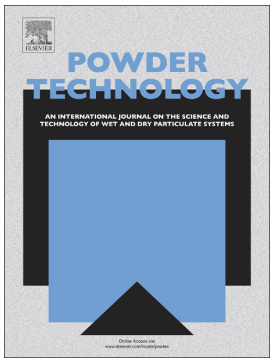

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The effect of impeller configurations on particle mixing in an agitated paddle mixer

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Abstract

The discrete element method (DEM) and experimental measurements were employed in order to investigate the influence of impeller configuration on the mixing performance of free flowing mono-disperse spherical particles in a horizontal agitated paddle mixer. Five different impeller configurations were used in the DEM simulations. It was found that the impeller configuration had an important impact on the mixing performance and granular behaviour. The relative standard deviation (RSD) results obtained from the validated DEM models revealed that in general, mixers employing angled paddle configurations referred to as 30°- Angle and 45°- Angle provided better mixing performances when compared to the mixers employing the 0°- Angle, rectangular and 60°- Angle paddle configurations. The influence of impeller configuration on the impeller-particle and particle-particle contact forces was also analyzed. The particle-particle contact forces were less affected by alterations in impeller configurations. Higher granular temperature values were obtained from the simulation performed with the 0°- Angle paddle in comparison to the simulation performed with the rectangular paddle which could partially describe the enhanced mixing performance obtained for the former impeller when compared to the latter impeller. The contributions of both diffusive and convective mechanisms on the particle motion were also investigated and it was attempted to analyze the mixing performance with respect to those mechanisms. It was also concluded that diffusion was the dominant mechanism in the current mixing system regardless of the impeller configurations.

Keywords: Agitated paddle blender; Discrete element method (DEM); Impeller configuration; Particle mixing; Mixing performance and mechanism