Tablet Coating at Low Bed Temperatures with a Novel Coating Polymer

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INTRODUCTION

Currently, when coating tablets with moisture sensitive actives, aqueous film coatings based on PEG, PVA, and HPMC are recommended to be applied at high product temperatures to overcome the API's sensitivity. Unfortunately, this approach can lead to heat degradation of the API and other potential physical tablet coating defects.

PURPOSE:
The goal of this study was to evaluate the coating quality of a modified pea starch based polymer in a ready to use coating formulation (ReadiLYCOAT®) at a process bed temperature lower than 25°C.

MATERIALS & METHODS

THERMOGRAVIMETRIC STUDIES: Thermogravimetric studies were performed on a Perkin Elmer Pyris 1 thermogravimetric analysis (TGA) equipped with Pyris software. Studies were performed on KLEPTOSE® Linecaps DE17, plasticizers and GRI to determine thermal stability during extrusion. Drug and polymers were heated from 30–200°C at 20°C/min.

DIFFERENTIAL SCANNING CALORIMETRY (DSC) STUDIES: The physical characterization of pure GRI, KLEPTOSE® Linecaps DE17 (KLD), plasticizers and extruded formulations was performed by DSC, using Perkin Elmer Diamond differential scanning calorimeter equipped with Pyris software (Shelton, CT, USA). Approximately 2–3 mg of the sample was hermetically sealed in a crimped aluminum pan and heated from 30°C to a temperature about 50°C higher than the melting point of the drug or the softening temperature of the polymers, at a heating rate of 20°C/min.

HOT MELT EXTRUSION: In order to increase KLD extrudability different polyols (Xylitol, Mannitol, Sorbitol, Erythritol and Maltitol) as plasticizers were evaluated at 10% and 20% w/w concentration. GRI at 10% -20% w/w drug loads were pre-mixed with KLD and plasticizer using a V-shell blender and further extruded using co-rotating twin screw extruder (16 mm Prism Euro Lab, ThermoFisher Scientific) at screw speeds of 50-150 rpm over a temperature range of 135-150 °C.
Milled extrudates were studied for in vitro dissolution release in simulated saliva fluid (pH 6.8) using USP Type-I apparatus at 37 ± 0.5 °C and 100 rpm. Samples (1 mL) were collected at predetermined time points (30, 60, 120, 180 and 300 sec) and were analyzed using a Waters HPLC-UV system (Waters Corp).

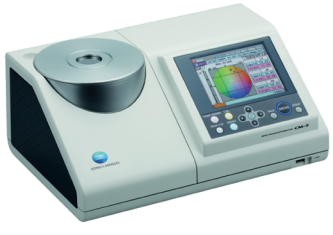
RESULTS & DISCUSSION

2.5 kilograms core tablets (800mg, mannitol based) were processed with 20% dry solids coating formulation (ReadiLYCOAT® , Roquette) to 3% and 4% coating by weight using a fully perforated 4 liters coating pan (LDCS, Freund-Vector Corporation) equipped with a spray gun utilizing a Schlick 1.0 mm fluid tip and ATB air cap (see **Figure 1**). Coating parameters are shown in **Table 1**. Color uniformity was evaluated visually, and via spectrophotometric ΔE values (ΔE is a positive number expressing a difference between two colors) using a Konica Minolta CM-5 spectrophotometer (see **Figure 2**).

Figure 1. Coating Equipment.

Freund-Vector
Laboratory Development Coating System (LDCS)
with 4 liter coating pan.

Figure 2. Spectrophotometric Equipment/Method.



L*, a*, and b* values for SCI
(Specular Component Included)
were used to calculate the
ΔE CIE 2000 (1.1.1) values:

$$\Delta E = \sqrt{\left(\frac{\Delta L'}{K_L S_L}\right)^2 + \left(\frac{\Delta C'}{K_C S_C}\right)^2 + \left(\frac{\Delta H'}{K_H S_H}\right)^2 + R_T \left(\frac{\Delta C'}{K_C S_C}\right)\left(\frac{\Delta H'}{K_H S_H}\right)}$$

Figure 3. Final Coated Product.

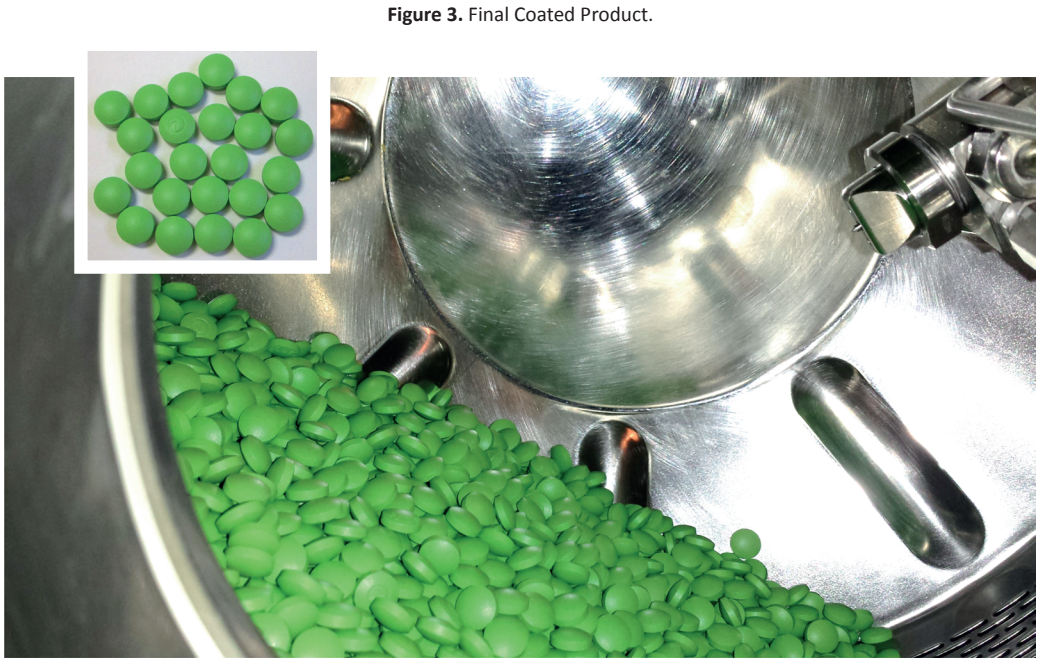
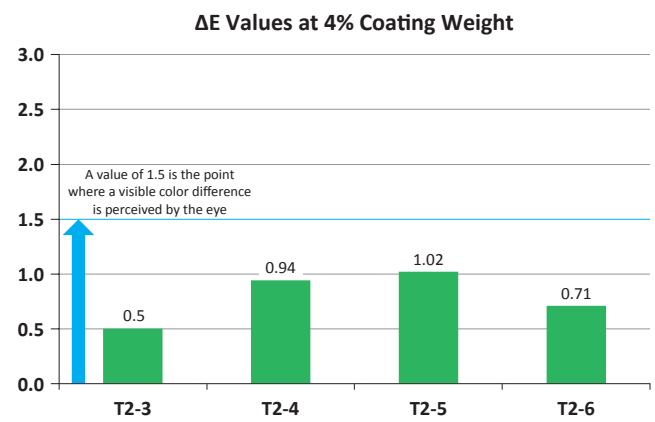


Table 1. Coating Parameters.

Parameter	Trial T2-2	Trial T2-3	Trial T2-4	Trial T2-5	Trial T2-6
Batch Size (Kg)	2.5	2.5	2.5	2.5	2.5
Inlet Air Temperature (°C)	57-60	60-62	42-47	37-42	30-35
Inlet Air Flow (M3/H)	100	68	68	68	100
Spray Rate (g/min)	10.0	10.4	10.4	10.5	8.2
Atomization Air (bar)	1.2	1.2	1.2	1.2	1.2
Pattern Air (bar)	1.2	1.2	1.2	1.2	1.2
Spray Gun to Tablet Bed (cm)	10	10	10	10	10
Final Coating %	4.0	3.9	4.1	4.0	4.0
Spray Time (min)	51.9	48.5	52.0	49.9	63.3
Pan Speed (rpm)	18	18	18	18	18
Product Bed Temperature (°C)	40-43	37-38	24-28	20-25	19-22

Figure 4. Color Uniformity.



Notes:
Tablets from Trial 2-2 were used as the reference tablets for ΔE values.
Trial T2-3 tablets were also compared at 3% coating weight and had a ΔE=0.86.

- Coated tablets had ΔE values in the range of 0.5-1.0, resulting in a tablet appealing with very good color uniformity and visually appealing.
- Friability measurements resulted in 0% loss of tablet/coating weight.
- Disintegration times for coated tablets compared to uncoated tablets increased only 39 seconds (86 seconds to 125 seconds).

CONCLUSION

The novel combination of the modified pea starch polymer with high solids content and low tablet bed temperature makes possible:
- Elegant, uniform coatings with zero visible defects,
- A practical coating solution for APIs with stability issues.

REFERENCE

ΔE values were calculated using the Color Difference Calculator found at http://www.brucelindbloom.com/index.html?Eqn_DeltaE_CIE2000.html.