22nd International Conference and Expo on NANOSCIENCE AND MOLECULAR NANOTECHNOLOGY

November 06-08, 2017 | Frankfurt, Germany

Functionalization of mesoporous zirconia nanoparticles with bis-phohphonic acids for successful tailoring of the surface properties: in depth investigation of the process

Khohinur Hossain, Patrizia Canton, Alessandro Scarso and Riello Pietro Ca' Foscari University of Venice, Italy

The design of surface modification of inorganic materials has been focused on silica-based materials for a long period. However, due to the limited chemical and physical stability of such materials, interest increasingly shifted to the use of ceramics such as Zirconia (ZrO₂) and Titania (TiO₂). Zirconia is chemically inert, biocompatible with good mechanical and thermal properties for in vivo biomedical applications. Nanoparticles (NP) for biomedical applications must maintain colloidal stability under physiological conditions and NP carrying a payload should limit a premature release of the guest before reaching the target organ. So, chemical modification of the NP surface is essential for specific interactions with biomolecules of interest. In particular, the functionalization of zirconia NP is a much less developed field compared to silica NP. The latter is based on the use of a wide range of commercially available tris-alkoxy-silane derivatives, while for zirconia a lack of suitable functionalization methods is present and silane chemistry is not suitable in this case. The purpose of this study is to develop a new functionalization method specific for zirconia NPs based on the synthesis and application of bis-phosphonic acids (BPs) bearing different functional groups as a chelating unit that can more efficiently bind the zirconia surface and impart unique and tailored properties to the NP. Bisphosphonates (P-C-P) are biological analogues of enzymatic hydrolysable pyrophosphates (P-O-P) whereas the P-C-P group is resistant not only to chemical but also to enzymatic hydrolysis. With solution 1H-NMR we followed the loading of the BP on the zirconia surface at different pH conditions and with thermogravimetric analysis (TGA) we investigated the amount of organic modification on the surface. With Zeta potential measurements we correlated the loading of BP on the NPs with the good anti-aggregation properties to the NP. Future applications of these modified NPs will be the loading of drugs for in vitro test of release.



Figure 1: Synthesis of bis-phophonic acids compounds (top) and functionalization of zirconia mesoporous nanoparticles with bis-phosphonic acids in water (bottom).

Biography

Khohinur Hossain has her knowledge on evaluation and passion in developing the nanomaterials focused on nanoparticles synthesis, functionalization, and application on biomedicine. After completion of her graduate studies in Chemistry and Advanced Chemical Methodologies from University of Camerino, Italy, she got the PhD position at the Department of Molecular Sciences and Nanosystems, Electron Microscopy Center "Giovanni Stevanato" and INSTM, Italy. She is member of several organizations, e.g. Italian Chemical Society (SCI), Bangladesh Chemical Society (BCS) and organizing committee of International Summer School of Physical Chemistry (ICPS).

989081@stud.unive.it

Notes: