

Compact Design of a Size Selective Inlet for Personal Particle Devices

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ABSTRACT

Particles in large diameters are present in the ambient. Light scattering and electrical mobility techniques are often used to monitor particles in submicron size range. The same techniques have recently implemented to miniaturize particle sizers or photometers for personal-level measurements. The presence of large particles often introduces the measurement interference for the devices using the techniques. It is necessary to remove particles of large diameters from particle-laden stream prior to the monitoring. For the compact packing of personal devices a size selective inlet is thus needed. In this study, a “quarter-size” mini-cyclone and a small impactor have been developed to remove particles larger than 1.0 μm and 0.4 μm at a low flow rate of 0.3 lpm, respectively. By combining these two devices, the general problem of small loading capacity for an impactor and less-steep particle cutoff curve for a cyclone can be solved while maintaining a low pressure drop.

The performance of the mini-cyclone and impactor were evaluated based on the particle penetration and pressure drop. To acquire the particle cutoff curve and consequently determine the 50% cutoff particle size, d_{50} , of the prototypes the upstream and downstream particle distributions were measured by Scanning Mobility Particle Sizer (SMPS, TSI 3096) and Aerodynamic Particle Sizer (APS, TSI 3321). Potassium chloride (KCl) particles were used as the challenging aerosol. Four different flowrates, i.e., 0.3, 1.2, 1.6, and 2.0 lpm were evaluated in the mini- cyclone. The mini- impactor was evaluated with three different nozzle configurations. The result from these developments will be reported in this presentation.