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ABSTRACT

The effects of inlet angle on the collection efficiency of a cyclone with helical-roof inlet have been computationally investigated using Large Eddy Simulations with the dynamic Smagorinsky-Lilly subgrid-scale model for five different inlet angles (7°, 11°, 15°, 20° and 25°). Forty thousand individual particles were tracked through the unsteady flow field using the Lagrangian approach. In order to reveal the collection efficiency of a cyclone with helical-roof inlet properly, simulation time should not be less than 3.5 times the average flow residence time. Particles which diameter is close to the cyclone cut size have the longest residence times while particles of 10 – 25 μm in diameter have the shortest. Based on the simulations, expressions for the cut size and Euler number normalized with the mean axial velocity in a cyclone with helical-roof inlet of different inlet angles are derived. The results show that, increasing the inlet angle increases the cyclone cut size and as a result reduces cyclone collection efficiency. At the same time, it decreases the cyclone pressure drop coefficient (Euler number) leading to lower pressure losses. For most cases where high separation efficiency at moderate pressure drop is required the optimum inlet angle is in the range 10 – 15°.

Keywords: Cyclone, Inlet angle, Large Eddy Simulation, Cut size, Collection efficiency

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