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Impact of the Design of Spray Guns on a Pharmaceutical Film Coating Process

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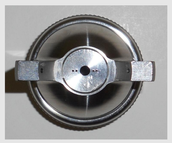
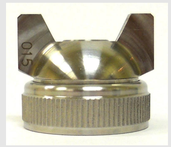
PURPOSE

This study is to evaluate the impact of the design of spray guns on a pharmaceutical film coating process.

METHODS

Three different designs of spray guns were used for this study (Table 1, Picture 1 to 3). For each coating, 40 kg of 500 mg oval tablets were coated using a 55-liter fully perforated pan (Freund-Vector Hi-Coater) with Aquarius™ clear solution and other commercial color suspension to a target weight gain of 3% w/w. The key coating parameters (i.e. pan speed, temperature, CFM, spray rate, spray zone…etc) were kept constant to minimize the variation (Table 2). The coating efficiency, surface roughness and color variation were measured.

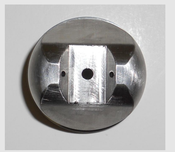
Picture 1. Spray Gun A --- Air Horn, Fluid Cap and Full Assembly

Front  Side  Assembled 

Picture 2. Spray Gun B --- Air Horn, Fluid Cap and Full Assembly

Front  Side  Assembled 

Picture 3. Spray Gun C --- Air Horn, Fluid Cap and Full Assembly

Front  Side  Assembled 

METHODS (Continued)

Table 1. Summary of the Design of Three Different Spray Guns Used in Study

Spray Gun Details	Spray Gun A	Spray Gun B	Spray Gun C
Gun Design Type	Regular	Anti Bearding	Anti Bearding
Air Horns	Full Air Horns	No Air Horns	Reduced Air Horns
Fluid Opening (mm)	1.5	1.2	1.5
Fluid Cap Position (relative to air cap)	Flush	Extended	Flush

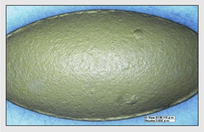
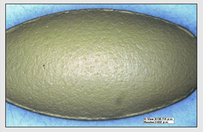
Table 2. Summary of the Key Process Parameters

Coating Parameters	Spray Gun A	Spray Gun B	Spray Gun C
Temperature Inlet/Exhaust/Bed °C	74-77/45-47/41-43	76-77/47-48/42-44	76-78/46-47/41-43
Pan Speed, rpm	8	8	8
Atomized/Pattern Air, SLPM	150/100	150/100	150/100
Spray Rate, g/min	150 ± 10	150 ± 10	150 ± 10
Gun to Bed Distance, Inch	10	10	10

RESULTS

The clear coated tablets are shown in Picture 4. The other results are listed in Table 3.

Picture 4. The Surface Appearance of Clear Coated Tablets by Different Guns

By Gun A  By Gun B  By Gun C 

RESULTS (Continued)

Table 3. Summary of the Non-Pictorial Evaluation Parameters

Evaluation Parameter	Spray Gun A	Spray Gun B	Spray Gun C
Coating Efficiency, %* /RSD%	98.9%/ 16.34%	93.1%/22.34%	101.3%/11.99%
Surface Roughness, (Sq, µm)/SD (Sq, µm)	6.34/0.90	8.45/4.47	5.82/1.59
Color Variation, (DE)/SD	0.29/0.12	0.20/0.12	0.21/0.12
D10 (µm, Droplets PSD)	17	29	14
D50 (µm, Droplets PSD)	50	73	43
D90 (µm, Droplets PSD)	123	196	97

CONCLUSIONS

A 5-8% difference in coating efficiency between the spray guns with air horns and the spray gun without the air horns was observed. The spray gun without the air horns shows the highest roughness number of 8.45 (Sq, µm) when compared to the other two at 6.34 and 5.82. Similar color variations ranging from 0.20 to 0.29 were observed.

Based on this study, the design of the air horn/the opening of pattern air was found to have an impact on the coating efficiency and surface roughness. However, all the three spray guns produced tablets with commercially-acceptable appearances, coating efficiencies, surface roughness, and color variations.

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