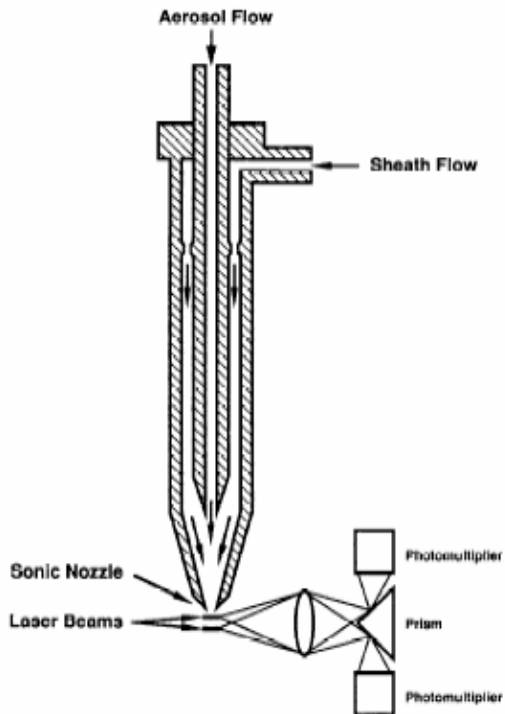


AUTOMATIC COUNTING AND SIZING INSTRUMENTS

Operation of Aerodynamic Particle Sizing Instruments: APS and Aerosizer

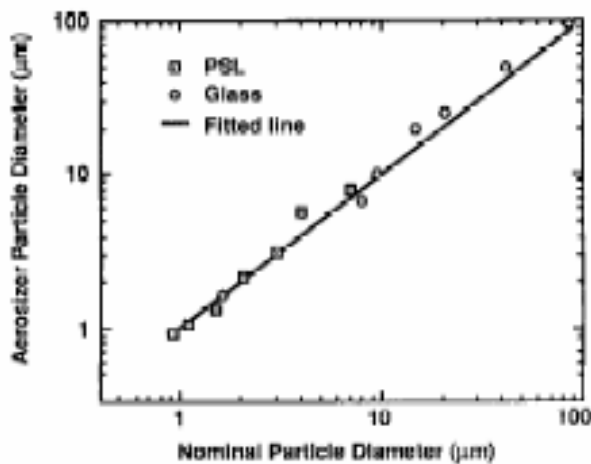


Particles accelerate through the nozzle.

Smaller particles have little inertia and move with the air. Larger particles have more inertia and accelerate through the nozzle more slowly.

As a result, smaller particles have a higher velocity than larger particles as they pass between the laser beams at the nozzle outlet.

Aerosol flow through the Aerosizer



The horizontal axis shows diameter of the test particles. The vertical axis shows particle diameter as reported.

Manufacturer's calibration for the Aerosizer

Desirable Characteristics

Measure size correctly – we will check this aspect of performance

Measure with constant counting efficiency – we will not check this aspect of performance.

Efficiency depends on factors that include:

- PMT voltage,
- cleanliness of the optics,
- particle size,
- particle type (liquid or solid),
- previous use of the instrument,
- particle concentration.

Advantages and Limitations of the Aerosizer and the Aerodynamic Particle Sizer

Advantages: Counts particles quickly
 Measures particle size accurately (in most cases)
 Measures aerodynamic diameter
 Portable and can be used in the field

Limitations: Restricted to particles between 0.5 and 20 μm (APS)
 Not good for size *distributions*
 Expensive - \$50,000
 Bulky, fragile, and difficult to use in the field

Appropriate Uses for These Instruments

Good when relative values of concentration are to be measured

Not good when size distributions are to be measured because counting efficiency depends on many factors that cannot be controlled.

Examples of APS and Aerosizer Use

Size distributions of outdoor air (EPA)

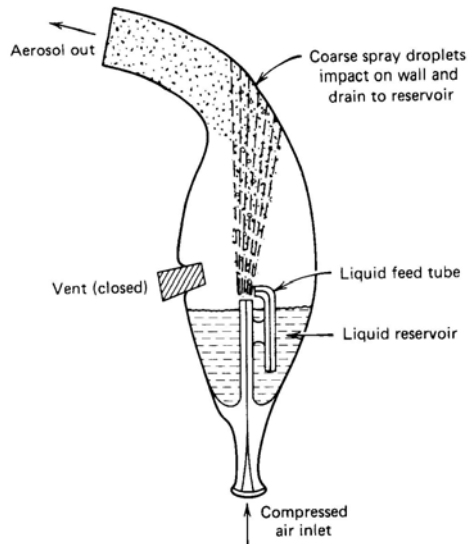
Concentrations and size distributions for inhaled drugs (FDA)

Filter efficiency

GENERATION OF PSL TEST AEROSOLS

Polystyrene latex (psl) spheres are in water with surfactant. Cost is about \$220/bottle.

Put one or two drops of psl solution into distilled water in the nebulizer sump.



Characteristics of Aerosol Generation with Nebulizer:

Good for particles up to about 3 or 4 μm ; particles must be small enough to fit into droplets

Concentration of psl spheres must be low enough to prevent multiplets – doublets or triplets

Concentration of psl spheres must be high enough to have a high particle generation rate.

Surfactant in the psl solution dries to form residual particles and coats the psl particles

Use the mode of the measured frequency distribution to characterize instrument performance.

