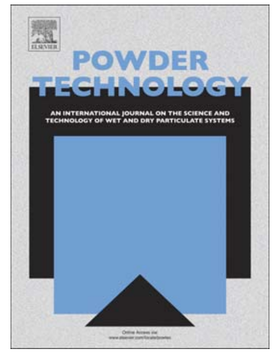

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ABSTRACT

Emissions abatement cyclone performance is improved by increasing collection effectiveness or decreasing energy consumption. The object of this study was to quantify the pressure drop and fine particulate ($PM_{2.5}$) collection of 1D3D cyclones ($H = 4D_c$, $h = 1D_c$) at inlet velocities from 8 to 18 m s^{-1} (Stk = 0.7 – 1.5) using heterogeneous particulate as a test material at inlet concentrations from 3 to 75 g m^{-3}. Cyclone exhaust was passed through filters. Laser diffraction particle size distribution analysis was used to estimate $PM_{2.5}$ emissions. Response surface models showed a strong correlation between cyclone pressure loss (Euler number) and inlet velocity and predicted a 46% reduction in pressure loss for a 25% reduction in inlet velocity (Stokes number). The model for $PM_{2.5}$ emissions was less definitive and, surprisingly, predicted a 31% decrease in $PM_{2.5}$ emissions when operating 25% below the design inlet velocity. Operating below the design inlet velocity (at a lower Stokes number) to reduce pressure losses (Euler number) would reduce both the financial and the environmental cost of procuring electricity. The unexpected co-benefit suggested by these trials was that emissions abatement may improve at the same time, though other empirical trials have shown emissions to be independent of inlet velocity and Stokes number.

Keywords. *Cyclones, Emissions, Energy consumption, Fine particulate, $PM_{2.5}$.*