

# Investigating the Up Scaling Properties of a Sustained Release Coating Using Side Vented Pan Coating Technology

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## Introduction

Scaling up of film coating processes in fully perforated drum coaters can easily be calculated, keeping circumferential speed (surface time), spray rate per nozzle and the amount of process air per nozzles in all scales constant [1].

This theoretical approach was already proven using Kollicoat® Protect formulation in the side vented pan coater Perfima 200 [2].

This study is to investigate whether it is possible to transfer this scale up concept to sustained release coatings.

## Experimental Methods

### Materials

As functional film former Kollicoat® SR 30 D (polyvinyl acetate – PVAc) (BASF SE, Ludwigshafen, Germany) was used. Triacetin (Merck, Darmstadt, Germany) is described as ideal plasticizer for PVAc [3]. The water soluble film forming polymer Kollicoat® IR (BASF SE, Ludwigshafen, Germany) polyvinyl alcoholpolyethylene glycol graft copolymer (PVA-PEG) was used as pore former to adjust the dissolution profile. It was mixed in the ratio of 2 : 8 with PVAc. The whole coating formulation is shown in Table 2.

To investigate the influence of the core shape on the up scaling properties both round and football shaped caffeine cores of the same formulation were used (Table 1).

Ingredients	Quantity [%]
Caffein, gran. 0.2-0.5	15.5
Ludipress® LCE	74.0
Kollidon® CL-F	5.0
Kollidon® VA 64 fine	5.0
Mg-stearate	0.5

Table 1: Formulation of the cores

Ingredients	Quantity [%]
Kollicoat® SR 30 D	43.5
Triacetin	0.7
Kollicoat® IR	3.3
Kollidon® 30	0.5
Titanium dioxide	0.5
Iron oxide red (Sicovit® Red 30)	0.5
Talc	3.5
Water	47.5

Table 2: Formulation of the coat

### Equipment

Side vented pan coater Perfima Lab (I.M.A. S.p.A., Bologna, Italy) with interchangeable drums was used (Table 3, Figure 1 and 2).

Drum	Diameter [mm]	Volume [L]	Drum speed [s <sup>-1</sup> ]
Small	765	15	9
Medium	865	30	8
Large	985	60	7

Table 3: Perfima Lab drum sizes

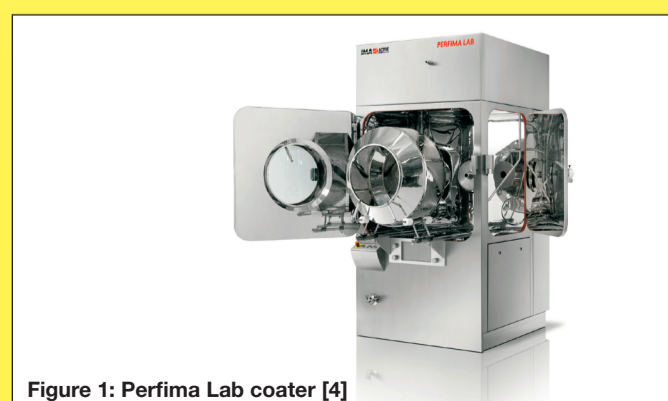


Figure 1: Perfima Lab coater [4]

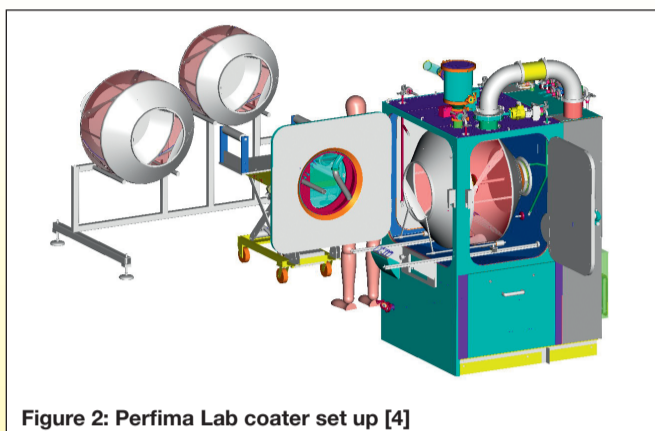


Figure 2: Perfima Lab coater set up [4]

### Methods

For the dissolution test, standard testing equipment suggested by European Pharmacopoeia was used (DT700, ERWEKA, Heusenstamm, Germany; Photometer 8453, Agilent, Waldbronn, Germany).

Before testing the dissolution profile the tablets were stored under conditions of 40 °C for 48 hours.

The dissolution test was performed with 0.08M HCl (pH 1.1) for the first 2 hours. Then the pH value was changed to 6.8 using phosphate buffer.

### Scale up process

As the tablet shape influences the bulk density, the batch size was determined by volume. Trials were performed according to Table 4.

In preliminary trials for both core types the maximum spray rate for the equipment was evaluated. As expected, the football shaped tablets could be coated with a distinctively lower spray rate. According to these trials, the settings for spray rate and inlet air quantity could be calculated (Table 5).

Drum	Round	Football
Small (S)	X	X
Medium (M)	X	
Large (L)	X	X

Table 4: Trials performed with the different core types

	Round			Football	
	S	M	L	S	L
Batch size [kg]	10.9	21.8	43.7	10.1	40.3
Inlet air volume [m <sup>3</sup> /h]	600	600	1,200	530	1,060
Number of nozzles	1	1	2	1	2
Spray rate [mL/min]	39	39	77	31	62

Table 5: Coater settings for the different core types in the different drum sizes

All trials were performed with an inlet air temperature of 46 °C.

For the scale up, the circumferential speed of the drum was kept constant with about 360mm/s leading to the drum speeds listed in Table 3.

## Results and Discussion

The chosen parameters lead to an optimal coating process in all scales. All film coated tablets offered a smooth surface.

The results of the dissolution test showed that in addition to the coating quality, coating functionally could be maintained for both tablet types throughout all scales. All coating trials lead to similar dissolution characteristics (Figure 3, 4).

During the process in small scale, the fastest possible process time was used in order to determine the maximum spray rate for large scale and this lead to a less homogenous distribution of the coat on the cores surface. For this reason, the standard deviation for the release profiles of the round shaped tablets in small scale was not as good as the large scale one.

During the up scaling process, both batch size and total process time increase. The longer the process, the more uniform the applied coat is. This results in release profiles showing lower standard deviation.

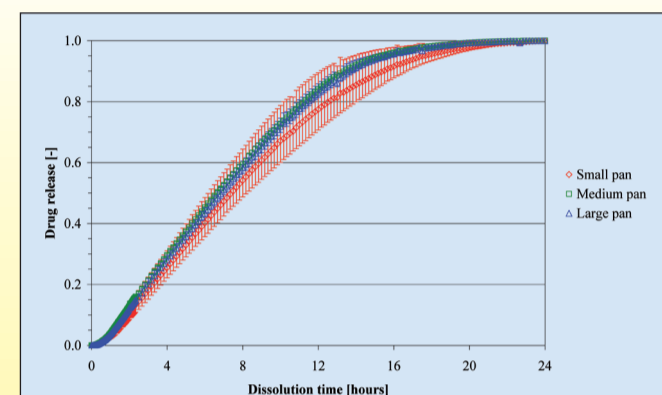


Figure 3: Dissolution profiles of the round shaped tablets coated in different scales

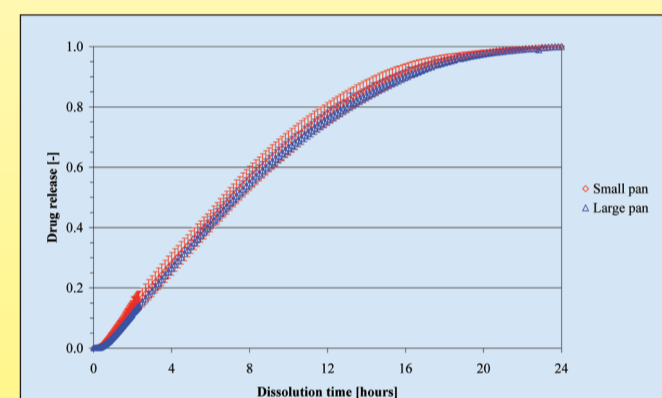


Figure 4: Dissolution profiles of the football shaped tablets coated in different scales

## Conclusion

It can be concluded that the up scaling theory suggested for instant release film coating polymers can be transferred to functional coatings as well. As the approach requires very short process times in small scale, the resulting release profile shows high standard deviation. However, the determination of the maximum spray rate in small scale is necessary to calculate the spray rate and process air volume in large scale, while maintaining the same moisture exposure throughout the entire scale up process.

Therefore, it is suggested to perform both trials in small scale during development:

1. Using optimal process time with low spray rate to apply a homogenous coat (development of the release profile).
2. Using maximum spray rate to do the up scaling calculations and to expose the same amount of moisture as in production (important for moisture sensitive drugs or formulations).

## References

- [1] T. Cech, F. Wildschek; Scale-Up of Film Coating Processes; ExcipientFest Europe; June 17–18, 2008; Cork, Ireland
- [2] T. Cech, F. Wildschek, C. Funaro, G. Mondelli, F. Cembali; Scaling up a Film Coating Process by Keeping the Ratio of Spray Rate and Inlet Air Quantity Constant using Kollicoat® Protect as Coating Material and the Side Vented Pan Coater Perfima 200; ExcipientFest Europe; June 17–18, 2008; Cork, Ireland
- [3] K. Kolter, F. Ruchatz; Influence of Plasticizers on the Physico-Chemical Properties of Kollicoat® SR 30 D-Films; AAPS Annual Meeting and Exposition; Nov. 14–18, 1999; New Orleans, Louisiana; U.S.A.
- [4] I.M.A. S.p.A., 40064 Bologna, Italy