Coated Drug Delivery Systems Based on Kollicoat® SR 30D

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Introduction

Sustained-release dosage forms include single-unit and multiple-unit forms as well as coated and matrix forms (Ravi Kumar and Kumar, 2001). Up to now, with the exception of the OROS System (Kettlehoit *et al*., 1999), the production of coated single-unit forms has been regarded as a malpractice, as the risk of dose-dumping due to an incorrectly applied coating, or damage to a coating was too high. The OROS System is used in several products that are available on the market, but it has major disadvantages, such as the tricky operation of laser drilling, the use of organic solvents, high cost and a low concentration of the drug in the core.

Objective

The aim of this project was to develop a coated, sustained-release single-unit form that is simple to manufacture and poses no risk of dose dumping.

Materials

Kollicoat SR 30D (polyvinyl acetate dispersion, **BASF AG**), metoprolol tartrate (**Moehs SA**)

Methods

Metoprolol tartrate was granulated with Kollidon 30 solution, mixed with the other excipients for 10 minutes in a Turbula mixer, and compressed into tablets on a Korsch PH 106 *(Table 1)*.

Tablet cores in batches of 5.0 kg were spray-coated with a pigmented Kollicoat SR 30D dispersion in a 24" Accela Cota *(Tables 2 & 3)*.

Mechanical Testing of the Tablets

The film-coated tablets were subjected to a friability test (500 revolutions, drop height 15.5 cm) in an Erweka Friabilator, allowed to fall 20 times from a height of 1.5 m, and pricked with a needle.

Results and Discussion

From theoretical considerations, it is clear that a controlled release coating on a tablet must possess a high degree of flexibility to ensure that any swelling of the core – whether in storage or during drug release – does not crack the film. Tests on isolated films showed that that polyvinyl acetate (Kollicoat SR 30D) has far greater elasticity than ethyl cellulose or ammonio methacrylate copolymer.

Metoprolol tartrate	200.0 mg
Kollidon 30	6.0 mg
Di-Tab	160.0 mg
Aerosil 200	3.0 mg
Talc	4.0 mg
Magnesium stearate	4.0 mg
Total tablet weight	**391.5 mg**

Table 1 – Core composition.

Kollicoat SR 30D	43.5 %
Triacetin	0.7 %
Kollicoat IR	3.3 %
Kollidon 30	0.5 %
Titanium dioxide	0.5 %
Sicovit Red (iron oxide) optional	0.5 %
Talc	3.5 %
Water	47.5 %
	100.0 %

Table 2 – Coating composition.

Batch size	5.0 kg
Inlet air temperature	50°C
Product temperature	35°C
Atomising pressure	2.0 bar
Spraying rate	22 g/min
Coating weight	4, 6, 8, 10 mg/cm^2

Table 3 – Coating parameters.

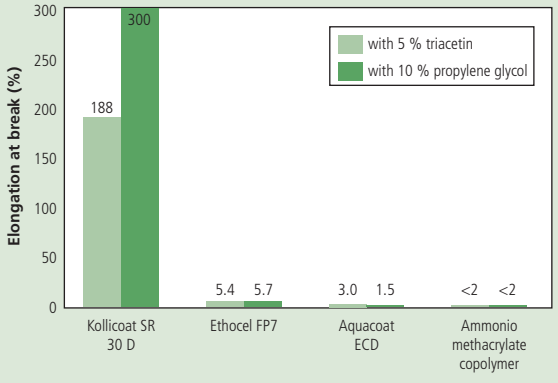

Figure 1 – Elongation at break of various coatings.

The permeability of the film coating can be adjusted by adding water-soluble or water-swellable substances, polymers if possible. As is to be expected, the release rate slows with increasing thickness of the coating. The release curve is S-shaped, as, initially, water has to penetrate the coating and enter the core in order to at least partially dissolve the drug substance before this can diffuse out through the coating. The time lag between first contact with water and drug release also depends on the thickness of the coating and the quantity of water-soluble excipients *(Figure 2)*.

The coated tablets were subjected to strong mechanical stress. Neither a friability test (500 revolutions, 15.5 cm drop height) nor 20 drops from a height of 1.5 m had any noticeable effect on the release characteristics.

Surprisingly, the film-coated tablets can even be pricked with a needle without affecting drug release. Kollicoat SR possesses enormous plasticity that ensures that small holes are self-sealing, particularly when the tablet is introduced into an aqueous medium. As a result, such coatings have a previously unknown self-repair mechanism *(Figure 3)*.

Conclusions

Film coatings based on Kollicoat SR 30D are very resistant to mechanical stress and possess a self-repair mechanism. The release rate can be adjusted by using water-soluble polymers and by varying the coating thickness. Film coatings based on Kollicoat SR 30D allow the simple manufacture of coated controlled-release single-unit forms without the risk of dose dumping.

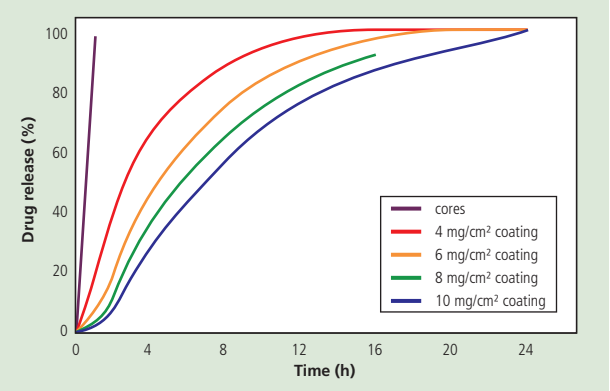

Figure 2 – Drug release of metoprolol tablets as a function of coating thickness.

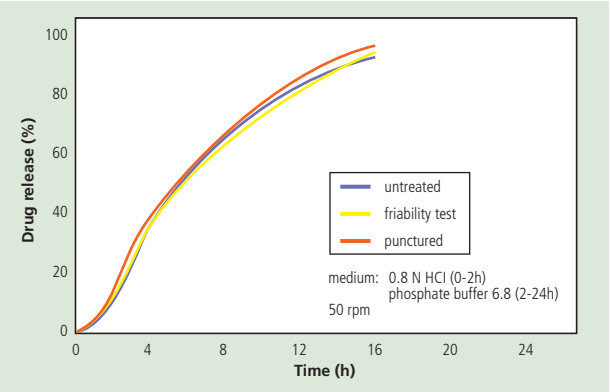

Figure 3 - Influence of mechanical stress on drug release of metoprolol tablets.

References

Kettelhoit S *et al.*, 1999. Osmotic drug delivery system, German Patent Application 19747261.

Ravi Kumar MNV, Kumar N, 2001. *Drug Dev Ind Pharm*, **27**:1-30.

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