USE OF SYNTHETIC JETS TO CONTROL AEROSOL DISPERSION IN A ROOM

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ABSTRACT

Reducing gaseous and particulate contaminates in buildings, effectively and efficiently, is important not only for the occupants but also to conserve energy. In this study, active flow control technology using synthetic jets were used to direct the dispersion of a plume of particulates toward a specific location in a 0.23 m^3 closed experimental chamber. A module containing eight pairs of synthetic jets, with only one pair used at a time, provided the vectoring. A procedure was developed to obtain direct number particle concentration measurements (measured using an Aerodynamic Particle Sizer) and to construct number particle concentration contour plots to visualize the interrogation area. The magnitude of raw number particle concentrations varied at different vertical positions within the chamber due to the variable output from the fluidized bed aerosol generator, so a reference probe was placed in a fixed location within the chamber (x/b = 4.25, y/b = 5.25). The number particle concentration measured with a sampling probe was normalized by the average concentration measured with a reference probe before and after the sample. The aerodynamic diameter size range of the particles studied was 0.5 to 5 μm, extending the lower limit of particle sizes (1.1 μm) studied in the previous research (Ziegler, 2007). A theoretical analysis determined that the air inside the chamber could be considered "still air" according to Davies sampling criteria and the estimated sampling efficiencies were expected to be greater than 89% with the lower efficiencies occurring furthest from the APS and increased to 99% closer to the measurement device. The assessment of the "still air" assumption within the chamber was investigated by comparing the measurements obtained with the two different sampling probes (93.1° and 141.4°) and the results suggest the alignment of the probe inlet with the fluid would be important for obtaining a representative sample (isokinetic sampling). Another goal of this work was to determine whether the synthetic jets, under *push* or *pull* mode could contain the plume and limit its dispersion throughout the room. The likely non-isokinetic sampling made any assessment of the jets effectiveness (containing and vectoring the plume towards the exhaust) difficult, resulting in no strong evidence to support any claims. That being said, for both the *push* and *pull* mode, the jets appeared to be able to vector the plume towards the exhaust but were unable to contain the plume.