A numerical analysis of a twin screw mixer using dry cohesion less material and experimental validation

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ABSTRACT

Mixing and blending of particles is an important process in many industries, such as chemical, pharmaceutical, ceramic, plastic, fertilizers, minerals etc.[1,2]. The primary objective of mixing is to obtain a highly homogenized product, which often becomes difficult due to various parameters (geometrical as well as operating conditions) [3]. The process becomes even more complex when conveying is also involved, which leads to a smaller operating window for mixing/diffusion.

An attempt is made to understand the effect of particle size in a Twin Screw Mixer (TSM) mixing with a filling level around 50%. Using the Discrete Element Method (DEM), the rate of mixing, granular temperature and residence time distribution (RTD) at varying Froude numbers are analysed to understand the mechanism(s) behind mixing in relation to lateral or axial dispersion during conveying.

While the shear zones are qualitatively analyzed based on granular temperature, the degree of mixing has been quantified using a simple mixing index [4] and Lacey index [1]. The particle size plays a significant role in mixing within the time frame of operation, but with enough time, the degree of mixing reaches a steady state. It has been found that the energy required for agitating the particles is transferred from the blades with the high shear regimes at the centre. Mixing led by particle diffusion is dominant normal to conveying direction. The calibrated particle size has been used to validate the simulation using residence time distribution.

REFERENCES


