Performance evaluation of activity meters using the in-situ calibration methodology with ^{99m}Tc

Elaine Wirney Martins e Maria P. A. Potiens

Email: elainewirney@alumni.usp.br
Instituto de Pesquisas Energéticas e Nucleares, 05508-000, São Paulo, Brazil

Introduction

Activimeters are measurement instruments used in nuclear medicine services procedures (NMS). Their efficiency in measuring readings must ensure with safety and reliability that the dose administered to the patient is in accordance with the medical prescription. To achieve this condition, it is necessary that the activimeters are well calibrated. Another important factor that can compromise the accuracy of their results is the type of container in which the radiopharmaceutical is packaged, with the difference in the geometry of the vial being the biggest source of error. The Instrument Calibration Laboratory (LCI) at IPEN provides radiation measuring instrument calibration services for hospitals, industries, and clinics located throughout Brazil. It is also responsible for calibrating all activimeters used in the IPEN Radiopharmacy Production Center (CERAF). Activimeters are difficult to remove due to their ionization chamber being too heavy and they are usually installed in controlled areas with difficult access. Due to these factors, in-situ calibration methodologies have been developed where there is no need for removal. The objective of this work was to implement and evaluate one of the in-situ calibration methodologies proposed and developed at LCI.

Methods

Eleven activimeters belonging to CERAF that are in this condition, where there is no authorization to remove them from where they are installed, were tested. To compare the performance of these activimeters, the reference activity meter called the Standard Working System, belonging to LCI, was used. The radioactive sample, ^{99m}Tc, was deposited in two vials: the calibration standard 10R Schott used by the National Physical Laboratory and the IPEN vial usually used by CERAF for the production and commercialization of radiopharmaceuticals. Ten measurements were recorded at intervals of 30 seconds in each activity meter, considering the mean of the obtained reading.

Results

With these registered data, uncertainties were calculated with results always below 0.5% and calibration coefficients different from one were found.

Conclusions

All the activimeters tested in relation to the reference activimeter belonging to LCI have shown the need for proper calibration and that the continuity of the tests should be maintained.

Dosimetric approach of Au-198 nanoparticles with radiochromic film

Maria Rigo[1], Lucas Angelocci[1], Priscila Rodrigues[1], Cristhian Talacimon[1], Ilca Medeiros[1], Lara Teodoro[1], Thuany Nogueira[1], Wilmer Rosero[1], Carlos Zeituni[1], Maria Rostelato[1]

Email: maria.rigo@unesp.br
[1]Instituto de Pesquisas Energéticas e Nucleares, Universidade de São Paulo (IPEN/USP), Avenida Professor Lineu Prestes, 2242, Cidade Universitária, São Paulo SP, CEP 05508-000, Brazil.

Introduction

Gold nanoparticles (AuNPs) stand out for the possibility of having unique physical-chemical properties, for being stable, easy to prepare and for having better penetration capacity due to their small size. AuNPs can be widely used for diagnostic purposes and for application in brachytherapy. Thus, with the dosimetric characterization of 198-AuNPs it will be possible to obtain relative dosimetric data of 198-AuNPs. Film dosimeters are of special interest for dosimetry, as they allow it to be performed in a two-dimensional and continuous conformation. The objective of this work is to perform the calibration of radiochromic films irradiated by a known source and subsequently the dosimetry of Au-198 nanoparticles.

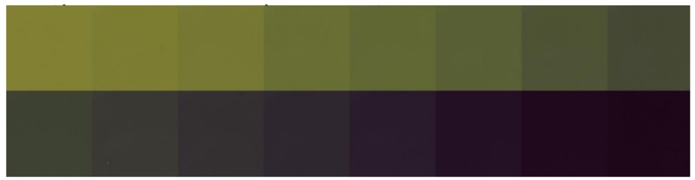
Methods

The model that was used in this work is Gafchromic External Beam Therapy 3 (EBT3). For the dosimetric system calibration process, the films were cut into 3 cm x 3 cm. Irradiations were performed at selected doses of 0, 10, 25, 50, 75, 100, 150, 200, 250, 300, 400, 500, 70, 1000, 1500, 2000 cGy by a panoramic Cobalt-60 source. For the reading, as well as for the calibration, the EPSON Expression 11000XL scanner was used.

Results

Figure 1 shows the images obtained in the region of interest for the films in each of the irradiated doses. The dose response in this dosimetric system follows the shape of the positive course of a sigmoid curve.

Figure 1: Images of the film's regions of interest used for calibration at different doses, from 0 to 20 Gy. The dose increases according to the darkening colors, from left to right, passing the line from top to bottom.



From the calibration curve, it is possible to establish the absorbed dose by a given film just by subtracting the image of the same film before irradiation.

Conclusions

After obtaining the calibration curve, a quantitative relation between the intensity of the signal detected in a single channel and the dose that is being analyzed experimentally using a source of AuNPs-198 is established.