ABSTRACT

A crucial filtration parameter is the size of particles which can be removed from the air. Over the years, there have been increased indications that fine and ultrafine particles (<100 nm) are toxic and can cause significant health risk. A few instruments that employ different techniques have been developed to measure real-time concentration of particles in terms of number and particle size. So far, the most reliable is Scanning Mobility Particle Analyzer (SMPS) which can measure particles size with high efficiency down to 5 nm. However, this technique is quite expensive and requires employment of an expandable and flammable fluid that limits its use outside the labs. In general, none of the conventional technologies allow to combine high efficiency easy access and low cost.

Previous studies have shown that a new apparatus based on aerodynamic particle focusing and corona charging techniques produces a good agreement in particle sizing and counting with the SMPS for particles larger than 60 nm. However, corona discharge generates particles less than 60 nm, and therefore can not be used directly in the range below 60 nm. The goal of the present research is to find a correlation which takes into account the particles generated by the corona charger, and eventually to correct the meterage of the prototype.

The source and appearance conditions of the generated particles by corona charger were studied. A comparison was conducted between the prototype and the SMPS using filtered air and generated sodium chloride aerosol particles below 300 nm to state how many fine particles have been generated in the corona charger. The experiments were performed for the different configurations of corona charger and supplied voltages. Also it was found that developing prototype filters some amount of particles due to filtration properties of the corona charger. Further, the theoretical investigations will be introduced and an empirical formula describing particles generation and filtration rate will be developed.