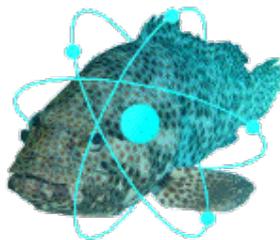


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Determination of the activity meter calibration factor for Re-188

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Aim

An innovative brachytherapy treatment based on Re-188 has been recently developed for squamous cell carcinomas of the skin. The planning and delivering of the treatment requires an accurate knowledge of the source activity and thus proper calibration of activity meters. However, reference sources for calibration purposes are not always available, as in the case of short-lived radionuclides. The aim of this work was to determine the calibration factors for Re-188 by comparing the results of measurements conducted with the calibration meters with those obtained using an HPGe spectrometer.

Materials and methods

Calibration factors were experimentally determined for two different activity meters, a Capintec CRC15 and a MecMurphil MP-DC. This study was conducted on a Rhenium-188 compound produced by OncoBeta® GmbH for Rhenium-SCT® therapy. In the compound, Re-188 is bound to a fluid matrix that can be applied over the tumor with a dedicated applicator. We considered two different geometries, point source and 5 ml vial, and we prepared three different samples for each, in order to reduce the uncertainties. All samples were measured using the activity meters and the results were recorded in terms of ionization current. The activity of each sample was accurately quantified, within an uncertainty of 5%, with a multichannel analyzer equipped with an HPGe detector (relative efficiency of 30% and resolution of 1.8 keV at 1332 keV). The spectrometer was previously calibrated using a multi-radionuclide certified reference solution (Areva CERCA LEA, Pierrelatte Cedex, France). The calibration process was conducted according to the IEC 61452 standard. The measurements were performed after a partial decay of Re-188, to achieve a dead time always below 4%. The spectrometry results were elaborated with Genie 2000 software (Canberra). We calculated the two calibration factors for each sample by comparing the activities and the recorded ionization currents. The final results were determined as averages of those factors.

Results

The final calibration factors (relative to Cs-137) for the MecMurphil MP-DC are:

- $4,44 \pm 0,23$ for point-like sources
- $4,44 \pm 0,23$ for 5ml solutions

The final calibration factors (relative to Tc-99m) for the Capintec CRC15 are:

- $2,21 \pm 0,09$ for point-like sources
- $2,46 \pm 0,10$ for 5ml solutions

Conclusion

With the presented method we managed to determine calibration factors with an uncertainty below 6%. This procedure can be reproduced in every laboratory and shows that accurate calibration factors for Re-188 may be obtained, preserving metrological traceability to standards and allowing the use of activity meters for the related radiopharmaceutical procedures. The same methodology can be applied for other radionuclides.

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