Hollow pH Sensitive Polymeric Nanospheres Modified With Quantum Dots For Bioapplications

Athina Papadopoulou[a,b], , Eleni K. Efthimiadou*[a,b] , Nikolaos Chalmpes[c], Dimitrios *Gournisc*

[a] *Inorganic Chemistry Laboratory, Chemistry Department, National and Kapodistrian University of Athens, Panepistimiopolis, Zografou 157 71, Greece*

[b] *NCSR "Demokritos", Sol-Gel Laboratory, Institute of Nanoscience and Nanotechnology 153 10 Aghia Paraskevi Attikis, Greece.*

[c] *Department of Materials Science & Engineering, University of Ioannina, 45110 Ioannina, Greece.*

e-mail: athinapapad@chem.uoa.gr

Nowadays, nanomaterials are widely used as carriers for theranostic applications. The advantages of using polymers in nanomedicine include biocompatibility, structural flexibility, low toxicity, and low cost [1].

Quantum dots (QDs) have also, stimulated interest in biological applications, in recent years, due to their special physicochemical characteristics. It is known that quantum dots can be used as fluorescent agents for real time monitoring, in bio-applications [2]. In this work, we focus on a strategy, where first prepared polymer nanospheres are subsequently doped with semiconductor quantum dots (QDs). This hybrid nanomaterial is expected to find use in a variety of *in vitro* and *in vivo* biological applications. With the ease to provide simultaneous therapy and imaging under controlled delivery, polymer nanoparticles have great potentials in biomedical research and applications. Are also developed hollow pH sensitive polymer nanospheres (NS) modified with quantum dots, which have important properties, for drug loading and release to the target cells. These NS will be synthesized in two steps procedure. In the first step, NS developed by using radical emulsion polymerization and in the second step doping with QDs will be taken place.

Their colloidal stability, structural and morphological characterization will be evaluated by DLS, FT-IR, SEM and AFM. Furthermore, hemolysis, wound healing and MTT assay, will be assessed in order to evaluate their biocompatibility. Fluorescent microscopy will be used to investigate the hybrid NS uptake and localization in different cell cultures [3].

References:

[1] G. Bao, S. Mitragotri, S. Tong, Multifunctional nanoparticles for drug delivery and molecular imaging, Annu. Rev. Biomed. Eng. 15 (2013) 253–282. https://doi.org/10.1146/annurev-bioeng-071812-152409.

[2] B.A. Kairdolf, A.M. Smith, T.H. Stokes, M.D. Wang, A.N. Young, S. Nie,

Semiconductor Quantum Dots for Bioimaging and Biodiagnostic Applications, Annu. Rev. Anal. Chem. 6 (2013) 143–162. https://doi.org/10.1146/annurev-anchem-060908-155136.

[3] E.-K. Lim, B.H. Chung, S.J. Chung, Recent Advances in pH-Sensitive Polymeric Nanoparticles for Smart Drug Delivery in Cancer Therapy, Curr. Drug Targets. 19 (2016) 300–317. https://doi.org/10.2174/1389450117666160602202339.