FORM OF DISTRIBUTION

Form of distribution relates to the number of iterations that are performed by the algorithm used to calculate particle size. There are several issues to consider when deciding which selection to use.

Background

Algorithms are mathematical operations that transform the light scatter pattern measured by the analyzer into a particle size distribution. Since there is no way to make a direct calculation of particle size from a measured light intensity distribution, modern algorithms use iterative deconvolution routines.

Each iteration, or step, is a comparison of the estimated particle size distribution, in which the exact light scatter pattern can be calculated, to the measured light scatter pattern. Once this comparison is made, a correction is made to the estimated particle size distribution and the light scatter pattern corresponding to this size distribution is calculated. This sequence of comparison, adjustment, and recalculation is repeated a number of times to achieve a minimal difference.

Selecting Form of Distribution

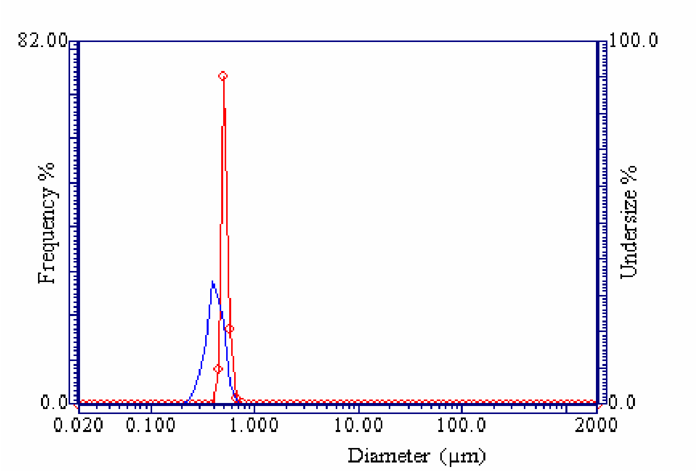
Theoretically, the greater the number of iterations, the better the fit between measured and calculated values would be and we would run this until some minimum level of difference was reached. In the practical application of these routines, the constraints on the mathematical model required by the analysis in question (no negative values, limits on the size range) mean that the iterations can actually cause the function to diverge, rather than converge to the measured values.

For this reason, a fixed number of iterations must be set for the calculations. For the LA-930, the Standard Form of Distribution is fixed at 30 iterations and the Sharp Form of Distribution is fixed at 150 iterations. These values were determined as being appropriate for the vast majority of materials. The manual mode allows other values to be entered if desired.

In general, fewer iterations will give a broader peak and a greater number of iterations will give a narrower peak. This is due to the greater resolution as the number of iterations increases. Caution must be exercised when determining the appropriate number of iterations, as an excess number of iterations will resolve distinct peaks in a distribution from what is actually only a small discontinuity in the curve.

Standard mode should be used on all samples unless there is a need to increase the resolution in the results. It should be noted that there are no changes being made to the measurement or the optics; the only change is in the calculations. Most materials have a fairly wide distribution. In a number of cases, such as materials from a classifier or narrow range sieve cuts, a narrow particle size range will be reported, but using Sharp will make this distribution narrower than it truly is.

If the material to be tested is manufactured as mono-sized (every particle is exactly the same size), then Sharp mode will help to resolve the distribution in to its correct width. The distribution should be less than one decade (10:1 ratio of smallest particle to largest particle) at the most before we can consider using Sharp mode.

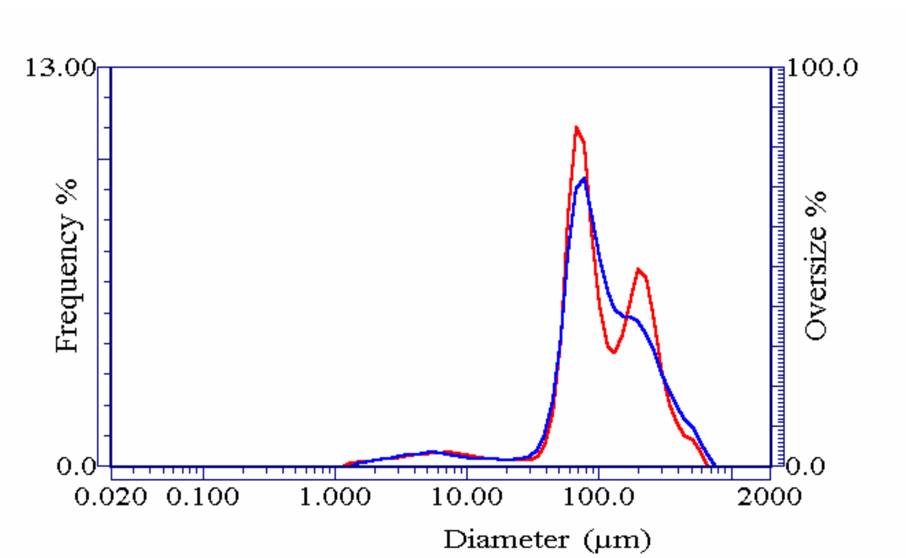


Example Data

The graph shows a mono-sized 500 nanometer polystyrene standard in both Standard and Sharp modes. With a narrow distribution material such as this, there is not much difference in the curves, but scanning electron microscopic evidence suggests that Sharp provides the best result.

One other application for Sharp mode is when higher resolution is desired with closely spaced multi-modal distributions. Samples that are know to contain two or three materials might not be resolved in Standard mode, but in the Sharp mode, the peaks may be distinctly resolved.

The second graph illustrates a bi-modal sample calculated in Standard and Sharp. A slight "shoulder" in Standard (blue) becomes a distinct peak in Sharp (red). It is up to the user in this case to decide which type of distribution is most correct. Confirmation of the results may be provided by microscopy or other analytical techniques.



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