

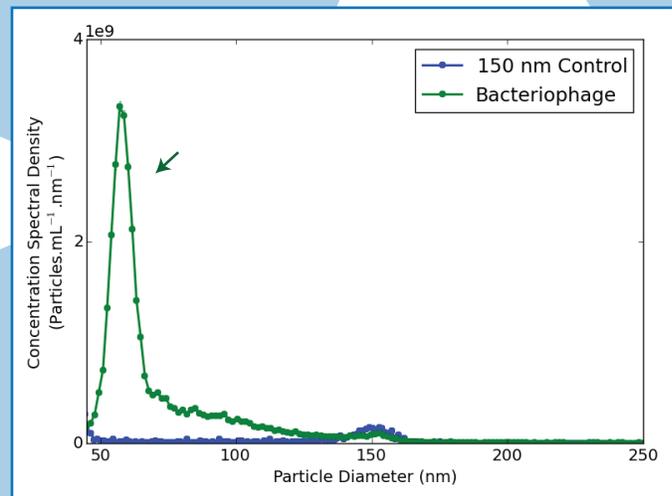
## Measurement of Biological Nanoparticles— Direct Quantification of Bacteriophage

The Spectradyne nCS1 employs a novel implementation of the resistive pulse sensing method to count and size nanoparticles quickly and with high resolution. Sizing precision of  $\pm 3\%$  is typically achieved, with measurement rates up to 10,000 particles/s. Because particles are measured electrically in the nCS1, not optically, biological particles that have an index of refraction similar to their suspension medium can be detected much more easily with the nCS1 than with other, light-scattering based techniques. This technical advantage makes the nCS1 ideally suited for measuring biological nanoparticles.

Spectradyne's nCS1 delivers complete size and concentration distribution in minutes, and only a few microliters of the sample are required for analysis. Only minimal sample preparation is necessary, especially for biological samples: Filtration built in to the cartridge eliminates the need to pre-filter the sample, and because the particles of interest are often naturally suspended in weakly conducting media (e.g., PBS), the particles can be directly measured in their native environment.

Viruses are biological nanoparticles that have been engineered for use in a wide variety of applications. In addition to their well-known use in vaccines, viruses are being developed as therapeutics for disease, and for example serve as a convenient means to transfer genetic information to cells. In industry, highly concentrated virus is used in quality control to validate sterilization methods. In all applications, an accurate measure of the concentration (titer) of the virus is required.

The nCS1 was used to measure the concentration-size distribution of particles in a phage sample for a manufacturer in the pharmaceutical industry (right). Polystyrene control particles 150 nm in diameter and a PBS-Tween concentrate were added to 5  $\mu\text{L}$  of the phage sample. The phage was readily detected (large peak, green), and its mean diameter measured to be 58 nm (CV  $\sim 13\%$ ). The concentration of phage was directly measured to be  $3.8 \times 10^{10}$  particles/mL. The nCS1 also detected a broad distribution of particles in the range of 75-125 nm diameter, which may be phage aggregates or cell fragments remnant from the manufacturing process.



The nCS1's ability to characterize nanoparticles that have index of refraction close to that of the surrounding medium makes it well suited for the quantitative analysis of biological nanoparticles such as virus. In addition, the high resolution concentration-size distributions delivered by the nCS1 provide a new opportunity to quantify polydispersity in situ in complex biological samples—a capability that has until now not been available in a commercial instrument.

Spectradyne's nCS1 provides accurate, high-resolution particle size and concentration distributions for particles of all material types. For more information or to arrange a demonstration of the technology, please visit our website or contact us by email.