

MEASUREMENT OF SUB-NANOMETER SIZE PARTICLES USING DYNAMIC LIGHT SCATTERING

CHOLESTEROL, Mw 387Da

INTRODUCTION

In principle, any 'small' particle, even under 1nm, can be measured using the DLS method. All that is required is that the particles scatter sufficient light, the particles diffuse freely and that the number of particles in the measurement volume are sufficient to suppress number fluctuations.

The amount of light scattered is a function of the relative refractive indices of the particle or molecule and the dispersant. The number of particles in the detection volume is unlikely to be a problem with sub 10nm particles.

However, for such small particles, the level of the scattered light usually is very small, even at higher concentrations, and only the most sensitive instruments are capable of performing DLS measurements in this range. The Malvern HPPS has a claim to be the most sensitive DLS system available and sizing of even sub-nanometer particles is within reach.

The sample chosen to test the sensitivity was Cholesterol at approximately 20mg/ml in Butanone.

EQUIPMENT USED

Malvern HPPS, Cholesterol, 1,2-Butanone, syringe / 0.2 μ m syringe filter, square glass cuvette, 375 μ l sample volume.

SAMPLE PREPARATION AND MEASUREMENT

100mg Cholesterol was dissolved in 5ml degassed 1,2-Butanone and the resultant solution filtered through a 0.2 μ m syringe filter, into a clean and dust free glass cuvette.

The cuvette was inserted into the Malvern HPPS and 30 minutes was allowed to elapse to ensure thermal equilibration of the sample at 50°C. After this period, a measurement of 120s duration was performed.

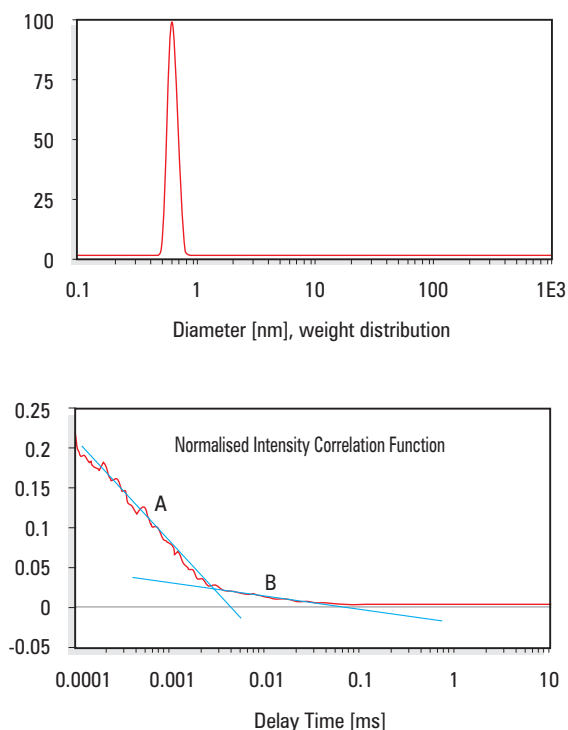
EXAMPLE AND RESULTS

The correlation function in (Fig. 1) clearly shows at least two slopes indicating a short time fluctuation due to a small component (A), and a slower component (B) indicating the presence of larger material. These slower fluctuations could be seen in the butanone solvent when measured on its own, while the faster component was absent.

This demonstrated that the fast component is due to the cholesterol, with the hydrodynamic diameter calculated as 0.64nm.

As expected, when the weight distribution is calculated, the cholesterol is the dominating component. While literature values for the hydrodynamic diameter of cholesterol in 1,2-Butanone are not easily found, the particle size measured here comes close to the value expected when calculated using a simple relationship between molecular weight and hydrodynamic diameter.

Figure 1



CONCLUSION

The extremely high sensitivity of the Malvern HPPS allows size measurement of sub-nanometer particles and molecules in solution, as demonstrated by the analysis of Cholesterol. The count rate obtained from this experiment indicates measurement at a concentration as low as 10mg/ml is feasible.

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