Ph.D.Thesis of Salahaddin University-Erbil Academic Staff Studied Abroad

Title of thesis: POROUS SILICON NANOPARTICLES AS A CARRIER FOR FOLIC ACID, MITOMYCIN C, AND TAMOXIFEN FOR POTENTIAL ANTICANCER THERAPIES

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Period of Study: from September 2011 to August 2014
Summary (Abstract):

The purpose of this study is to investigate porous silicon (pSi) nano-particles as drug delivery devices of different cancer therapies. The identification of the target tissue and time management of the drug release is paramount for achieving maximum treatment. pSi nano-particles have been reported to be an excellent tool for drug delivery, but have not been investigated before for this type of therapies. Hence, pSi nano-particles were fabricated by a simple and rapid method that consisted of electrochemical etching of n-type single crystalline Si wafer. The surface chemistry of the pSi carrier was modified by thermal oxidation and thermal hydrosilylation with undecylenic acid and the effect of this was studied comparing the release profile before and after modification. The physiochemical properties of pSi nano-particles during the different steps of pSi fabrication and loading were characterized by various physical techniques. The release profile of various drugs was investigated in vitro with UV-visible spectrometry. Folic acid-loaded pSi nano-particles were investigated in phosphate buffer saline and this was observed to be enhanced (60 % released after 6 h) when the pSi nano-particles were modified by thermal oxidation. Mitomycin-loaded pSi showed a slower release profile during the cytotoxicity study in human prostate carcinoma cells compared with the drug per se. Another anticancer drug, tamoxifen was loaded into the pSi together with iron oxide nanoparticles. The latter conferred the pSi with magnetic properties that allow the carrier to be directed to an specific target. In this case, the pSi carrier was modified by hydrosilylation and by coatings with chitosan, silica-xerogel and hybrid of these two. The effect of surface modification on the drug release is discussed and compared with other works providing similar results and hence optimal delivery capabilities for folic acid, tamoxifen and mitomycin. pSi due to its simple fabrication method and its intrinsic optical properties has the potential to be used as a diagnostic and therapeutic point of care tool.
Acknowledgment: I would like to record my great appreciation for Salahaddin University-Erbil-Kurdistan (http://international.su.edu.krd), for giving me the permission leave and giving me full salary study permission for the whole period of the study abroad.