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Preparation of sustained release capsules by electrostatic dry powder coating, using traditional dip coating as reference

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Abstract: Lately, a great deal of attention is being paid to capsule coating, since the coat protects active pharmaceutical ingredients (APIs) from damage, as is in the case of tablet and pellet. However, moisture and heat sensitivity of gelatin shells make it challenging to coat capsules using the conventional aqueous coating techniques. In an effort to overcome this challenge, the present study aims to coat capsules using two different coating techniques: electrostatic dry powder coating (EDPC) and dip coating (DC). Both capsule coatings and free films were prepared by these two coating techniques, and the effects of coating formulations and processing conditions on the film quality were investigated. The corresponding drug *in vitro* release and mechanisms were characterized and compared. The results of dissolution tests demonstrated that the drug release behavior of both EDPC and DC coated capsules could be optimized to a sustained release of 24 hours, following the Fick's diffusion law. The results of this study suggest that EDPC method is better than DC method for coating capsules, with respect to the higher production efficiency and better stability, indicating that this dry coating technology has promised in gelatin capsule coating applications.

Keywords: Capsule coating; Electrostatic dry powder coating; Dip coating; Free film; Sustained release

1. Introduction

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Abbreviations: APIs, active pharmaceutical ingredients; EC, ethylcellulose; EDPC, electrostatic dry powder coating; T_g, glass transition temperature; TEC, triethyl citrate; RS, Eudragit® RS PO; RL, Eudragit® RL PO; DC, dip coating; MT, metoprolol tartrate; MCC, microcrystalline cellulose; M_0, weight before coating; M_t, weight after coating; SEM, scanning electron microscopy; WVP, water vapor permeability; W_0, initial width; T_0, initial thickness; F_{max}, ultimate load; L_0, initial length; ΔL, elongation at break; σ_b, tensile stress at break; ε_b, tensile strain at break; Q_{1h}, Q_{2h}, Q_{4h}, Q_{24h}, drug release at 1,2,4,24 h; dQ/dt, drug release rate; A, surface area; D, diffusion coefficient; K, drug distribution coefficient between film and core; d, thickness of coating; ΔC, drug concentration difference inside and outside the coating.