عنوان مقاله:

CFD and Statistical Approach for Optimization of Operating Parameters in a Tangential Cyclone Heat Exchanger

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خلاصه مقاله:

Present work optimizes the operational parameters such as solid particle diameter, inlet air velocity and inlet air temperature on heat transfer rate by Taguchi method. Operational parameters play an important role in the performance of cyclone heat exchanger thus the parameter optimization is deemed important. The parameters have been analyzed under varying solid particle diameter (۳۰۰ and ۴۰۰ μm), inlet air temperature (۳۲۳, ۳۷۳, ۴۲۳ and ۴۷۳ K) and inlet air velocity (۵, ۱۰, ۱۵ and ۲۰ m/s). Results of heat transfer rate by varying the operational parameters have been found from Computational Fluid Dynamics (CFD) software Ansys Fluent. Orthogonal array of Taguchi, the signal-to-noise ratio and analysis of variance have been employed to found the optimal parameter values and the effect of parameters on heat transfer rate. Mixed level factor and L۳۲ array is chosen for the design of analysis in Taguchi. Result of statistical analysis shows that the developed approach yields worthy results when comparing with predicted simulation values with confidence level of ۹۹.۵%. Taguchi analysis reveals that optimized levels of parameters are ۳۰۰ μm, ۴۷۳ K & ۲۰ m/s for solid particles diameter, inlet air temperature and inlet air velocity respectively. Confirmation test was conducted in simulation and experiment for optimized parameters and result shows that maximum heat transfer rate was obtained with optimized parameter among the chosen operational parameters.

کلمات کلیدی:

CFD, Taguchi method, Cyclone heat exchanger, Optimization