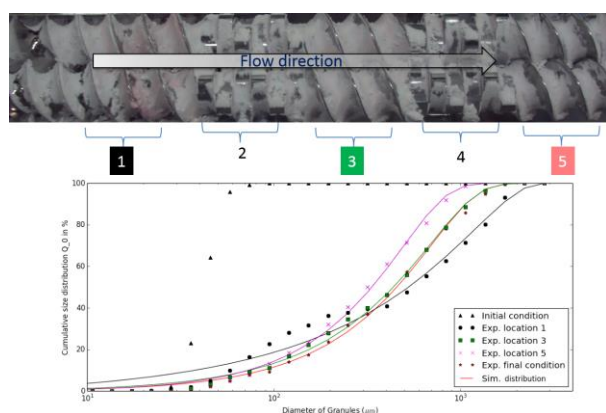


ANALYSIS OF A TWIN-SCREW GRANULATION PROCESS USING A COMBINED EXPERIMENTAL AND COMPUTATIONAL APPROACH

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Continuous processing in steady state, smaller equipment footprint and less tedious scale-up is a potential alternative for the currently applied batch wise methods in secondary pharmaceutical manufacturing. Consequently, twin-screw granulation has recently emerged as a popular continuous wet granulation technique. This granulation method depends on several process variables. However, available studies have primarily focused on the effect of these variables on granule properties at the outlet of the twin-screw granulator due to the opacity of the multiphase system. Thus, little is in fact known about how these variables affect the evolution and kinetics of granule formation and the resulting granule structure. This work is the combination of theoretical development and experimental validation of a population balance modelling framework for twin-screw granulation. For the first time, a Population Balance Model (PBM) has been developed to model twin-screw granulation which accounts for the granulator design and the process parameters such as number and location of kneading discs, along with the effect of the number of axial compartments. The rate processes which are considered dominant in a twin-screw, i.e. aggregation and breakage, were included. The work demonstrated that a good agreement between experimental and simulated results can be achieved for the evolution of particle size distributions in a twin-screw granulator. The modelling framework presented in this paper forms the basis of the kinetic analysis of granulation experiments that may lead to the development of a modelling tool and combination with micro-level models such as Discrete Element Models (DEM) in a hybrid framework. Such a framework can be used both to simulate and predict twin-screw granulation.



Agreement between experimental and simulated granule size distribution results in a twin-screw granulator.