أنموذج ( أ ) الخاص برسائل الماجستير و اطاريح الدكتوراة ( اخر شهادة )

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Abstract

The main goal of this dissertation was to explore new protocols to synthesize biocompatible radioactive gold nanoparticles to treat and image cancer and calculate the dose distribution by using MCNP in tumor inside the human prostate as well as surrounding normal tissues.

This dissertation is classified into three parts or projects. The objective of the first project is production and evaluation of radioactive MGF-$^{198}$AuNPs and MGF-$^{199}$AuNPs towards prostate cancer treatment and imaging. Non-radioactive MGF-AuNPs were synthesized first and *in vitro* evaluated. Results of *In vitro* evaluation showed that this type of nanoparticles is stable, non toxic, and can be internalized into prostate cancer cells. Next, new modified protocols were devloped to produce radioactive MGF-$^{198}$AuNPs and MGF-$^{199}$AuNPs. UV-Vis spectroscopy and TLC measurements showed that these radioactive MGF-$^{198}$AuNPs and MGF-$^{199}$AuNPs are stable and more than 96% of radioactive gold was within nanoparticlate structure. Then, MGF-$^{198}$AuNPs were *in vivo* evaluated to investigate their *in vivo* stability, retention in tumor, and efficacy to cure prostate cancer. The results indicated that MGF-$^{198}$AuNPs are stable and have excellent ability to be retained within the tumor up to 24 hours with very minimum leakage to non-target organs. It was also found that radioactive MGF-$^{198}$AuNPs have significant therapeutic effect and that

they were able to control the tumor size in comparison to control group.

The objective of the second project is production and evaluation of radioactive citrate-$^{199}$AuNPs as imaging probe for single photon emission computed tomography. In this study, a new protocol was developed to synthesize radioactive citrate-$^{199}$AuNPs, UV-Vis spectroscopy and TLC measurements showed that new protocol was successful to produce stable radioactive citrate-$^{199}$AuNPs. Also, *In vivo* evaluation results showed that citrate-$^{199}$AuNPs are stable *in vivo* and therfore, they can be used in imaging procedures.

The objective of the third project is estimation, by means of MCNP simulations, the dose distribution delivered by radioactive gold nanoparticles ($^{198}$AuNPs or$^{199}$AuNPs) to tumor inside the human prostate as well as to the normal tissues surrounding the tumor, using water and A-150 tissue equivalent plastic phantoms. A simple geometrical model of a human prostate was used, and the dose distribution that is deposited by radioactive gold nanoparticles ($^{198}$AuNPs or $^{199}$AuNPs) was calculated using MCNP. The results showed that the deposited dose by $^{198}$AuNPs or $^{199}$AuNPs, which are distributed homogenously in the tumor, has maximum value at the tumor region and then decreases toward the normal tissue in the prostate as well as surrounding organs. However, the dose deposited by $^{198}$Au is significantly higher than the dose deposited by $^{199}$Au at the tumor region as well as normal tissues. Therefore $^{198}$Au should be preferred to for therapeutic applications, while should be preferred for $^{199}$Au in imaging applications.