Characterizing Nanoparticles in Biological and Physiological Media through Dynamic Light Scattering

Webinar Q&A Transcript

1 Can Depolarized DLS be used to characterize aggregates in a suspension?

Aggregates are heterogeneous, cluster-like particles and promote Depolarized DLS extremely well. It is thus an excellent technique to detect aggregation in a suspension. Furthermore, Depolarized DLS is more sensitive to size changes and one can thus achieve a better time resolution as compared to DLS, when characterizing the kinetics of aggregation.

2 Can we quantify this in terms of number?

Yes, the onset of aggregation can be assessed in a straightforward way, and further quantified with a calibration of the measurement using a diluted sample. This requires additional analysis, but is feasible.

3 In which systems/particles could one expect a translational-rotational coupling? And how would the equations change?

In this webinar and in most cases when working with Depolarized DLS, we address dilute suspensions, for we are addressing particle sizing. Thus, interparticle interactions (repulsive and attractive forces between particles) are negligible and the particle would not “feel” the presence of the other. If the concentration increases, the particles would indeed interact with one another.

4 How does one differentiate aggregation from size increasing because of a protein corona?

Typically, aggregation would result in a much larger measured hydrodynamic radius than a protein corona would. In addition, one can dilute the system and observe the

effect on the hydrodynamic radius. A protein corona consists of a “hard” part, bonded rather firmly to the particle, and a “soft”, outer part that is not bonded strongly. This soft corona could therefore be dispersed via a simple dilution, while aggregates (not agglomerates!) are not dispersible.

5 How do you deal with the fact that samples with multiple modes species might be an ill-posed inverse problem?

Light Scattering, while being a powerful, fast & in-situ characterization method, is by definition an ill-posed inverse problem: as it is based on a Fourier transformation, where the phase information is lost owing to the fact we measure the intensity of light (photons) and not the scattered electric field itself. Thus, according to theory, different particle systems may produce the same result. On top of this, noise in the auto-correlation function may render it difficult to solve the inverse problem. As for every measurement technique, a good practice is to use complementary information. For example, electron microscopy can help one assess whether there is a bimodality in the system.

6 What criteria are in place (if any) to know if DDLS can be used with certain particles in complex media? For e.g. - do we measure how the particles polarize light and is there a threshold?

There are no criteria: if one can detect depolarized scattering, one can benefit from it. Depolarized scattering is generally not more than 10% in intensity compared to polarized scattering. In other words, the so-called depolarization ratio I_vh/I_vv is usually below 0.1 for round (quasi-spherical) particles. For rods, fibers, etc. this number may be much higher.

Therefore, depending on the particle system of your interest, one might require a more powerful laser than usual, but nowadays this is not a problem. In case of specific need, please contact sales@lsinstruments.ch.