Silver modified surfaces for photothermal therapy

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Photothermal therapy seems to be one of the promising tools in the treatment of various cancerous diseases. In this case, cancer cells were killed by high local temperatures, which were induced by laser irradiation of the nanoparticles coated on the well surface. If the surface is illuminated by laser of suitable wavelength, which corresponds to the position of the nanoparticle absorption maximum, the conversion of energy to heat is enhanced and leads to local hyperthermia and causes irreversible cell damage. The main goal of this research was to prepare nanoparticles, whose position of the absorption maximum could be tuned easily and would be in resonance with the wavelength of the used laser.

Nanoparticles with a wide range of sizes, shapes, therefore plasmonic/optical properties were synthesized by two step reduction process, where the ratio between reducing and stabilizing agent had the main impact on the nanoparticle final properties. Nanoparticles with the absorption maximum of desired wavelength (with respect to the used laser) were deposited on 96-well microtitration plate (by electrostatic layer-by-layer deposition) and used to evaluate anti-tumor efficacy in photothermal therapy.

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References

[1] Mistrik, M., Skrott, Z., Muller, P., Panacek, A., Hochvaldova, L., Chroma, K., Buchtova, T., Vandova, V., Kvitek, L. & Bartek, J. (2021). Microthermal-induced subcellular-targeted protein damage in cells on plasmonic nanosilver-modified surfaces evokes a two-phase HSP-p97/VCP response. *Nature Communications*, *12*(1).

[2] Malá, Z., Žárská, L., Bajgar, R., Bogdanová, K., Kolář, M., Panáček, A., Binder, S. & Kolářová, H. (2021). The application of antimicrobial photodynamic inactivation on methicillin-resistant S. aureus and ESBL-producing K. pneumoniae using porphyrin photosensitizer in combination with silver nanoparticles. *Photodiagnosis and Photodynamic Therapy*, *33*.

Figures

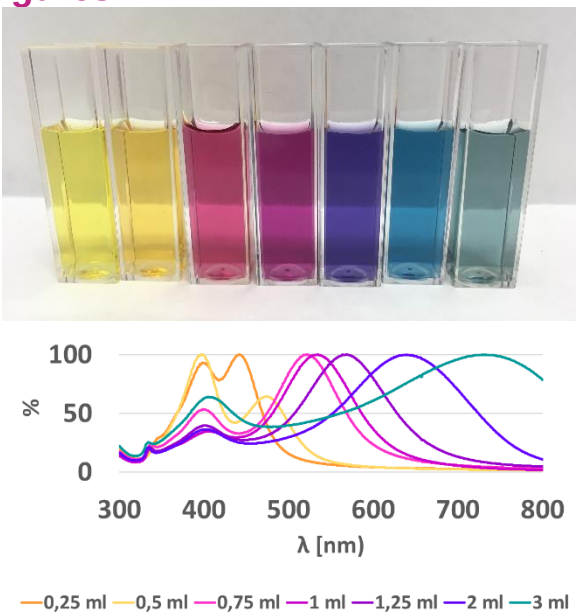

Figure 1a. Water dispersion of silver nanoparticles prepared by stabilization with different amount of citrate and their absorption spectra **(Figure 1b)**.

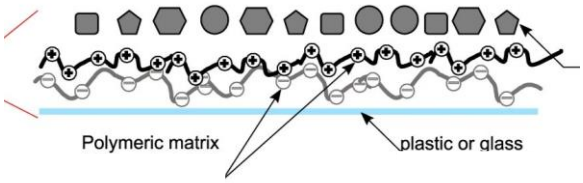

Figure 2. Formation of the plasmon layer on the cultivation surface (- PAA, + chitosan & AgNPs of various shapes)

Figure 3. Poster in PDF