Fabrication of platinum nanoparticles by laser ablation in water

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INTRODUCTION
- Laser ablation of a solid target immersed in a liquid is a novel technique to form colloidal nanoparticle suspensions of metals and semiconductors [1].
- Noble metal nanoparticles and nanocrystals are being used as substrates for laser desorption/ionization (LDI) mass spectrometry [2,3].

OBJECTIVES
- Synthesize and characterize platinum colloidal nanoparticles with control of particle size, shape distribution, and crystallinity by varying laser wavelength using different polymeric stabilizing agents.
- Test the use of platinum colloidal nanoparticles for assisting LDI mass spectroscopy of low molecular weight (m/z < 1500) biomolecular analytes.

EXPERIMENTAL SETUP
- UV ablation in pure water produces crystalline spherical nanoparticles.
- UV ablation in PVA aqueous solution produces nanorods.

EXPERIMENTAL DETAILS
- Colloidal nanoparticle formation: Ablation of platinum metal in aqueous solutions of different stabilizing agents using the fundamental, 2nd and 4th harmonics (1064, 532 and 266 nm) of a Q-switched Nd:YAG pulsed laser (Quantel, Brilliant B, 8 ns FWHM) operating at 10 Hz during 15 min.
- Colloidal nanoparticle characterization: optical properties, nanoparticle size, size distribution, morphology, and crystalline phases were investigated by UV-Vis absorption spectroscopy, Transmission electron microscopy (TEM), and High resolution TEM (HRTEM).
- Nanostructured assisted LDI (NALDI) experiments: NALDI mass spectrometry measurements in positive-ion mode were performed in a reflection-time-of-flight mass spectrometer. Angiotensin I (Ang) was used as analyte. Excitation 337 nm light from a N2 laser was focused on the sample. Signals from the analyte either protonated or cationized by the Na+ or K+ impurities of the sample were analyzed.

APPLICATION: NALDI EXPERIMENTS
- Platinum colloidal nanoparticles with different size, shape, and crystallinity depending on the laser wavelength and the stabilizing agent were obtained.
- Smallest spherical nanoparticles were produced under UV ablation in aqueous citrate solution, nanorods were obtained in crystalline stabilizing agent solutions.
- Platinum nanoparticle substrates are capable of assisting laser desorption/ionization mass spectrometric analysis of low molecular weight analytes amenable for cationization by metals.

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REFERENCES