IFPRI BRIEF TEMPLATE

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

Descriptive Title	Numerical modeling of spray droplet formation, dispersion and drying within spray related powder manufacturing processes to predict accurate particle size and surface deposition
Working Title[1]	Numerical modeling of spray droplet formation, dispersion, and drying
Technical Area[2]	DS, M, F
Date	21st June 2021
Short Description	Spray atomization is a widely used phenomenon used for powder manufacturing and film coating in various industries such as, chemical, pharmaceutical, food, etc. While sprays have been used for several centuries, there is still lack of in-depth understanding of the process due to non-linear multi-physics interactions. It is not only desired to have a control on the droplet size but also on the drying rate of those droplets. In applications such as, spray drying, dried particles are generated but an improper drying of droplets could lead to surface deposition. However, in applications such as, film coating, droplet drying could lead to substandard coating coverage (for e.g. tablet coating). Therefore, it is essential to understand the multi-physics interaction happening during the formation, dispersion, and drying of the spray droplets got equipment design and operations. With the recent advances in modeling (for e.g., Eulerian-Lagrangian CFD approach) and computational resources, combined with machine/deep learning algorithms, it is possible to extract practical information from these models to be utilized for equipment and process optimization.
Objectives	1. Develop an experimentally validated high-fidelity CFD model for spray atomization (near field + far field) for industrially relevant viscous liquid sprays. 2. Implementation of a drying model to predict the drying behavior of the spray droplets and its impact on surface deposition.

[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. Derive a reduced order model for droplet size and drying profiles from above-mentioned modeling predictions, which can be utilized in an industrial setting
Scope	• Atomization of viscous industrially relevant liquids used in chemical, pharmaceutical, or food industry • Use pressure driven nozzle to begin with, other nozzles can be explored as stretch goal • Include turbulent as well as laminar regime to include different processes and operating conditions • Inclusion of effect of particle shrinkage upon drying

Recommended Contractors (2 or 3)		
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