



Numerical investigation and optimization for performance analysis in Venturi inlet cyclone separator

S. Venkatesh^{a,*}, M. Sakthivel^b

^aMechanical Engineering, Sri Eshwar College of Engineering, Coimbatore, Tamil Nadu, India, email: venkatesme2014@gmail.com

^bMechanical Engineering, Anna University Regional Campus, Coimbatore, Tamil Nadu, India, email: sakthi_vel_m@yahoo.com

Received 17 May 2017; Accepted 12 September 2017

ABSTRACT

A mathematical model has been developed for Venturi inlet cyclone separator by considering various geometric parameters. The most important geometrical parameters such as Venturi inlet length and Venturi inlet width and outlet diameter are considered for optimization. Response surface methodology has been used to fit the quadratic polynomial equation and the significance of quadratic model is tested by using analysis of variance. These parameters are optimized to get minimum pressure drop in cyclone separator by means of genetic algorithm. The optimized new design gives less pressure drop and high collection efficiency compared with mathematical model. The Reynolds stress turbulence model and discrete phase model have been utilized to simulate the Venturi inlet cyclone separator. The results from optimized design such as pressure drop, cut-off diameter, Euler number and Stokes number were compared with the results of computational fluid dynamics technique and found highly agreeing.

Keywords: Mathematical model; Pressure drop; Response surface methodology; Genetic algorithm; Reynolds stress model; Discrete phase model

* Corresponding author.