EuroSciCon

17th Edition of International Conference on

Emerging Trends in Materials Science and Nanotechnology

April 26-27, 2018
Rome, Italy

Ilya Zharov et al., Nano Res Appl, Volume:4
DOI: 10.21767/2471-9838-C1-008

BORON AND GADOLINIUM RICH NANOPARTICLES FOR NEUTRON CAPTURE THERAPY OF CANCER

Ilya Zharov and Yulia Yegeris
University of Utah, USA

Neutron capture therapy (NCT) is a suggested treatment for cancer. Species with large amounts of boron-10 or gadolinium-157 are required for an effective NCT. Gadolinium-containing nanoparticles might also be useful in MRI imaging, thus leading to theranostic agents. Dopamine-modified boron nanoparticles (BNPs) were prepared by ligand exchange on the surface of hydrophobic BNPs formed by ball milling. The boron core-silica shell nanoparticles were prepared by first performing a hydrosilylation reaction to convert the double bonds of the hydrophobic BNP ligands into trialcoxysilane moieties, followed by a sol-gel reaction to form the silica shell. The latter imparts hydrophilicity to the boron nanoparticle and provides a surface that can be further modified with various functionalities for targeted delivery. Furthermore, silica encapsulation results in particles that are uniform in shape and size, and are easy to manipulate. Silica nanoparticles (SNPs) grafted with carborane containing polymer brushes were prepared by modifying the silica surface with initiator moieties, followed by surface-initiated atom transfer radical polymerization of reactive monomers. After the formation of the polymer brushes, they are treated with carboranyl alcohols or acids, resulting in an almost complete modification of the polymer side-chains with the carboranyl moieties. Finally, silica nanoparticles were prepared with internal functional groups and microporosity, suitable for the incorporation of modalities for both MRI imaging and cancer treatment by neutron capture therapy using boron-10 and gadolinium-157 nuclei. These modalities were incorporated by preparing ORMOSIL particles with reactive functional groups throughout the nanoparticle body, followed by their conversion into the metal chelating and boron-containing moieties inside the nanoparticles.

Recent Publications

1. Brozek E M, Washton N M, Mueller K T and Zharov (2017) Silsesquioxane particles with internal functional groups. Journal of Nanoparticles Research 19:85-97.
2. Dubey R, Kushal S, Levin M D, Mollard A, Oh P, Schnitzer J E, Zharov I and Olenyuk B Z (2015) Tumor targeting, trifunctional dendritic wedge. Bioconjugate Chemistry 26:78-89.
3. Brozek E M, Mollard A H and Zharov I (2014) Silica nanoparticles carrying boron-containing polymer brushes. Journal of Nanoparticle Research 16:2407-2412.
4. Gao Z and Zharov I (2014) Tannic acid-templated mesoporous silica nanoparticles with large pores. Chemistry of Materials 26:2030-2037.
5. Yushkova E A, Ignacio-de Leon P A, Khabibullin A, Stoikov I I and Zharov I (2013) Silica nanoparticles surface-modified with thiacalixarenes selectively adsorb oligonucleotides and proteins. Journal of Nanoparticle Research 15:1-9.

Biography

Ilya Zharov is an Associate Professor at the Chemistry Department, University of Utah. He obtained his BS degree in 1990 from Chelyabinsk State University; MS in 1994 from the Technion; and PhD in 2000 from the University of Colorado, Boulder. In 2000-2003, he was a Beckman Postdoctoral Fellow at the Beckman Institute for Advanced Science and Technology, University of Illinois at Urbana-Champaign. His research focuses on novel nanoporous materials, ion conductive membranes, and on theranostic agents. Among his awards are Camille and Henry Dreyfus Foundation New Faculty Award and the National Science Foundation CAREER Award. He was named an Emerging Investigator by the *Chemical Communications* in 2011 and serves on the Editorial Board of *Current Smart Materials.*

i.zharov@utah.edu