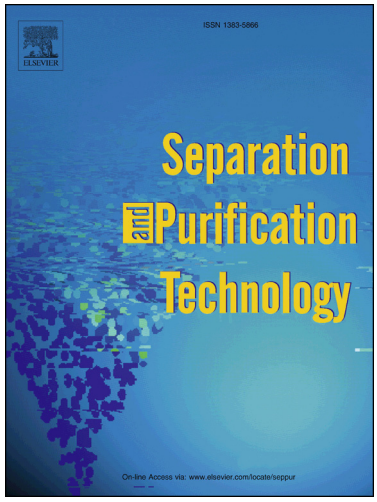

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Development of Novel Hydrocyclone Designs for Improved Fines Classification Using Multiphase CFD Model

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Abstract

In this paper, a set of potential hydrocyclone designs are explored for fines classification using Computational Fluid Dynamics (CFD) technique. The CFD model uses Volume of Fluid multiphase model coupled with Reynolds Stress turbulence model for two phase flow predictions. Lagrangian Particle Tracking and Algebraic Slip Mixture model (ASM) modified with shear lift forces and slurry rheology corrected with fines fraction are used to predict the particle classification. Conventional cylindrical-conical design and various novel cyclone designs having a combination of multiple and small cone angles, tapered vortex finder and air core free designs are considered in this study. Simulation results are presented in terms of mean and turbulent flow field along with particle efficiency curve. Predictions show that all the tested novel designs are inherently having the potential for finer cut separation and higher tangential velocity compared to the conventional design. Cyclone design with a small cone angle is further modified by placing various sizes of rods at the center axis of the cyclone. Multiphase simulations with modified ASM model are also carried out for the multiple cone angles design, standard design, and the modified small cone angle design with full length rod at 15 wt% of solids. Performance by multiphase simulations show that multiple cone angles design and modified small cone angle design with the full length rod are the best among the tested designs yielding high separation efficiency, smaller cut-point and minimum coarse particle misplacement due to resultant turbulence minimization.

Keywords: Air core, CFD, Cut diameter, Design, Hydrocyclone, Multiphase

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