Combining experimental and model-based investigation of residence time distribution in twin screw granulator

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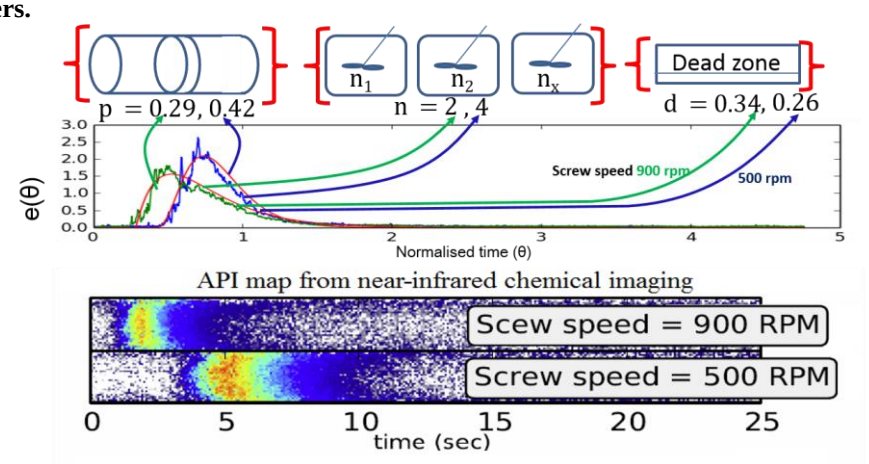
Twin-screw granulation (TSG) is seen as a promising continuous alternative for traditional batch high shear wet-granulation processes. It achieves mixing by a combination of screw configuration and process settings (e.g. feed rate, screw speed, etc.) to produce a certain end-product specification in a short time. The residence time distribution (RTD) in a TSG provides interesting information to understand its mixing behaviour. Currently, experimental data are used to determine the RTD. However, in order to obtain the detailed understanding regarding the mixing, modelling of the residence time distribution is desirable. In this study, a conceptual model based on classical chemical engineering methods has been proposed to understand and simulate the RTD (Fig. 1). Comparision between the experimental and the model estimated data was performed to propose “most suitable conceptual model” for describing the RTD in TSG. The parameters estimated by this model were used to analyse and predict the effect of changes in number and stagger angle of kneading discs, screw speed and material throughput on the RTD. The measured RTD established that the screw speed primarily controls the residence time of material inside the granulator, whereas the kneading blocks in screw configuration act as a plug-flow zone inside the granulator. The results suggest that a balance between the throughput force and conveying rate is needed to obtain a good axial-mixing inside the twin-screw granulator. Further efforts are required towards linking the RTD with the particle size distribution by combining experimental and model-based investigations.

Figure 1: NIR chemical map of API to measure resudence time distribution and alaysis using the conceptual model parameters.



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