HORIBA Scientific

Application Note

Preparing Latex Standards for DLS

AN211

Latex is an important application for dynamic light scattering. In addition, monodisperse latex standards are often used to evaluate instrument performance. Frequently these materials are polystyrene and called "PSL standards" where PSL stands for polystyrene latex. Typically, these standards are sold at relatively high concentration (0.1%) and must be diluted in order to test instrument performance. Often, issues with the results are due to issues with the sample. This note discusses sample preparation.

Introduction

Dynamic light scattering (DLS) is the technique of choice for analyzing the size of submicron particles including nanoparticles (1). DLS can be used to characterize particles with sizes ranging from less than a nanometer to several microns. The measurement is fast and repeatable and the volume of liquid required can be as little as 10 microliters. In addition, particle charge, that is, zeta potential can be determined with an appropriately enhanced DLS instrument.

Nanoparticle size distribution analyzers such as the SZ-100 need to be evaluated with check standards in order to ensure that they are performing properly. Due to the nature of the instrument, if the wrong answer is obtained then the instrument will require repair. That is, there are no "adjustments" to the results. Fortunately, in the vast majority of cases, the issue is the sample preparation, not the instrument.

Check standards are frequently provided as a concentrated suspension, often 0.1% solids. They are also provided with a certificate of analysis. It is important to review the certificate of analysis in order to evaluate the results of measurements. In particular, pay attention to the uncertainty in the obtained size. For 100 nm materials, this uncertainly is often about 3~5%.

Since dynamic light scattering (DLS) is actually a measure of particle motion, it is important to ensure that the condition of free diffusion is met so that accurate size results are obtained.

In general, PSL has a strong surface charge. Since electrostatic interactions are long range interactions, they can affect particle motion and distort DLS size results. Thus, the diluent for the PSL should be chosen with some care.

Finally, one must consider the pernicious effect of dust. DLS is a great technique for evaluating nanoparticles and will reliably report the average size of all particles in the suspension, including any large dust particles that arrive with the salt or the air. Dust is typically removed by filtration.

Method

First prepare a 10 mM solution of NaCl or KCl or any other 1:1 electrolyte. Use de-ionized laboratory water to avoid any "surprise" effects such as from polyvalent ions (e.g., Ca++).

Below is a table of the mass of NaCl (58.44 g/mol) or KCl (74.55 g/mol) required when preparing the solution.

Volume solution (DI water)	grams NaCl	grams KCl
100 mL	0.0584	0.0745
1000 mL	0.584	0.745

Next the solution must be filtered to remove any dust. Load 10 mL of the salt solution into a 10 mL or larger syringe. Add a 0.2 nm or smaller pore size filter and slowly push the liquid through the filter into a 20 mL scintillation vial or similar vessel. For the case of ~100 nm PSL, use about 10 mL of liquid.

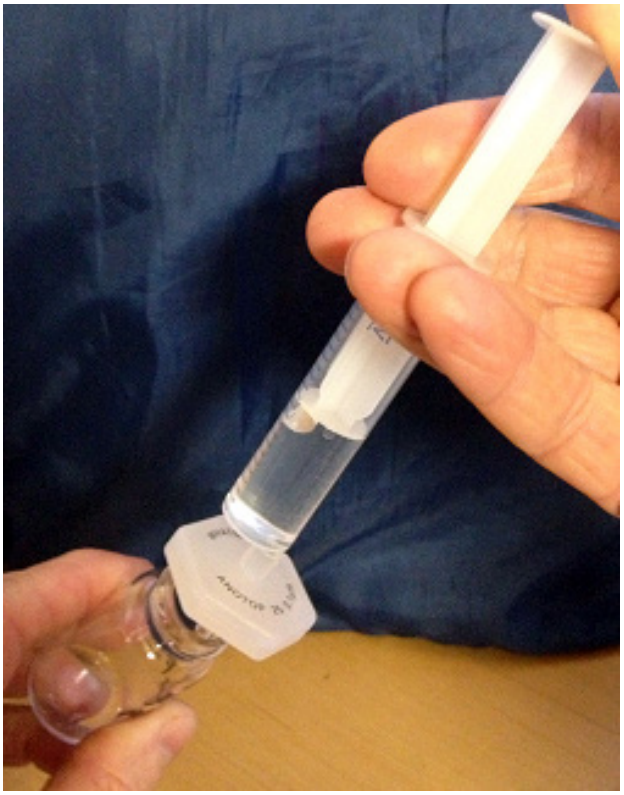

Figure 2: Filtering 10 mm NaCl before adding PSL standard

Inspect the tip of the bottle of standard to ensure that it is clean. Then, put one drop of standard into a waste container. This is an additional cleaning step. For the case of ~100 nm PSL, add one drop to the 10 mL of liquid. This will give a concentration of about 30 ppm (w/w). Note that the concentration is quite approximate. A final concentration of 15 to 60ppm is fine.

Figure 3: PSL bottle (Note - tip should be pristine)

Inspect the material for any visible dust particles. There should be none. If there are any, discard and start again.

Figure 4: Final suspension

Pour the liquid into a clean cuvette and measure for one minute.

If the initial results are poor, try making the sample again from scratch.

Conclusions

By careful attention to suspension preparation, reliable information about DLS instrument condition can be obtained.

References

(1) ISO 22412:2008 Particle Size Analysis – Dynamic Light Scattering