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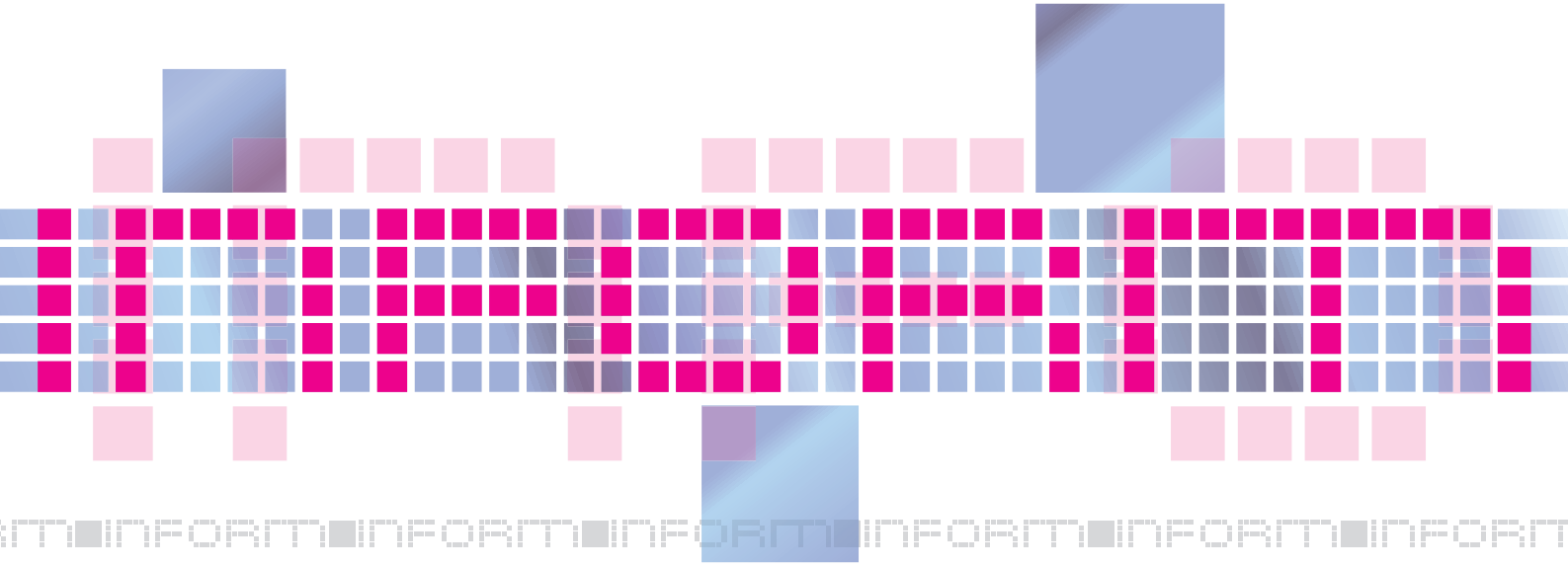

Top 10 factors to consider...

When Selecting a Dynamic Light Scattering (DLS) Instrument

Malvern

Top 10 Factors to Consider When Selecting a Dynamic Light Scattering (DLS) Instrument

The physical components and features of a dynamic light scattering (DLS) instrument along with the instrument's technical specifications are obviously important considerations when purchasing a new system. However, written specifications can be confusing, misleading and maybe even have very little bearing on the instrument's actual performance. Specifications on paper do not necessarily translate into advantages or disadvantages when it comes to making measurements on your samples. The best components and technical specifications in the world do not matter if the instrument is not assembled or optimized in way that they translate into real improvements in data quality when you are making measurements on your samples.

Here are some questions you should ask yourself as you begin evaluating dynamic light scattering instruments:

1 What type of samples will I be analyzing?

This sounds so basic that it is easily overlooked and too often dismissed as a silly question. If you know that you need a DLS instrument then surely you know what you plan to measure with it, right?

Not always.

Researchers often know their specific application and samples quite well and they usually understand exactly what information they need from a DLS instrument. The purchase of a light scattering system, however, sometimes requires multiple researchers or several labs to work together to find an instrument that suits the needs of everyone involved. It is in these cases where the answer to the "What type of samples will I be analyzing" question becomes complex because not only must you understand your own samples but you must then also understand the needs of others who will be sharing the instrument. Sometimes these differing needs start to compete with each other.

Every model of DLS instrument has its own strengths and weaknesses and there are usually trade-offs involved when considering a wide range of applications or sample types.

What works best for your samples might not be ideal for those samples from the lab down the hall. Some might be at high concentrations others at low concentrations. Some researchers might have plenty of sample available for DLS analysis while others might only have a few microliters of precious sample. Some might need to quantify trace amounts of aggregation in pure protein solutions and others might need to determine if final formulations are remaining stable over a range of temperatures, numerous freeze/thaw cycles or for an extended shelf life. Others yet might be characterizing novel nanoparticles, quantum dots, inks, pigments or wide range of other types of samples. An instrument optimized for one application might not be ideal for the other applications.

Define the types of samples you will be measuring most often and make sure you find an instrument that excels in those measurements first. After you are confident that an instrument's strengths apply to the types of samples you will measure most often then you can consider how flexible the instrument is in terms of applicability to a range of other sample types whose importance might be secondary.

What are the main differences between instruments that I need to understand? 2

While each vendor of DLS instrumentation has its own jargon and specific trademarked names and approaches that they will attempt to tout as "must haves", all considerations about light scattering instruments must start with an understanding of your application requirements.

The actual hardware that light scattering manufacturers use to build their instruments is pretty much irrelevant unless these components are assembled and configured in a way that delivers the performance you need.

A high power laser, for instance, does not necessarily represent an overall improvement in performance if its wavelength is farther away from the optimal response range for the detector or if it induces heating of your samples. Sometimes the specifications that vendors put on paper to imply a benefit do not actually translate into real-world performance benefits at all due to other mitigating factors.
Instead of asking about hardware, ask about the performance of the

instrument because even the same hardware can deliver different performance outputs if configured differently.

The main differences you should understand are: the smallest and largest size molecules or particles that can be measured, the size range for which the instrument is optimized, the concentration ranges possible, how the instrument deals with intensity spikes from aggregates or agglomerates, whether the instrument is susceptible to number fluctuations from dust or large particles, whether or not the optics are highly susceptible to effects from multiple scattering and whether or not the instrument uses good temperature control of the sample being measured.

3 What typical volume of sample do I have for analysis?

Currently-available commercial dynamic light scattering instruments have sample volume requirements ranging from 2µL to 3mL or more. It is important to understand the minimum sample requirement that each instrument needs and what is the maximum amount of sample it can handle. If you typically only have a few microliters of sample then the otherwise best performing instrument you can find doesn't matter if it requires milliliters of sample.

4 How user-friendly is the instrument and software?

The user-friendliness of the instrument and its associated software is critically important. But user-friendliness is in the eye of the beholder.

Some scientists want an instrument that is extremely easy for any operator to use with very little training and as little user-intervention as possible. Others want data interpretation to be easy and as non-subjective as possible. Other scientists want to know that they can access and modify just about every parameter that goes into a measurement, export the raw data to perform their own analyses or otherwise exploit the instrument as a true research tool.

The only way to get a true understanding of the user-friendliness of instruments is to have them demonstrated to you in your lab so you can

see them in operation with your actual samples before you make your purchase decision.

Performing measurements on standards in a vendor's lab is not going to tell you much when the vendor is in control of the entire situation and experiments are most likely pre-optimized and pre-set in the software before you arrive to ensure they yield ideal results. Only once you get back to reality in your own lab with your own samples will you have a true test of how easy it is to operate the instrument and interpret data. Merely being shown data reports from previously run standard samples won't enlighten you much either. Ask to use the software and run an experiment or two from start to finish yourself during the demo in your lab. You'll be glad you did because only then will you have a true understanding of how user-friendly the instrument and software are according to your own definition of "user-friendliness."

Do I just want to know the size of my particles or molecules? 5

This is another question that sounds simple but it can often become complicated.

DLS instruments should measure the size of your molecules or particles in solution accurately and repeatably, of course, but often the distribution or Polydispersity Index of those particles and the ability for the deconvolution algorithms to resolve multiple components within the sample is just as important.

Ask vendors to provide you with information about how their instruments report and quantify data. At the very least your instrument should accurately and reproducibly be able to determine the size and distribution of your samples and include at least two or three deconvolution algorithms to allow you to resolve multi-component distributions accurately.

Some DLS instruments also have additional capabilities to provide molecular weight, zeta potential and Aggregation Index information so a clear understanding of the information you are trying to gain beyond just the average particle size is very helpful before you start evaluating different instruments.

6 How will I operate the instrument?

Most DLS instruments on the market can be operated in batch mode but several can also be operated in flow mode in combination with size exclusion chromatography to achieve absolute size exclusion chromatography (ASEC) capabilities. In ASEC, molecules are measured for absolute hydrodynamic size as peaks elute and then good estimates of molecular weight are provided to eliminate the need to run molecular weight standards for SEC column calibration. A clear understanding of your current and future needs is important before deciding on an instrument such as an online-only instrument or an instrument that can be operated in additional or different modes such as combined batch and flow, automated micro plate sampling, attached with an autotitrator or simply operated in batch analysis mode.

7 How confident can I be in the result?

Some dynamic light scattering instruments are very much “black box” machines that provide masses of data output for the user to then subjectively qualify and interpret. It is a very good idea to find out if and how many “behind the scenes” measurement parameters are available to you and how you can use those to gain confidence in your results.

Some dynamic light scattering instruments automatically qualify data and “grade” it according to rigid criteria and generally-accepted data tolerance ranges to ensure the instrument returns statistically-significant results from measurements that reflect good science and good light scattering practices.

You are making important decisions based on your data so assurance of the quality of that data is very important to have confidence both in the results and in the decisions you make.

How good is the manufacturer or vendor? 8

With more and more companies developing seemingly low cost dynamic light scattering instruments and rushing to make them available on the market, it is important to assess the reputation of the manufacturer or vendor you choose.

Choosing a DLS instrument is not like choosing a pipette or bench top centrifuge where all options are pretty good and they will all pretty much get the job done. DLS instruments must be manufactured using high standards and engineered by solid, technology leading companies in order to yield publication-quality or decision-making results.

Look for a manufacturer that has not just recently embraced dynamic light scattering technology but that has a suitable history of being at the forefront of developing and optimizing these instruments. Such companies have been through the learning curve and you will benefit greatly as a result. These companies are much more likely to have the expertise, experience and support resources to not only build great instruments but also to support them properly.

Also be cautious of companies or manufacturers that simply re-label somebody else's instrument, who have a short history with dynamic light scattering technologies or who have not invested in keeping their instruments up-to-date to take advantage of recent advances in technology. These practices indicate a lack of long-term commitment to the science and should cause you to become concerned and cautious.

What about post-sale service and support? 9

Once you purchase your instrument your experience is really just beginning so it is important to purchase a system from a company that offers acceptable service and post-sale support.

Look for a company that can provide telephone, in-person and email support, ongoing training opportunities, field-based service and expert level support. Some also provide 24/7 support via their websites by offering extensive on-demand application notes, pre-recorded seminars or training sessions and ongoing live educational/training seminars.

Before you purchase an instrument ask about what support is offered and maybe even ask to try some of these before you make your decision so you get a feel for the quality and depth of support you can expect once you have your new instrument installed in your lab.

Dealing with small, family-run or thinly resourced companies can often make the support and service processes difficult, complicated or just plain frustrating. Larger suppliers usually offer stability and depth of resources so you can get the answers, support and services from local experts when and how you need them.

10 Shouldn't I just buy the instrument with the lowest price because they are all pretty much the same on paper?

Absolutely not.

Dynamic light scattering instruments can vary greatly in their design, quality and performance.

Even though many different instruments may have specifications that look similar on paper (often done so purposefully by unprincipled vendors who are out to simply win bids from people who haven't evaluated actual performance), instruments vary greatly in real-life performance, quality and longevity. It has been reported that some instruments available today cannot actually even meet their own stated performance specifications so simply comparing prices and specifications on paper does not ensure you of anything at all.

Instruments that have unique capabilities or that come with tested and proven performance specifications, free software updates, warrantees, training and re-training opportunities, excellent support and superior service might cost a little more up front but they can significantly reduce your recurring costs, ensure actual instrument performance and lower the total ownership cost over the lifetime of the instrument. The low-price choice often leads to unexpected surprises, hidden costs and unwanted headaches.

As with most things in life, the cheapest option available is often not the best long-term value and usually winds up costing you the most in the long-run.

We hope you find 'Top 10 Factors to Consider When Selecting a Dynamic Light Scattering (DLS) Instrument' useful.

This is one in a series of publications designed to help decision makers in your industry make more informed choices.

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