Effective Taste-Masking Based on the New Coating Dispersion Kollicoat® Smartseal 30 D

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Abstract Summary

The new aqueous methyl methacrylate and diethylaminoethyl methacrylate copolymer dispersion (Kollicoat® Smartseal 30 D) was applied to caffeine pellets and theophylline granules to investigate the taste-masking properties. Both round pellets of approx. 1 mm and irregular granules of approx. 0.5 mm could be coated homogeneously, resulting in smooth and glossy surfaces. Drug release was found to be quick in gastric fluid (pH 1.2) and almost negligible in saliva (pH 6.8), particularly at coating levels above 1.5 mg/cm², proving a strong taste-masking effect. Stability studies in different climate zones indicated that the formulations are stable for at least 6 months (test periods).

Introduction

A new aqueous methyl methacrylate and diethylaminoethyl methacrylate copolymer dispersion (Kollicoat® Smartseal 30 D) has been developed for taste-masking and moisture protection purposes. The polymer is insoluble in the saliva (neutral pH) but dissolves quickly in gastric fluid; thus, it can be considered to be a reverse enteric polymer.

Previous studies [1] have shown that the polymer has excellent film properties. This study deals with the application of the polymer dispersion to pellets and granules aiming at a strong taste-masking effect. In particular, the correlation between coating level, dissolution in various media and taste-masking effect was investigated. Two actives were chosen, one being neutral (caffeine) and the other slightly acidic (theophylline).

Table 1: Pellet core

Caffeine, fine powder	20.0 %
Granulac® 230 (fine lactose)	38.5 %
Avicel® PH 101 (MCC)	38.5 %
Kollidon® CL-F	3.0 %
Total	100.0 %

Table 2: Coating composition

1. Polymer suspension	Content suspension
Kollicoat® Smartseal 30 D	33.33 %
Water, demin.	22.17 %
Tributyl citrate (15 % based on polymer)	1.50 %
Butyl hydroxytoluene (1 % based on polymer)	0.10 %
2. Pigment suspension	
Talc	8.00 %
Colorant	0.40 %
Water, demin.	34.50 %
Total	100.00 %
Solid content of the spray suspension	20.00 %
Polymer content in dried film	50.00 %

Experimental Methods

Caffeine pellets were manufactured using a wet extrusion process followed by spheronization [2]. Pellet diameter was 0.7–1.4 mm.

Theophylline granules with a particle size of 0.2–0.7 mm were supplied by BASF SE.

Table 3: Caffeine pellets in Aeromatic Strea 1 and theophylline granules in Innojet Ventilus 1

Machine	Aeromatic Strea 1	Ventilus 1 with IPC 1 (Innojet)
Inlet air temperature	55 °C	55–65 °C
Inlet air volume	80 m³/h	45 m³/h
Batch size	0.50 kg	0.25 kg
Outlet air temperature	30 °C	30–34 °C
Spraying rate	9 g/min	5–10 g/min
Nozzle	Schlick	IRN2-V
Nozzle diameter	0.8 mm	1.0 mm
Spray pressure	1.5 bar	0.8 bar
Blending	0.2 % colloidal silica for 10 min in a Turbula blender (prevents any stickiness of granules)	0.2 % colloidal silica for 10 min in a Turbula blender (prevents any stickiness of granules)

Results and Discussion

Kollicoat® Smartseal 30 D could be applied to pellets and granules easily without any agglomeration even at a relatively high solids concentration of 20 %.

The dissolution curves of coated caffeine pellets up to a coating level of 3 mg/cm² in acidic medium are similar to the one of the uncoated pellets, this revealing that the coating dissolves quickly in the stomach (Figure 1). At higher coating levels, a slight delay of a few minutes min could be determined. In contrast to the quick release in acidic medium, the release rate in phosphate buffer pH 6.8 was extremely slow, particularly at coating levels above 1.5 mg/cm². As the saliva has a neutral pH, it can be concluded that this polymer acts effectively as a taste-masking coating on caffeine pellets.

A taste panel where the pellets were moved for 2 min in the mouth with the tongue supported these findings.

The microscopic photos of the caffeine pellets proved that the coating was applied homogeneously with a very smooth and glossy surface.

The caffeine pellets with a coating level of 4.5 mg/cm² were stored in several climate zones for 6 months and investigated again in order to see whether the barrier function had changed. However, no significant change could be determined; in acidic medium the release stayed quick and in neutral medium slow.

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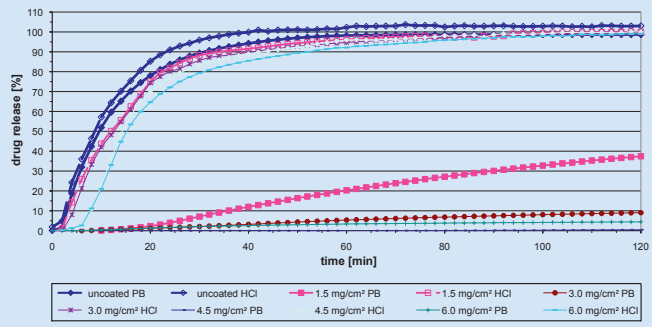
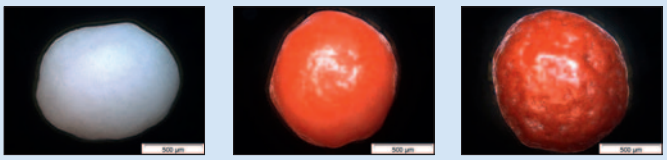


Figure 1: Dissolution of caffeine pellets in acidic and neutral medium



uncoated | 1.5 mg/cm² coating level | 4.5 mg/cm² coating level

Figure 2: Surface structure of coated caffeine pellets

Theophylline granules differed from caffeine pellets in their smaller size (0.2–0.7 mm) and an irregular structure, which can be described as non-uniform with rough edges. Since the surface area could not be determined exactly, the coating level is expressed in weight gain and not in mg/cm². The findings were similar to those for the caffeine pellets, with a quick release in acidic medium and a slowing down of the release at pH 6.8 as a function of the increasing coating level.

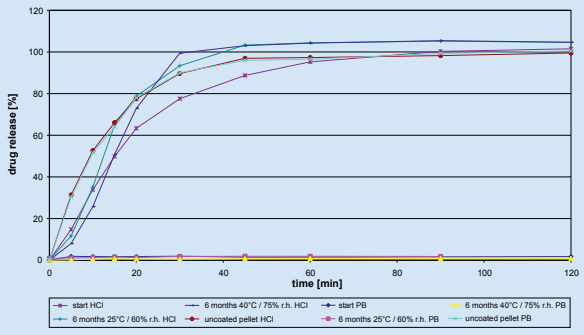


Figure 3: Stability of caffeine pellets (dissolution in gastric fluid and intestinal fluid)

The oral test showed that an 8 % weight gain was not sufficient to completely mask the taste but 18 % was. The microscopic photos of the theophylline granules revealed that a rough surface can also be homogeneously coated and the granules do not stick together.

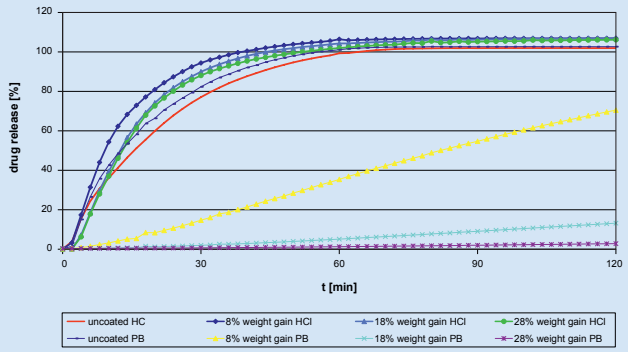
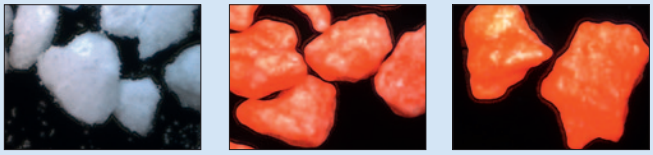


Figure 4: Dissolution of theophylline granules in acidic and neutral medium



uncoated
Strong bitter taste | 6 % weight gain
Slight bitter taste after 30 s | 18 % weight gain
No bitter taste

Figure 5: Surface structure of coated theophylline granules

Conclusion

- **The new polymer dispersion Kollicoat® Smartseal 30 D acts as an effective taste-masking coating, with no release in the saliva and a quick release in gastric fluid.**
- **It can be applied in high solids concentrations leading to smooth and glossy surfaces.**
- **Coated pellets maintained their properties upon storage even under stress conditions.**

References

[1] K. Kolter, F. Guth and M. Angel, Physicochemical characteristics of a new aqueous polymer designed for taste-masking and moisture protection AAPS Annual Meeting 2010, November 14–18, USA, New Orleans

[2] D. Flick, S. Scheiffele and K. Kolter, Stability of Kollicoat® SR 30 D – coated sustained release dosage forms AAPS Annual Meeting 2000, October 29 – November 02, USA, Indianapolis

CRS 2011 38th Annual Meeting & Exposition of the Controlled Release Society, July 30 – August 3, 2011, National Harbor, Maryland, U.S.A.

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