# An Investigation of the Mixing and Segregation of Powders in a Spheronizer

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## Abstract

Spheronization is a mixing and pelletizing process often used in the pharmaceutical industry to obtain uniformly sized spherical pellets from a mixture of powder extrudates the form of which is cylindrical. The equipment used, a spheronizer, consists of a rotating grooved disk that spins at high speed at the bottom of a cylindrical bowl and thus increases friction with the cylindrical particles. One important issue related to this process is the likely occurrence of segregation within the bed of particles, which can lead to a lack of uniformity of the pellets and, subsequently, to a poor quality of the end-use product. Powder flow in spheronisers is characterized by a toroidal motion that promotes the roundness of the pellets and increases their density. The characterization of the segregation phenomena during the operation of such equipment and the evaluation of the residence time of each type of particles, which both depend on the flow patterns, are essential to the design and improvement of such a granulation process. These flow patterns depend on the disc velocity, the fill level and the inherent properties of the particles. This work investigates numerically by means of a model based on the discrete element method (DEM) the impact of these parameters on the flow dynamics and segregation patterns of polydisperse particles in a spheronizer. The simulation results are compared to other results from the literature as well as experimental data obtained in our pilot-scale rig. Characteristics such as mixing curves, concentration profiles and radial residence time distributions (RTD) are presented and discussed.