Designing light-responsive nanogold-polyelectrolyte microsystems for controlled drug release in human retinal cells

R. Ghiman¹,³*, D. Rugină², A. Campu¹,³, M. Focsan³ and S. Astilean¹,³

(1) Faculty of Physics, Babes-Bolyai University, Kogalniceanu 1, 400084 Cluj-Napoca, Romania
(2) Faculty of Veterinary Medicine, University of Agricultural Sciences and Veterinary Medicine, 400372, Cluj-Napoca, Romania
(3) Nanobiophotonics and Laser Microspectroscopy Center, Interdisciplinary Research Institute on Bio-Nano-Sciences, Babes-Bolyai University, T. Laurian 42, 400271 Cluj-Napoca, Romania

Diabetic retinopathy (DR) is one of the most severe ocular complications that causes visual impairment and blinding due to retina and optic neuronal path damage. During recent years, there was expressed a general interest in using resveratrol (RV) (3,5,4‘-trihydroxystilbene) for prevention or complementary therapy for eye diseases¹. However current challenges in RV delivery and bioavailability require a targeted delivery strategy. Our current approach is to load RV as a cargo molecule, into polyelectrolyte multilayer microcapsules (PEM) and deliver it to retina pigmented epithelial cells (RPE cells). Moreover, gold nanoparticles (like spheres, bipyramids and rods) were proposed for encapsulating into shells of PEM for release of the loaded drug under laser radiation. The synthesis process of the AuNPs-PEM complex is based on a layer by layer assembly technique². The AuNPs-PEM obtained by this procedure were characterized using scanning electron microscopy method. Quantification of the RV released from microcapsules was assessed by HPLC-ESI-MS. The obtained microcapsules have 1–3 μm diameters, with a spherical shape, a rough surface a homogeneous coating entrapped with a high efficiency RV. TEM analysis showed that AuNPs-PEM were internalized into D407 retina cells, and proved to have no cytotoxicity at the dose used (10 AuNPs-loaded PEM/cell).

The results obtained show a promising strategy to enhance the bioavailability of RV and to increase its solubility, stability and remotely controlled release, by developing a delivery system specifically targeted toward retina.

References

Corresponding author email: ralughiman@yahoo.com