

Comparing the simulation of a Fette 102i by the Stylcam 200R

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INTRODUCTION

The Stylcam 200 R is a mechanical single punch tablet press, simulating speed profiles of various rotary tablet presses by controlling the speed of two cams electronically. It can be utilised for trouble shooting in production, scale-up problematics and R&D by using the force and height instrumentation of upper and lower punch. Equipped with just one pair of standard punches the Stylcam needs therefore a minimum amount of powder.

Being able to realise compaction velocities of high speed rotary presses and a precompaction force, the Stylcam has two big advantages over frequently used single stroke tablet presses, which have comparably slow tableting speeds. Tye et al. demonstrated how important the correlation between tableting speed and tablet properties is [1].

MATERIALS AND METHODS

Materials

- pharmaceutical excipients:
Tablettose 80, Meggle, Lot 9685
CPharmGel, Cerestar, Lot HE 3839
Mg-Stearat, Bärlocher, Ch 2079
- Fette 102i, machine no 1478
- Stylcam 200 R, no 0709109
- Punches: 9mm R15 EU-B
(both presses)
- parallel data acquisition system:
DAQ4 Hücke Software



Fig. 1: Stylcam

Methods

- operating mode:
single-punch (Fette102i),
one-tablet-mode (Stylcam)
- rotor speed set by comparable tablets/h
- die filling and lubrication manually

RESULTS

Simulation

One aim of the Stylcam is to simulate the tableting behaviour of various rotary tablet presses. Based on the dimensions of the compaction rolls, the ejection bar and the turret diameter as well as the time lag between pre-, main compaction and ejection, the cam movement is controlled[2]. This leads to the following advantages: firstly, since both the upper and the lower punch are moved, a two sided compaction process like on a rotary tablet press is simulated; secondly, because of the geometry of the cams, high tableting speeds are realised; thirdly, while two cams are present on each roll, precompaction forces can be simulated, too. For mimicking different geometries of rotary tablet presses, the Stylcam is able to accelerate and decelerate within one revolution, leading to various force-time-profiles. Fig.2 outlines important parameters for the simulation (marked in red).

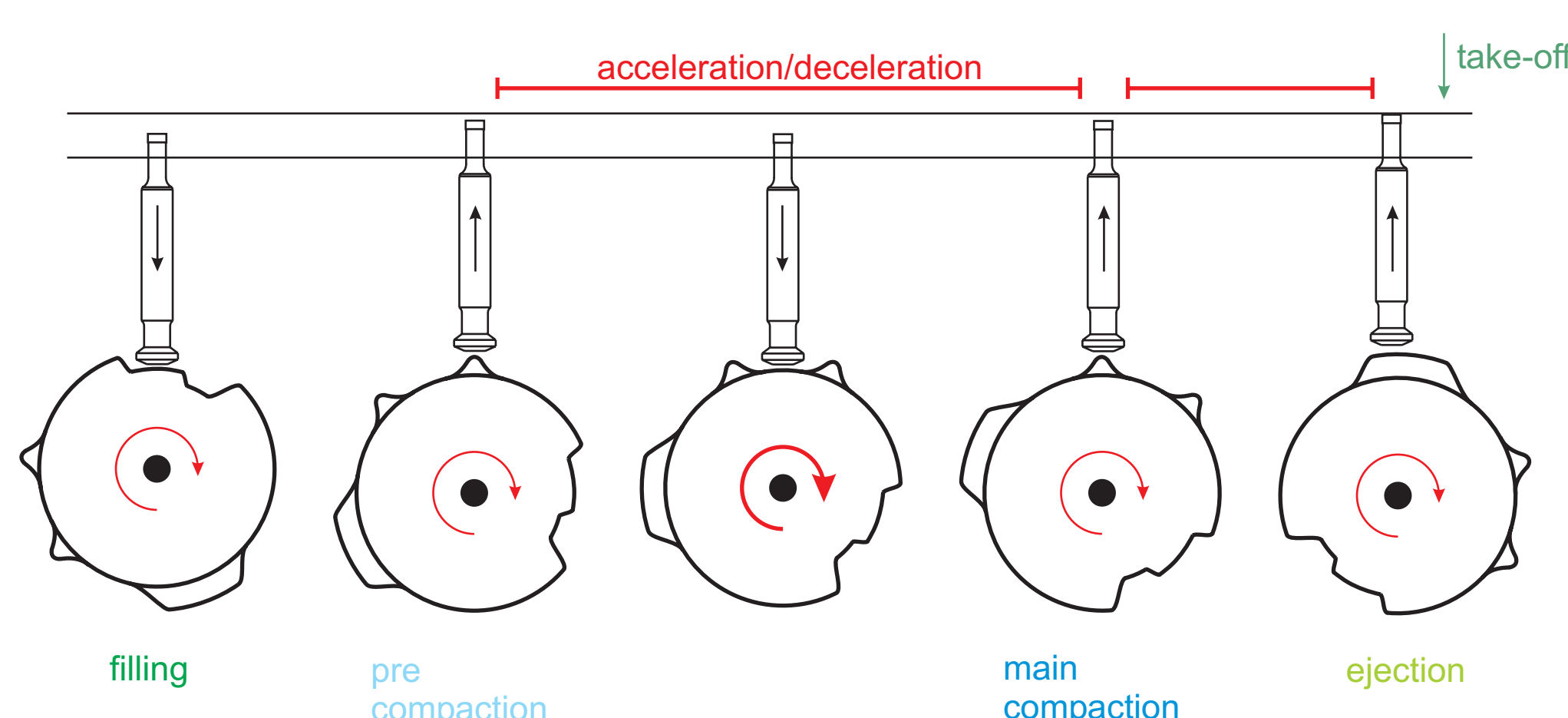


Fig. 2: Implementation of the Simulation by the Stylcam

Fig. 3 compares an original Fette 102i profile with a simulated one at 50 rpm turret speed.

The two overlaying force-time-curves show that the Stylcam is able to realise the simulation concerning the pre- and main compaction force and the time lag between them. Looking at the ejection force a small time shift can be noticed, which is due to a rough estimation of the distance between main compaction roll and ejection bar of the Fette 102i.

So one striking point gets obvious: the mimicking can only be as good as the knowledge of the system to be simulated.

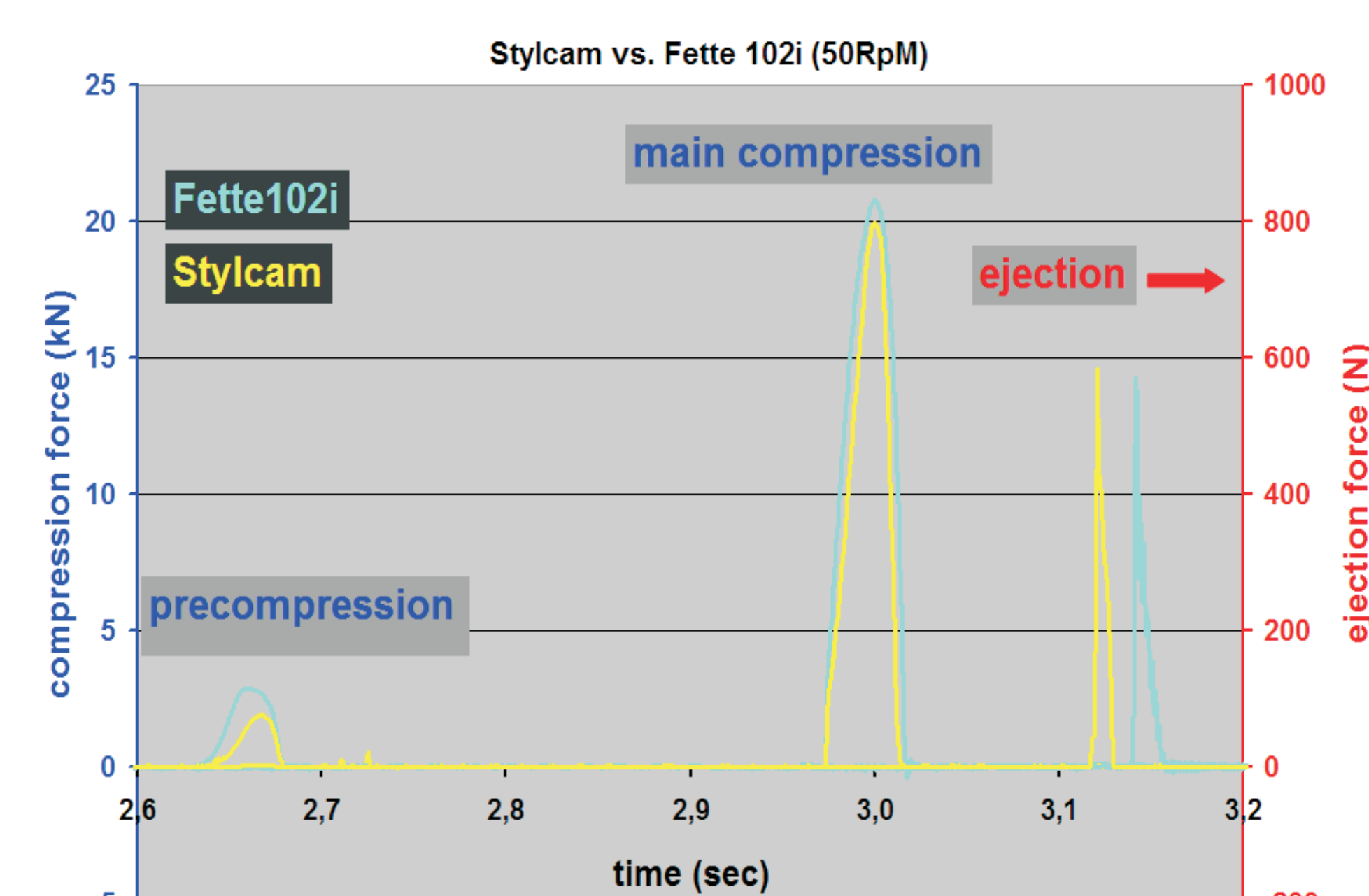


Fig. 3: force-time profile: original Fette 102i vs. Stylcam simulating Fette 102; Tablettose

In Fig. 4 the main compaction force at different speeds is focused. At all velocities the Stylcam matches pretty well with the Fette 102i curves. A closer look at the practical dwell-time, which is defined as the compression time at 90% of force, show, that the Stylcam is always a bit faster than the Fette 102i. The reason therefore is unknown by now.

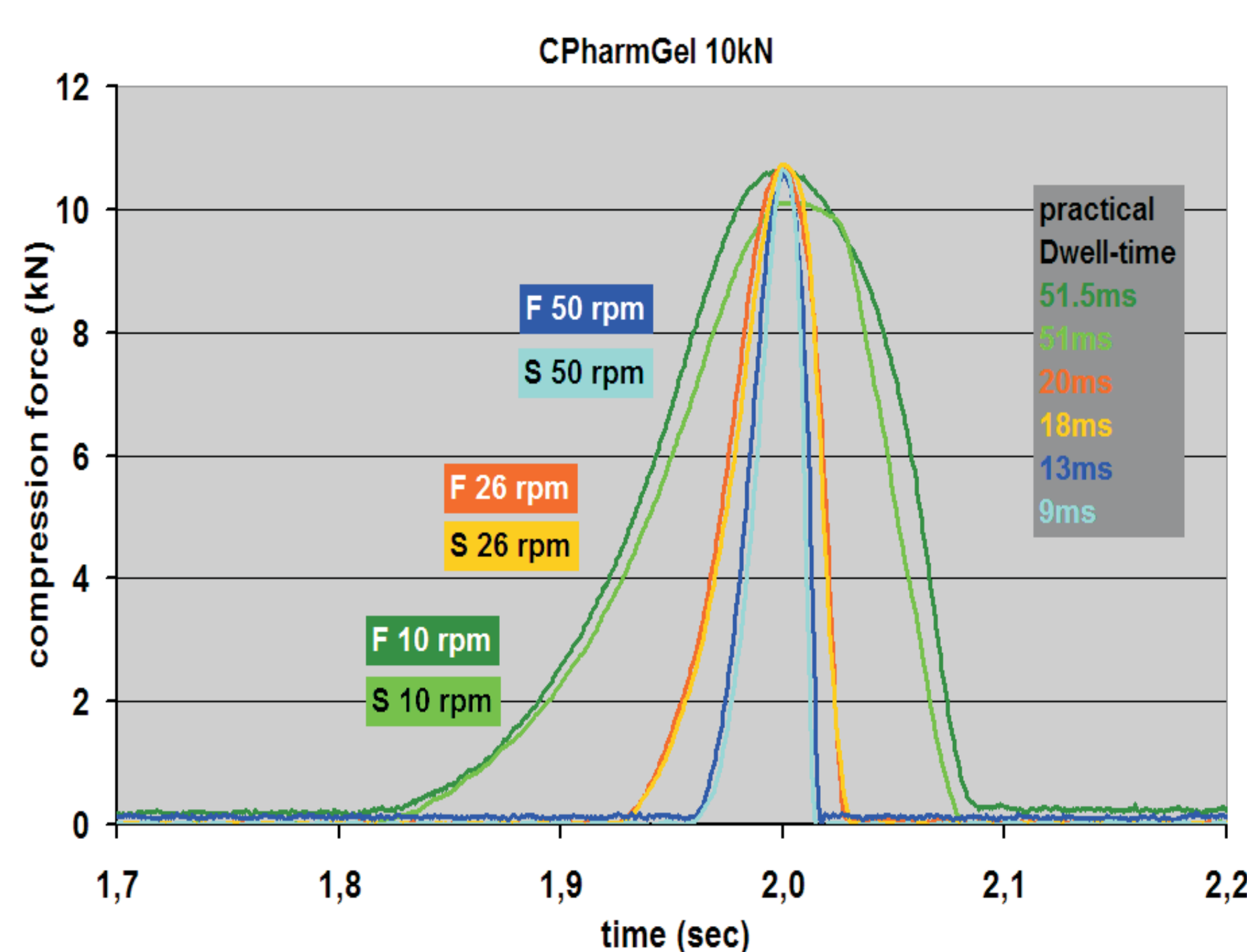


Fig. 4: main compaction in detail at various rpm; CPharmGel

Tablet properties

Fig.5 compares the Tensile Strength of tablets produced with the Fette 102i and the Stylcam simulation. From this graph, it is obvious that the tablet properties are quite similar. The capping tendency at high speed and pressure can be detected on both machines. At a velocity of 26 rpm, the tablet properties differ. Tablets produced with the Fette 102i show no capping compared to the tablets produced with the Stylcam. So, at this speed capping tendency becomes evident.

Being able to simulate velocities of rotary tablet presses with the Stylcam, it is possible to detect problems as to capping or speed in early stages of development.

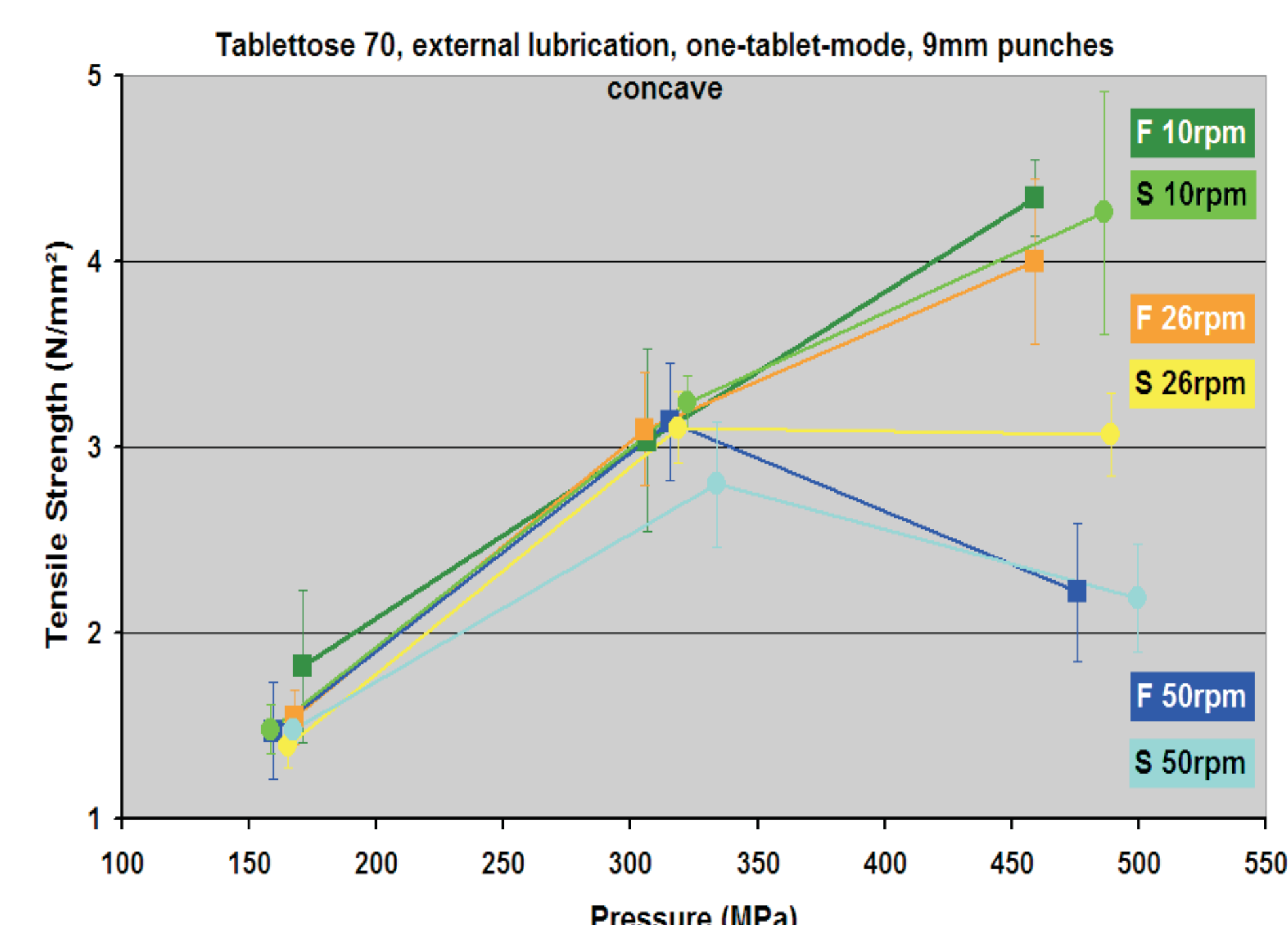


Fig. 5: Comparison of the tablet properties produced with an original Fette 102i and the Stylcam simulating the Fette 102i

Differences to rotary tablet presses

The main focus of simulation is on the tableting process consisting of pre- and main compaction and ejection. Due to its special functional principle, the Stylcam has some differences to rotary tablet presses. Feeding shoe problems cannot be examined as the Stylcam fill shoe is moving forwards and backwards like a fill shoe of an eccentric press. Also a simulation of vibration and centrifugal forces is not possible because the die is not mounted on a rotating turret but the die fill process as to overfill and later weight adaption is simulated correctly.

Due to the performance limit of the variable speed drive, extraordinary short time lags between pre- and main compaction and ejection can not be realised.

So it is not possible to simulate every rotary tablet press by the Stylcam or theoretical force profiles like squared or triangle ones.

SUMMARY AND OUTLOOK

The Stylcam is a rotary tablet press simulator with just one pair of standard punches. To this end it needs small amounts of powder which is very important in early stages of development. At various velocities, the original force-time-profiles of a Fette 102i and the Stylcam simulated ones are quite similar as to the time lag between pre- and main compaction and the curve progression of the main compaction.

Also the properties of tablets produced with the Fette 102i and the Stylcam simulating the Fette 102i are comparable.

Achieving high tableting speeds like the ones prevailing on rotary tablet presses, it is possible to detect capping tendencies at different speeds or speed sensitivity of a formulation in early stages of development.

Next step will be to compare the filling construction Fill-O-Matic of the Fette 102i to the different fill shoes of the Stylcam.

REFERENCES

- [1] Tye et al.: Evaluation of the effects of tableting speed on the relationships between compaction pressure, tablet tensile strength, and tablet solid Fraction. Journal of Pharmaceutical Sciences, 94 (3), 465-472 (2005)
- [2] K.Duchatsch, B.Fretter: The Stylcam 200R, a rotary tablet press simulator, DPhG Jahrestagung 2008, 8th to 11th October, Bonn

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