Green preparation and spectroscopic characterization of plasmonic silver nanoparticles using fruits as reducing agents - DTU Orbit (09/02/2019)

Green preparation and spectroscopic characterization of plasmonic silver nanoparticles using fruits as reducing agents

Chemicals typically available in plants have the capability to reduce silver and gold salts and to create silver and gold nanoparticles. We report the preparation of silver nanoparticles with sizes between 10 and 300 nm from silver nitrate using fruit extract collected from pineapples and oranges as reducing agents. The evolvement of a characteristic surface plasmon extinction spectrum in the range of 420 nm to 480 nm indicates the formation of silver nanoparticles after mixing silver nitrate solution and fruit extract. Shifts in plasmon peaks over time indicate the growth of nanoparticles. Electron microscopy shows that the shapes of the nanoparticles are different depending on the fruit used for preparation. The green preparation process results mainly in individual nanoparticles with a very poor tendency to form aggregates with narrow gaps even when aggregation is forced by the addition of NaCl. This explains only modest enhancement factors for near-infrared-excited surface enhanced Raman scattering.

In addition to the surface plasmon band, UV-visible absorption spectra show features in the UV range which indicates also the presence of small silver clusters, such as Ag42+. The increase of the plasmon absorption correlates with the decrease of absorption band in the UV. This confirms the evolution of silver nanoparticles from silver clusters.

The presence of various silver clusters on the surface of the "green" plasmonic silver nanoparticles is also supported by a strong multi-color luminescence signal emitted by the plasmonic particles during 473 nm excitation.

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