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Evaluation of the performance of an electrostatic enhanced air filter (EEAF) by a numerical method

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ABSTRACT

The electrostatic effect can significantly increase filtration efficiency of a fibrous filter. Numerical tools for the performance evaluation or design of electrostatic enhanced filtration system are lacking. This study developed a numerical model to simulate the performance of an electrostatic enhanced filtration system. The model considered all the physical phenomena in a filtration system: the corona discharge, air flow, particle charging, particle motion and filtration. Measured data from previous studies were used for model validation. The validated numerical method was then used to investigate the influence of filter structure parameters on the performance of electrostatic enhanced pleated filter. The filtration efficiency and energy consumption were evaluated. The effects of pleat distance, pleat height, applied voltage, and discharge wire position were examined. The results show that EEAF with shorter pleat distance and greater pleat height has higher efficiency. An increase in applied voltage raises both the efficiency and the electrical energy consumption. Filter performance is also sensitive to discharge wire placement. Overall, the

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