

Light Scattering for the Masses®

Identification of Nanoparticles in Instant Cappuccino using DLS, AF4, and Multi-Angle Light Scattering

Just a few years ago, nanoparticles were the focus of interest only for a small scientific community. But since then, the situation has changed dramatically. Now, nanoparticles have made their way into numerous consumer products that are used by hundreds of millions of people. This torrid pace of development is paralleled by the need to collect reliable data on the distribution and behavior of these particles. The characterization of nanoparticles represents a pivotal step in the quality control of the production process.

As a first step in the analysis, the polydisperse sample has to be separated. This is achieved by the use of an Eclipse Asymmetrical Flow Field Flow Fractionation (AF4). This separation technology works without columns and utilizes hydrodynamic forces in a flat separation channel. The components are separated according to their size (i.e. their diffusion coefficients). Since this method operates without shearing forces, the structure of the molecules and particles separated remains unaltered. The detection of the components is performed using a DynaPro Plate Reader Dynamic Light Scattering (DLS) instrument and a DAWN Multi Angle Light Scattering (MALS) detector, the latter of which allows for absolute determination of molar mass and radius without the need to calibrate the system with standards.

The sample in this case is a complex matrix of a commercially available consumer food product—an instant cappuccino. Separation of the particles into their different fractions using AF4 and subsequent measurement of the RMS radii by MALS results in a more precise differentiation, depicted in Figure 2.

The MALS analysis reveals that the size of the components ranges between 100 nm and approximately 2000 nm. Discovering larger particles suggests the formation of aggregates with a size reaching the micrometer range. This proves that even compounds of this size can be perfectly detected with the DAWN HELEOS 18-Angle MALS instrument.

In this application note we demonstrated that batch measurement using the DynaPro Plate Reader can provide an overview of the particle size distribution of a sample in a rapid manner without laborious sample preparation and processing. Additionally, if a broad size distribution is expected, it makes perfect sense to separate the sample components and determine mass and radius data using the AF4 technique coupled to MALS detection. This procedure yields comprehensive information even for particles that are embedded in a complex matrix.

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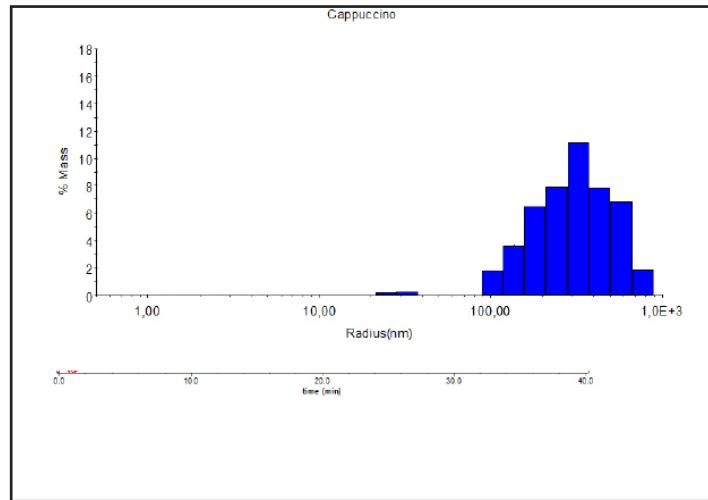


Figure 1: Batch-Measurement (DLS) of the particle size distribution in cappuccino.

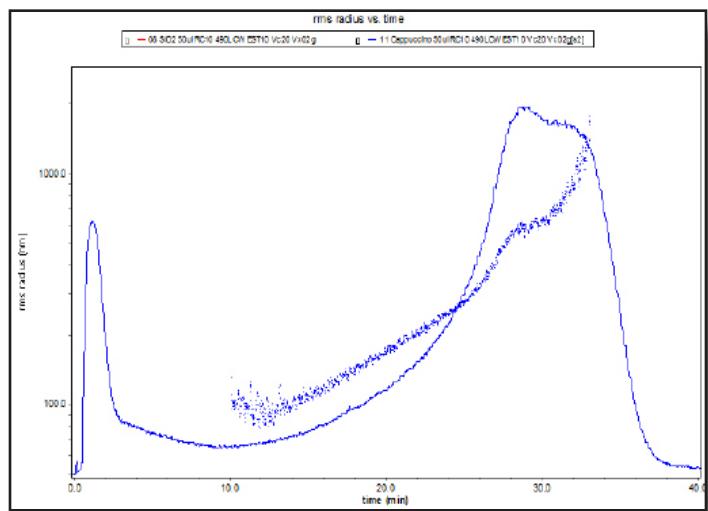


Figure 2: MALS-Determination of the RMS radii of the cappuccino depicted vs. elution time. Overlay: UV signal



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