

Introduction

Use of a gamma counter in clinical trials and routine practice for counting different isotopes such as ^{99m}Tc , ^{125}I , ^{177}Lu , ^{89}Zr



Necessary metrological and analytical validations

Objectifs

Determination of the counting efficiency for several isotopes and development of a standardised and reproducible protocol

Materials and methods



Use of the gamma counter : Which applications ? Which isotopes ?
Critical parameters for analysis (analytical range, volume, counting time, counting window, etc.) ?



Creation of a protocol and an Excel spreadsheet
to calculate the dilutions required to cover the defined analytical range and analyse the data



Equipment qualification :
Analytical balance, Micropipettes,
Dose calibrator

LABORATORY WORK



1st calibration range to determine **the maximum volumetric activity before saturation** of the gamma counter (dead time factor <1,04)

Multiple half-dilutions of a radioactive stock solution and counting of sample doublets with a gamma counter



2nd calibration range with volumetric activities below the saturation limit, determination of **counting efficiency** and creation of an accuracy profile of +/-10% in order to validate the data

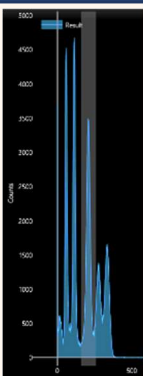
Dilutions with predefined volumetric activities and counting of 5 to 10 samples per dilution with calculation of the theoretical number of Count Per Minute (CPM) and comparison with the practical CPM obtained.



Results



Spectrum obtained after counting the ^{177}Lu samples with a gamma counter



Isotopes	Counting time (min)	Counting window (keV)	Volume per sample (mL)	Volumetric activity at saturation (kBq/mL)	Counting efficiency
^{99m}Tc	1	110-180	1	22,8	79,5%
^{125}I	5	15-80	2	6,65	100%
^{177}Lu	5	150-370	0,2	540	9,2%
^{89}Zr	1	450-570 et 830-995	0,5	16,6	23,0%

$$= \frac{\text{CPM obtained}}{\text{Theoretical CPM}} * 100$$



Gradual improvement of the protocol and Excel spreadsheet aimed at standardising measurements



Discussion/Conclusion

Determination of the counting efficiency : **an essential metrological step** in interpreting the results of a gamma counter



Impact of **counting geometry** (volume, bottle shape) on the results obtained → Repeat the study with the desired parameters.



Protocol enabling standardisation and simplification of the implementation of the counting of new isotopes