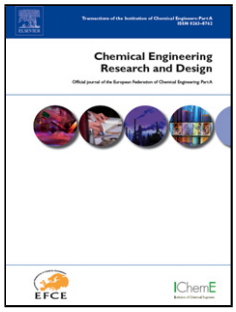

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Compartment Based Population Balance Model Development of a High Shear Wet Granulation Process via Dry & Wet Binder Addition

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Abstract

Population balance models (PBM) have been used traditionally to model high shear wet granulation (HSWG) with wet binder addition where the binder is pre-dissolved in a liquid and added to the granulator. However, wet granulation with dry binder addition can not accurately be modeled with the models developed for wet binder addition since it involves the additional step of dissolution of the dry binder present in the granulator in the pure liquid added during liquid addition stage. In this work, a reduced order multi-compartment population balance model integrated with binder dissolution model was developed to address the differences in average diameter of particles obtained from dry and wet binder addition. Experimental data were generated on a 10-L PMA granulator using wet and dry binder addition modes. The experimental data were used to estimate the model tuning parameters to validate the model which was further used as predictive tool. This model showed good agreement with experimental data in capturing the trends in average particle diameter for two different binders, hydroxypropyl cellulose (HPC) and polyvinylpyrrolidone (PVP). The model was also able to accurately predict the average diameter for both the wet binder and dry binder addition cases.

Keywords: High shear wet granulation, dry binder addition, multi-compartment population balance model, particle dissolution model, reduced order model

1. Introduction

Wet granulation is a process of agglomeration of primary fine particles into large agglomerates to improve the particle flowability and compressibility. It is considered as one of the key unit operation in various particulate industries manufacturing pharmaceuticals, agricultural chemicals, mineral, detergents, among other things. In the pharmaceutical industry, wet granulation is majorly used for the production of solid dosage forms such as tablets and capsules from fine powder of active pharmaceutical ingredients (API) and excipients. Owing to its economic importance, considerable amount of research has been done in understanding the process. However, in spite of decades of research, many industrial plants operate at lower efficiency due to poor understanding

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