



Gold radioactive nanoparticles for brachytherapy

Wilmmer Alexander Arcos Rosero, Angélica Bueno Barbezán, Carlos Alberto Zeituni, Maria Elisa Chuery Martins Rostelato

Instituto de Pesquisas Energéticas e Nucleares - IPEN, São Paulo, Brazil

<https://doi.org/10.21175/rad.abstr.book.2023.42.3>

The development of new materials emerges as an alternative to the treatment of cancer, Nanobrachytherapy is born from the union of nanotechnology and brachytherapy being a modality of radiotherapy in which the nanosources are placed close to or in contact with the region to be treated. In nanoparticle synthesis, a key role is played by coatings, certain sizes of uncoated nanoparticles tend to accumulate in tumors due to vessel irregularities. When coated with gum arabic, the size of the nanoparticles is controlled, allowing the particles to properly penetrate the vasculature.

The choice of radionuclide depends on the radiobiology of the cancer and the dose deposited in the tissue, which takes into account the type of decay (beta particles penetrate less into the tissue than X-rays and gamma rays), energy and half-life time (which influence the deposited dose per duration of radioisotope). In this work, ^{198}Au will be used, which presents Beta as the main type of emission with an energy of 314.55 KeV, gamma 411.8 KeV, and a half-life of 2.7 days.

The synthesis of radioactive nanoparticles is carried out in a closed chemical reactor, developed during the tests. The chemical reactor gold nanoparticles and precursor chloroauric acid are obtained. The morphology of nanoparticles and their size is guaranteed cold by TEM and radioactive by DLS. With an average diameter (TEM) of 5 nm, gum arabic nanoparticles have a curious property, when solution they form stable agglomerates of 45 nm (DLS), optimal size for in vitro and in vivo tests. They were tested with cancer cells of prostate and mice.

In one of the evaluated LNCaP strains, 11% cytotoxicity was observed at the lowest concentration (0.9 $\mu\text{Ci}/\text{well}$). At the concentration of 1.8 $\mu\text{Ci}/\text{well}$, there was cell proliferation and at the highest concentration (2.7 $\mu\text{Ci}/\text{well}$) it showed 32% cytotoxicity.

After statistical analysis, the results revealed that although none of the animals showed regression of tumor mass. Tumor growth was slower at treated animals when compared to the tumor growth of the control animals (zero dose). Signaling us then that there is a positive effect on therapeutic efficacy, but these data suggest that the activity used was relatively low to achieve the regression of this mass. In the next experiments we will increase the injected radioactive activity to confirm these results and evaluate its real therapeutic potential.