Controlled Release Coatings of Ethylcellulose on Drug Loaded Multiparticulates: A Comparison of a Novel Rotor Dry Powder Layering Process to a Traditional Wurster Bottom Spray Coating Process.

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PURPOSE

Spray coatings of ethylcellulose for controlled release on multi-particulate dosage forms are common in the pharmaceutical industry, but can be disadvantageous because of long process times, need for organic solvent capabilities, and particulate agglomeration. This study highlights the advantages of a rotor dry powder layering process in overcoming these deficiencies by comparing performance, productivity and cost to solvent-based Wurster coating and aqueous-based Wurster coating.

METHODS

Sugar Spheres (#20-25 mesh; Suglets® Colorcon Inc., USA) coated with acetaminophen (APAP) at a 28% w/w level were used as core materials for each of the coating processes. Using a conical rotor, (Granurex® GXR-35, Freund-Vector Corporation, USA) the drug layered beads were powder layered with micronized ethylcellulose (ETHOCEL™ EXP-1, The Dow Chemical Company, USA) using a 40% dibutyl sebacate (DBS) emulsion as a binder/plasticizer. For comparison, APAP drug layered beads were also coated in a bottom spray fluid bed (VFC-3 8" Wurster, Freund-Vector Corporation, USA) using an organic solvent based ethylcellulose (ETHOCEL™ STD 10 Premium, Dow) solution in ethanol and an aqueous ethylcellulose DBS based dispersion. Dissolution was evaluated for the various weight gains of dry powder, organic and aqueous coatings.

EQUIPMENT

Freund-Vector Corporation
Granurex® GXR-35

Freund-Vector Corporation
VFC-3, 8" Wurster

RESULTS

PROCESS DATA

Wurster Process

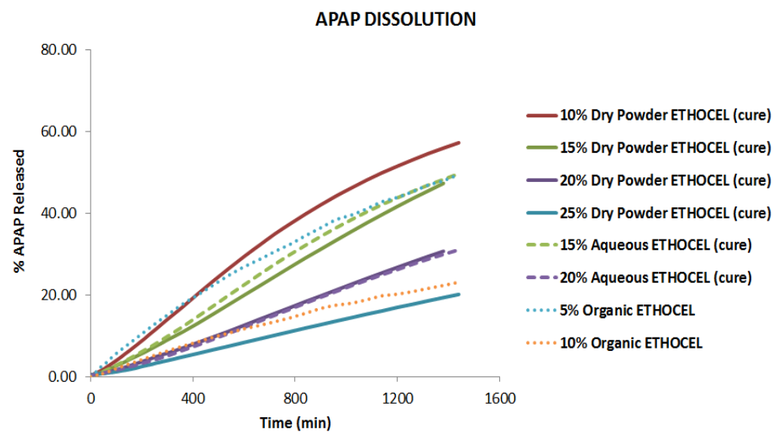
PARAMETER	AQUEOUS COATING	SOLVENT COATING
Polymer Weight Gain*	20.0%	10%
Polymer Application Rate	3.77 g/min (15% solids)	2.88 g/min (7.5% solids)
Process Yield	96.2%	97.0%
Curing Time	120 min	0 min
Total Process Time	421 min	245 min

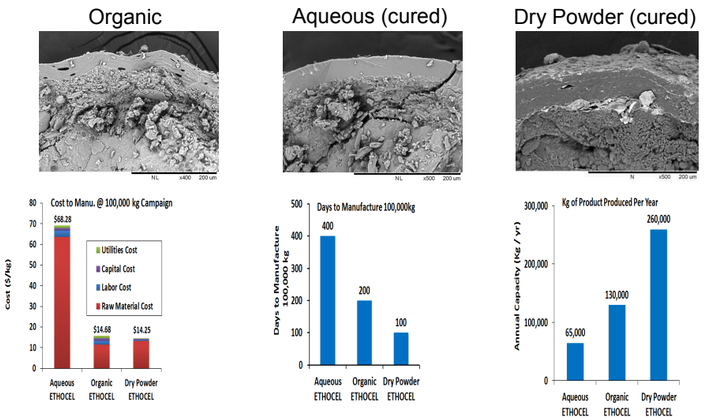
Dry Powder Layering Process

PARAMETER	DRY POWDER LAYERING
Polymer Weight Gain*	20.0%
Polymer Application Rate	15 g/min (100% solids)
Process Yield	98.4%
Curing Time	120 min
Total Process Time	187 min

*weight gain chosen to show equivalent dissolution performance

DISSOLUTION AND SEM IMAGES





Coatings achieved through the dry layering process were consistent, reproducible, and demonstrated controlled release at 10-20% weight gain and took 25-50 minutes of coating time. Wurster spray coatings took 110-240 minutes to achieve the same coating levels. The dry powder layered coatings had the same dissolution performance as the aqueous wurster coatings, but needed more weight gain to achieve the same performance as the organic wurster coatings,

CONCLUSIONS

The rotor dry powder layering process demonstrated controlled release coatings and was applied at rates 2-4 times faster than traditional spray coating systems, although it did require more polymer weight gain to achieve the same performance as the solvent based solution. The rotor dry powder layering process also A) eliminates organic solvent based formulations which help alleviate concerns around environmental health and safety considerations and B) eliminates aqueous based formulations which enable coatings to be applied to water sensitive ingredients. Further testing with experimental ethylcellulose samples, various curing times and conditions as well as different polymer/plasticizer combinations is needed to optimize performance for the dry layering process.