Distinct Element Simulation of Inter-particle Coating Variability in a Rotary Drum Coater

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ABSTRACT

Coating of particulate solids by a thin film layer is of interest in many industrial applications such as seed and tablet coating. In seed processing, seeds are commonly coated with a protective coating layer consisting of fertilisers and crop protection products. Rotary drum batch coaters are typically used for this purpose. The coater consists of a cylindrical vessel with a rotating spray disk in the centre, onto which the coating liquid is fed. The seeds are driven around the vessel by its rotating base, and are mixed by two baffles (one on either side of the vessel). In the present study, DEM simulations are used to analyse the seed coating process. Corn seed is used as a model material and its shape is captured using X-Ray micro-tomography (XRT). The shape is incorporated into the simulations by the clumping of multiple spheres to form a particle assembly [1]. The coating uniformity of the seeds is predicted by implementing two coating models. The first method predicts the amount of coating liquid mass received by the seeds during the coating process [2], whereas the second method calculates the residence time of the seeds present in the coating zone. The distribution of mass of sprayed spheres on the corn seeds, their residence time in the coating zone and the coefficient of variation of coating mass and residence time of the seeds are evaluated for a range of process conditions, such as spinning disk rotational speed, droplet size, and baffle arrangement and designs. In addition, the required scale-up rules for rotary drum batch coaters are investigated and reported. The outcome provides guidelines on scale-up rules for rotary batch seed coaters and how to improve the coating uniformity.

REFERENCES

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