



Plasmonic Photothermal Cancer Therapy with Reduced Graphene Oxide Nanocomposites

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Abstract

Gold nanoparticles (Au NPs) and reduced graphene oxide (rGO) mediated hyperthermia are the two most widely explored systems used for the photothermal ablation of cancer cells. We show that the photothermal conversion and efficiency of these nanomaterials can be improved not only by combining them into one material, but also by changing the particles geometry, forming Au nanorods or bimetallic AuPd nanoparticles. The Au and AuPd NPs were covered with rGO and covalently functionalized with poly(ethylene glycol) (PEG) chains. It is greatly improved the solubility and stability of the nanocomposites in biological media and ensured its biocompatibility towards cancer cells. We show that Au NRs@rGO-PEG are ideal multifunctional theranostic nanostructures that can exert efficient photothermal destruction of tumors in mice upon low doses of NIR light excitation and can act as fluorescent cellular markers due to the presence of a NIR dye integrated onto the rGO shell. The nanocomposite was successfully used for the in vitro photothermal ablation of HeLa cells. At 1 W cm⁻², the total killing of HeLa cells was achieved through irradiation nanocomposites incubated cells for 10 min at a particle concentration of 20 mg mL⁻¹.

Biography

Prof., Dr. Volodymyr Zaitsev graduated from Taras Shevchenko National University of Kyiv (KNU) in 1981 with master degree in Inorganic chemistry and PhD in coordination chemistry in 1984 at the same university. He did postdoc training at University of Southampton (1990-91, Prof. J. Evans) and Texas A&M University (1995, Prof. D. Bergbreiter). In 1997 he habilitated in Kiev National University as D.Sc. in inorganic chemistry. From 2000 to 2014 he was full Professor and department chair at KNU. Currently he is Professor at the Pontifical Catholic University of Rio de Janeiro. In 1990 he received the British Council scholarship and in 1995 Fulbright research fellowship. In 2007 he received the National Ukraine state Prize in Science and Technology and in 2009 he was elected to Academy of Sciences of Ukraine. From 2011 till 2016 he was a member of scientific advisory board of Organization of Prohibition of chemical weapon (OPCW). From 2001 till 2016 he was a president of the Scientific Council of analytical chemistry in chemistry division of the National Academy of Sciences of Ukraine, from 2003 he is a member of the European Association for Chemical and Molecular Sciences (EuCheMS) and a representative of Ukraine in that association. From 2005 Vladimir Zaitsev is an editor of scientific journal *Methods and Objects of Chemical Analysis*; scientific, member of the Editorial Board of magazines: *Journal of analytical chemistry*, *chemical papers*, *chemistry and water technology*, *University Kiev reports*.