



IFPRI BRIEF TEMPLATE

Check One: **Project** **Review** **Collaboration**
 Workshop **Other**

Descriptive Title	Reduced order model development for melt granulation using twin screw extruder
Working Title¹	Melt Granulation Model
Technical Area²	F, M, SE
Date	06/27/2019
Short Description	<p>Twin screw extruder-based melt granulation processes have proven to be a useful enabling technology alternative to manufacture crystalline and/or amorphous solid dispersions consisting of very high (>50%) loadings of active drugs in pharmaceutical formulations, embedded organic salts in molten mass in food industry, or specialty products in process chemical and allied industry, etc.</p> <p>The challenge is to design the process equipment (i.e. screw element design and configuration) and operational parameters (i.e. screw speed and temperature profile) to achieve a uniform dispersion of solids into the melt for a given formulation.</p> <p>Development of an experimentally validated, reduced order model for routine use is desired in order to facilitate rapid process development and optimization.</p>
Objectives	<p>Build a reduced order 1-D model based on experimentally validated 3-D modeling and simulation of a co-rotating twin screw extruder to predict the optimal operating conditions, namely the screw element configuration, screw speed, residence time and temperature profile to achieve a uniform solid dispersion.</p> <ol style="list-style-type: none"> 1. Development of 3-D model for solid dispersion in the melt in the co-rotating twin screw extruder accounting for powder melting and temperature-dependent rheology. 2. Experimental model validation of granule quality (e.g. structure, composition, uniformity) using various loadings and PSD of the active compound.

¹ Title used in meeting agendas and file archives

² One or more from the following list: W = wet systems; D = dry systems; F = particle formation; SR = size reduction; M = modeling; SE = systems engineering

	3. Development of reduced order 1-D model to enable quick prediction of the effect of underlying extruder design and operational parameters on the granule quality.
Scope	<p>In scope:</p> <ul style="list-style-type: none"> • One mutually agreed twin screw extruder size with specified screw elements. • Consideration of multiple ‘active’ formations with varying mass fractions and PSDs <p>Out of scope:</p> <ul style="list-style-type: none"> • Optimization of various screw designs

Recommended Contractors (2 or 3)		
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