Templated green synthesis of plasmonic silver nanoparticles in onion epidermal cells suitable for surface-enhanced Raman and hyper-Raman scattering - DTU Orbit

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We report fast and simple green synthesis of plasmonic silver nanoparticles in the epidermal cells of onions after incubation with AgNO₃ solution. The biological environment supports the generation of silver nanostructures in two ways. The plant tissue delivers reducing chemicals for the initial formation of small silver clusters and their following conversion to plasmonic particles. Additionally, the natural morphological structures of the onion layers, in particular the extracellular matrix provides a biological template for the growth of plasmonic nanostructures. This is indicated by red glowing images of extracellular spaces in dark field microscopy of onion layers a few hours after AgNO₃ exposure due to the formation of silver nanoparticles. Silver nanostructures generated in the extracellular space of onion layers and within the epidermal cell walls can serve as enhancing plasmonic structures for one-and two-photon-excited spectroscopy such as surface enhanced Raman scattering (SERS) and surface enhanced hyper-Raman scattering (SEHRS). Our studies demonstrate a templated green preparation of enhancing plasmonic nanoparticles and suggest a new route to deliver silver nanoparticles as basic building blocks of plasmonic nanosensors to plants by the uptake of solutions of metal salts.

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