AEROSOL TRANSPORT BY INDOOR AIR CURRENTS

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Abstract—Indoor air currents and concentration gradients can play an important role in transporting and dispersing aerosols from their source to the rest of a room. These air currents arise from the ventilation system, movement of people or objects in the room, and natural convection currents driven by thermal gradients. The structure of the indoor air flow depends on the location of flow sources and sinks, as well as on the geometric barriers in the room. Concentration gradients occur when a contaminant, such as cigarette smoke, is distributed unevenly throughout an enclosure. The location and strength of the contaminant sources strongly affect the size of the gradients. With such a complex array of influences it is difficult to determine the mechanism dominating the transport and dispersion of aerosols such as sidestream tobacco smoke. To begin to understand the process, this paper describes a two-dimensional numerical simulation of the transport and dispersion of smoke particles due to convection and mass diffusion.

The simulation numerically solves the Navier–Stokes and concentration equations for a square enclosure with a single ventilation inlet and outlet. The position of the outlet varies, causing large scale flow structures of different shapes in the room. In addition, the simulations include cases where vertical partitions are placed in the room to modify air currents. Results indicate that with proper placement of partitions, inlet, and outlet, it is possible to confine dominant vertical structures to particular regions of the room. With such confinement, it is then possible to control the exchange of aerosols between partitioned room segments. The calculations demonstrate, for example, that proper room air current design can greatly reduce the transport of sidestream smoke from the smoking section to the non-smoking section of a single room.

THE MEASUREMENT OF WALL-LOSS COEFFICIENTS OF SO_2 AND PARTICLES IN THE DARK PHASE OF A SMOG CHAMBER

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Abstract—The wall losses of SO_2 and polystyrene latex spheres (PSL) in a 200 L dynamic chamber constructed with Teflon film in dark phase were investigated in this work. The results indicate that the wall-loss coefficient of SO_2 is 0.00027 s^{-1}, while those of PSL particles are 0.00042 s^{-1}, 0.00045 s^{-1}, 0.00048 s^{-1}, 0.00051 s^{-1}, 0.00054 s^{-1} and 0.00061 s^{-1} for diameters of 0.153, 0.197, 0.343, 0.426, 0.497 and 0.740 μm, respectively. In addition to Brownian diffusion and gravitational sedimentation, electrostatic effect is also thought to be a major factor that affects the wall loss of aerosols in the chamber.

SIMULATING THE MOTIONS OF ELLIPSOIDAL PARTICLES IN LAMINAR AND TURBULENT FLOW FIELDS

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Abstract—In this paper, a computational model for simulating the motion of a nonspherical particle in a general shear flow is presented. The computational model is used to obtain the trajectories and orientations of ellipsoidal particles suspended in various flow fields of practical interest. Results concerning sample particle trajectories and orientations in both laminar and turbulent flow fields are presented.