

CFD Modeling and Optimization of Gas Cyclone Separator for Performance Improvement

Authors : N. Beit Saeid

Abstract : Cyclones are used in the field of air industrial gases pollution and control the pollution with centrifugal forces that is generated with spatial geometry of the cyclone. Their simple design, low capital and maintenance costs and adaptability to a wide range of operating conditions have made cyclones one of the most widely used industrial dust collectors. Their cost of operation is proportional to the fan energy required to overcome their pressure drop. Optimized geometry of outlet diffuser of the cyclones potentially could reduce exit pressure losses without affecting collection efficiency. Three rectangular outlets and a radial outlet with a variable opening had been analyzed on two cyclones. Pressure drop was investigated for inlet velocities from about 10 to 20 m s⁻¹. The radial outlet reduced cyclone pressure drop by between 8.7 and 11.9 percent when its exit area was equal to the flow area of the cyclone vortex finder or gas exit. A simple payback based on avoided energy costs was estimated to be between 3600 and 5000 h, not including installation cost.

Keywords : cyclone, CFD, optimization, genetic algorithm

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