both mass and shape (conformation). Dynamic scattering is particularly good at sensing the presence of very small amounts of aggregated particles and studying samples containing a very large range of masses. It can be quite valuable for comparing the stability of different formulations, including real-time monitoring of changes at elevated temperatures. For submicron materials, particularly colloidal particles, QELS is the preferred technique. Two theories dominate the theory of light scattering—the Fraunhofer and Mie. According to the Fraunhofer theory, the particles are spherical, nonporous, and opaque; diameter is greater than wavelength; particles are distant enough from each other and have random motion; and all particles diffract light with the same efficiency, regardless of size and shape. The Mie theory takes into account the differences in refractive indices between the particles and the suspending medium. If the diameter of the particles is >10 μm, then the size produced by utilizing each theory is essentially the same. However, discrepancies may occur when the diameter of the particles approaches that of the wavelength of the laser source.

The following are the values reported from diffraction experiments:

- *D* (*v*, 0.1) is the size of particles for which 10% of the sample is below this size.
- *D* (*v*, 0.5) is the volume (*v*) median diameter, of which 50% of the sample is below and above this size.
- *D* (*v*, 0.9) is the size of the particle for which 90% of the sample is below this size.
- *D* [4, 4] is the equivalent volume mean diameter calculated using:

$$D\ [4,3] = \frac{\sum d4}{\sum d3} \tag{7.4}$$

- *D* [3, 2] is the surface area mean diameter, also known as the Sauter mean, where *d* is the diameter of each unit.
- Log difference represents the difference between the observed light energy data and the calculated light energy data for the derived distribution.
- Span is the measurement of the width of the distribution and is calculated using:

$$\text{Span} = \frac{D\ (v,0.9) - D\ (v,0.1)}{D\ (v,0.5)} \tag{7.5}$$

The dispersion of the powder is important in achieving reproducible results. Ideally, the dispersion medium should have the following characteristics:

- Have a suitable absorbancy
- Not swell the particles
- Disperse a wide range of particles
- Slow sedimentation of particles
- Allow homogeneous dispersion of the particles
- Be safe and easy to use