Nanoplasmonics and surface enhanced spectroscopy

The plasmonic nanocontainers for regulated drug delivery

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The development of novel nanomaterials for applications in drug delivery to human body systems has recently become more advanced industry. The traditional medicine often require large doses of drugs to achieve a therapeutic effect, which leads to an increase in the cost and may cause unwanted side effects and increased toxicity of drugs. One of the most attractive approaches for solving the aforementioned problems is the delivery of drugs with the ability to control time, speed and duration of drug release. Recently, the use of nanomaterials for targeted drug delivery has attracted great attention due to the unique optical, electronic and chemical properties of these materials. For therapy that requires chemical drugs or genes, plasmon-enhanced photothermal effects can also be used to develop smart nanocarriers that make possible the delivery of drug molecules, which is optically controlled. The various metal nanoparticles for photothermal therapy, like gold nanoshells, nanorods and nanocages has been the mostly studied due to their wide localized surface plasmon resonance (LSPR) range that extends into the near infrared region, where the absorption of living tissues is minimal [1].

In present work the method for fabrication of hollow spherical gold nanocontainers with varying wall thickness was worked through. The approach based on reduction of gold from oxidized state in chloroauric ions ($AuCl_4^-$) using the galvanic replacement reaction of silver with gold was used. It was found that by varying the nanocontainer wall thickness, the wavelength of the LSPR in aqueous solution can reach up to 800 nm instead of usual 520 nm for solid gold nanoparticles. The gold nanocontainers were investigated upon filling with protein as a model of drug, increase of the solution temperature and laser irradiation. A characteristic decrease of LSPR wavelength for nanocontainers with adsorbed protein upon the IR laser photothermal action and heating to 50 °C was registered, which may indicate the release of the protein molecules from the nanocontainers.

1. Luo YL, Shiao YS, Huang YF. Release of photoactivatable drugs from plasmonic nanoparticles for targeted cancer therapy. ACS Nano 5(10), 7796–7804 (2011).