

Characterization of Au Nanoparticles in a Complex Biological Matrix

There has been a remarkable surge in recent years in the use of nanoparticles in a variety of consumer products. Nowadays, they can be found in samples as diverse as body creams, facial preparations, lotions, and coatings. Oftentimes, nanoparticles containing metals like silver, gold or titanium are used in medical and pharmaceutical applications. Of course, scientists must address the possible impacts which might result from the use of and exposure to these agents. This is why the reliable and comprehensive characterization of nanoparticles is of prime importance.

Such investigations can be difficult, however, since the particles are often embedded in a complex matrix. Usually the first step of a comprehensive analysis is the separation of the components. Hydrodynamic Chromatography (HDC), which is frequently used, does not always yield satisfactory results. Moreover, the interaction between sample and column material often requires the use of a special mobile phase, which can result in difficult calibration procedures. In this situation an Eclipse Asymmetrical Flow Field Flow Fractionation (AF4) represents a powerful alternative. Separation is achieved using only hydrodynamic forces, which are applied in a separation channel. Subsequently, the size determination is performed using a DAWN Multi Angle Light Scattering (MALS) instrument, which allows absolute molar mass measurements without the use of calibration standards. In this application note we show that gold (Au) nanoparticles in human blood serum can be characterized routinely by AF4-MALS.

The serum proteins were separated and detected at 5 min (Albumin), 11 min (Antibodies) and 15 min (Lipoproteins). The elution of the Au nanoparticles started at 20 min and was easily detectable at the selected wavelength of 252 nm. It is believed that the detergent SDS forms variable micellar layer structures coating the particles. This facilitates the separation and quantification process, whereas elution time and the measured radii are slightly increased.

Using the Eclipse technology, the highly concentrated serum proteins (Albumin, Immunoglobulins, Lipoproteins) could be separated rapidly and automatically. Moreover, the particles were easily detected by the DAWN MALS and radii from 25 nm to more than 60 nm were determined. Finally, in this experimental approach the SDS detergent forms variable micelles coating the particles.

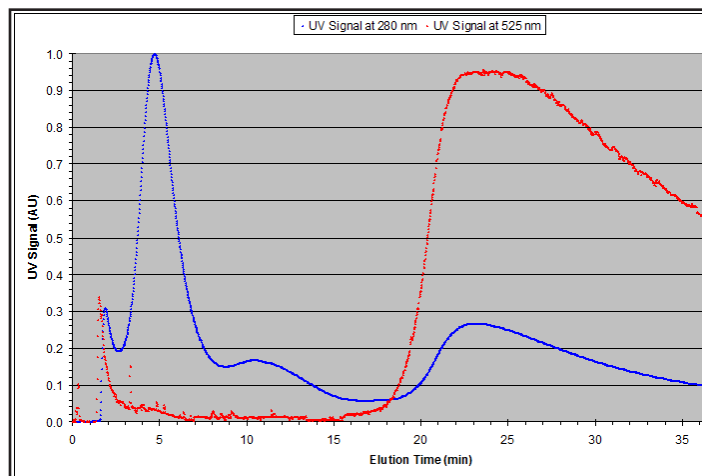


Figure 1: UV-Signal at 280 nm (blue); VIS Signal at 525 nm (red); separation of human serum spiked with gold nano particles. Signal vs. elution time is depicted.

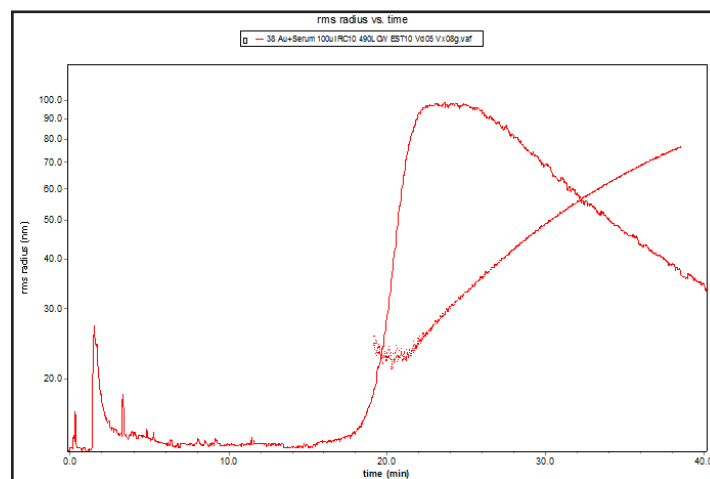


Figure 2: Besides the signal at 252 nm the radius of gyration (rms radius) of the gold particles is depicted here vs. elution time. The radii between 25 and more than 60 nm consist of the particles and the detergent SDS, which forms variable layers around the particles.

Graciously submitted by Petra Krystek, Institute for Environmental Studies (IVM), VU University, Amsterdam, The Netherlands; Thomas Jocks, Dierk Roessner, Wyatt Technology Europe, Dernbach, Germany.



6300 Hollister Avenue
Santa Barbara, CA 93117

Tel: +1 (805) 681-9009
Fax: +1 (805) 681-0123
Web: www.wyatt.com