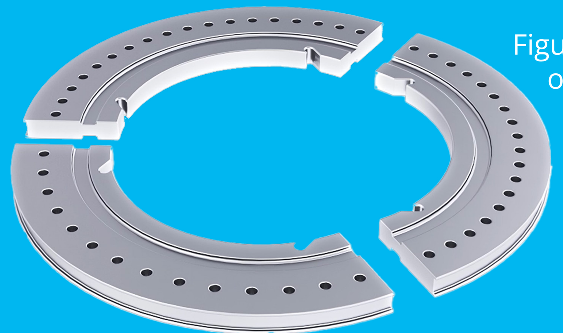

Figure 6: image of segments

Figure 7: Illustration of tapered die

Optimal interplay enables optimal output

### PRESS PARAMETER

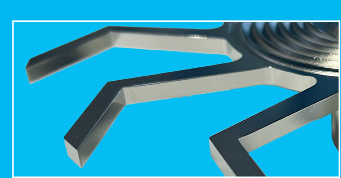

Figure 8: Square cranked (Sq-Cr)

Figure 9: Square cranked with bevel (Sq-Cr bevel)

Figure 10: Round cranked (R-Cr)

Figure 11: Round spider leg (R-Spider)

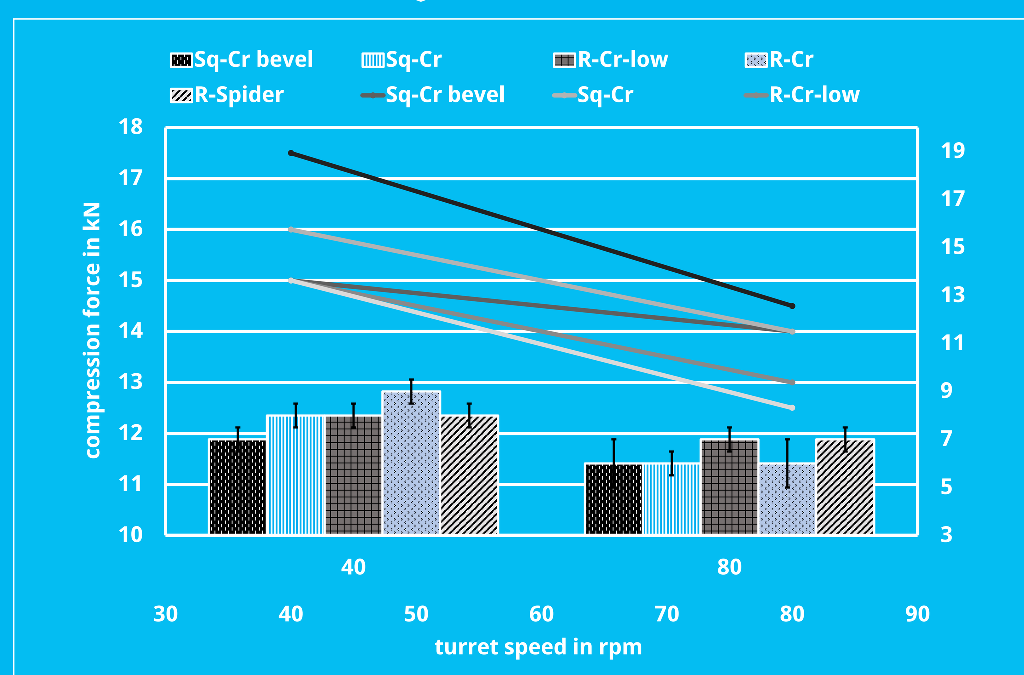


Figure 12: Compression force and its standard deviation at two different turret speeds for various filling paddle geometries. For geometries. Dosing height (9 mm) and paddle speed (18 rpm) were fixed.

### TRANSFER/ SCALE-UP

Table 1: Transfer parameter and resulting tablet parameters at 37,500 tab/h

| Stations on B turret | Dwell time in ms | Filling time in ms | Tablet breaking force in N | Tablet weight Srel in % |
|---|---|---|---|---|
| 44 | 62 | 0.913 | 61 (±5 with n=10) | 2 |
| 54 | 65 | 0.953 | 61 (±5 with n=10) | 0.5 |

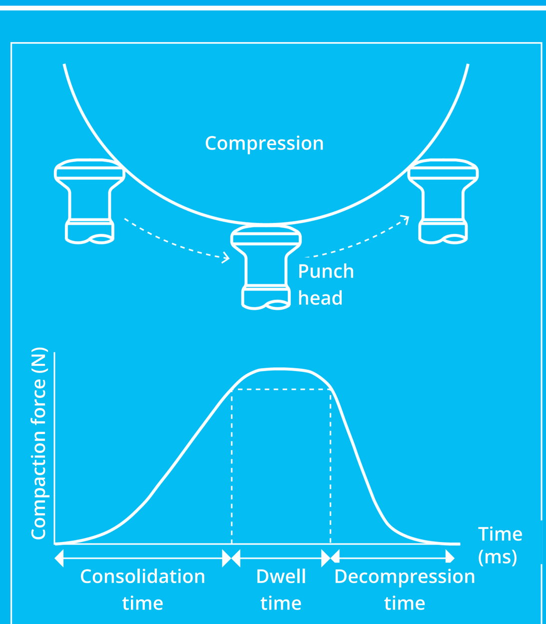


Figure 13: Illustration of punch displacement and resulting compression force

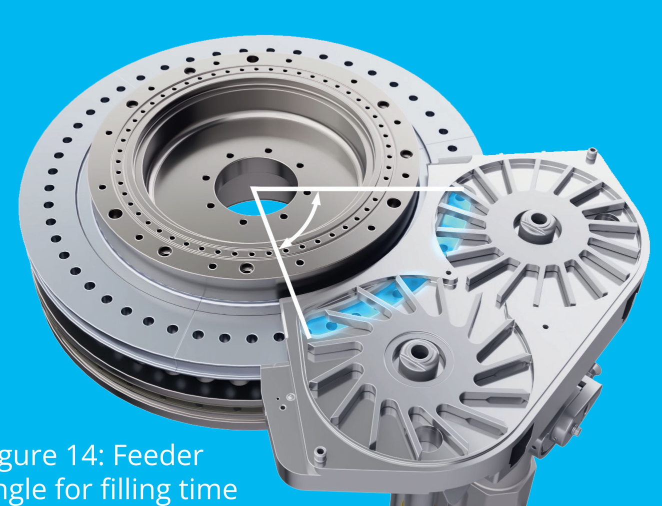

Figure 14: Feeder angle for filling time calculation

Table 2: Compression on different press models. 8 mm R12 punches at 150,000 tab/h and 20 kN main compression force

| Stations on B turret | Pitch cycle diameter in mm | Head flat punch in mm | Tablet tensile strength in MPa |
|---|---|---|---|
| 54 | 490 | 15 | 2.15 |
| 96 | 594 | 10.2 | 2.1 |
| 50 | 470 | 9.8 | 1.3 |

## Conclusion

This study demonstrates that the optimization of tablet manufacturing processes is achievable through the targeted adjustment of compaction parameters as well as tooling and machine settings. The findings highlight the importance of understanding material-specific deformation and filling behaviors to ensure high tablet quality at maximum output.

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