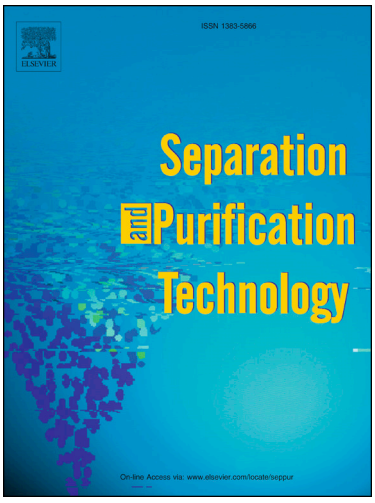


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# Analysis and optimization of cyclone separators with eccentric vortex finders using large eddy simulation and artificial neural network

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**Abstract**

The present study is aimed at exploring the effects of eccentric vortex finder tubes with respect to the cyclone axis, as well as to optimize the performance parameters. For this, experiments are designed using Latin hypercube sampling (LHS) plan for different combinations of the two independent variables viz. $e_x/D$ and $e_y/D$ on a plane that contains the cyclone roof (with $D$, the main body diameter; $e_x$ and $e_y$, the eccentricity in $x$- and $y$-direction, respectively). The range of both $e_x/D$ and $e_y/D$ is taken between -0.06 to 0.06. Secondly, large eddy simulation (LES) is used to predict the Euler number and Stokes number for different combinations of independent variables, and this data is used to train an artificial neural network. The variations observed in the performance parameters with change in location of vortex finder are significant. Lastly, the optimal data sets are generated using genetic algorithms – these Pareto front points facilitate the designers to choose the eccentric locations according to the desired cyclone performance.

**Keywords:** Cyclone separators; Eccentric vortex finders; Large eddy simulation (LES); Latin hypercube sampling (LHS) plan; Artificial neural network (ANN); Surrogate-based optimization (SBO)