

INVESTIGATION OF SMALL, AIRBORNE, CHARGED PARTICLES BY AN ELECTRICAL METHOD

J. H. DANIEL, Sc.D.(Physics)

AND

F. S. BRACKETT, Ph.D.(Physics)

BETHESDA, MD.

PROPERLY to conduct and interpret investigations of the physiological effects of particle clouds, or aerosols, an understanding of the nature and behavior of the airborne particles which comprise the clouds is essential. Such an understanding must be based on knowledge of physical characteristics, such as size, number and charge, and state and rate of aggregation, of the particles. Although it is generally appreciated that particles less than a micron in diameter may have great physiological importance,¹ methods for determining even the presence of such particles are all too few.²

We have described elsewhere³ in detail an electrical method, applicable to either solid or liquid charged particles, which allows a considerable amount of information to be obtained on the physical characteristics of the particles and their relation to the various mechanisms (aggregation, diffusion, settling) through which particles disappear from the aerosol. In this method, a small (about 1 l./min.), continuous flow of the aerosol is maintained through a parallel plate condenser. A voltage applied to the condenser causes positively charged aerosol particles to be collected at one plate and negatively charged particles at the other. The resulting minute currents are measured and plotted as a function of the applied voltages.

From such current-voltage characteristics (provided certain limiting conditions having to do with streamline flow, particle speed, condenser design, etc., are satisfied) charge-weighted distributions of $\frac{r}{e}$, the radius-charge ratio of the particles, may be obtained⁴ for particles small compared with the mean free path of air molecules (0.064 micron). For particles large compared with this mean free path,

From the Laboratory of Physical Biology, National Institute of Arthritis and Metabolic Diseases, National Institutes of Health.

1. Hatch, T., and Hemeon, W. C. L.: Influence of Particle Size in Dust Exposure, *J. Indust. Hyg. & Toxicol.* **30**:172, 1948.

2. La Mer, V. K.; Inn, E. C. Y., and Wilson, I. B.: The Methods of Forming, Detecting, and Measuring the Size and Concentration of Liquid Aerosols in the Size Range of 0.01 to 0.25 Micron Diameter, *J. Colloid Sc.* **5**:471, 1950.

3. Daniel, J. H., and Brackett, F. S.: An Electrical Method for Investigating the Nature and Behavior of Small, Air-Borne, Charged Particles, *J. Applied Phys.*, to be published.

4. As outlined by us in our figures 6 to 8 published elsewhere.³