International Conference on Radionuclide Metrology and its Applications

(ICRM 2007: Cape Town, Sept 3 - 7)

Liquid Scintillation Working Group

ICRM: LS Session : Presentations

P006: Kossert, K (PTB) and Grau-Carles, A (CIEMAT)

“Study of a Monte-Carlo rearrangement model for the activity determination of Electron capture nuclides by means of liquid scintillation counting”

CIEMAT/NIST efficiency tracing method requires computations of electron spectra in LS samples. For EC nuclides, the existing models yield considerable discrepancies between calculated efficiencies and experimental data.

A new Monte-Carlo model (MICELLE computer code) was proposed incorporating all possible re-arrangement processes, including L, M and N sub-shells: for EC, EC/γ, isomeric transitions with $29 < Z < 55$.

MICELLE applied to ^{109}Cd and ^{125}I, and compared with experimental efficiencies.

ICRM: LS Session : Presentations

P015: Ivan, C.; Sahagia, M (IFIN-HH - Romania), Cassette, P. (LNHB-France)

“A new TDCR-LS counter using channel photomultplier tubes”

The construction of a new TDCR counter using ¾” CPM tubes (Perkin-Elmer) with bi-alkali photo-cathodes was discussed.

- *CPM tubes are compact and do not require an external voltage divider*
- *smaller surface of photo-cathodes than traditional LS system*
- *photo-electron amplification gain of 10^8 was achieved with HT of +3kV*

Prototype TDCR system used 3 CPM tubes arranged symmetrically around a 20ml LS vial, and compared with a traditional TDCR system using BURLE 8850 PMTs.

- *^{3}H, ^{63}Ni, ^{55}Fe, $^{90}Sr/^{90}Y$ sources prepared in commercial LS cocktails.*

Observed lower efficiencies for CPM system, but remarkable agreement for activity determination between the two systems.

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ICRM: LS Session : Presentations

P021: van Wyngaardt, W.M, Simpson, B.R.S. (NMISA), Jackson, G.E.(Univ. Cape Town)

"Further investigations of a simple counting technique for measuring mixtures of two pure β-emitting radionuclides"

Technique based on combination of the TDCR and CIEMAT/NIST methods, and was tested on a variety of mixture ratios of ^{63}Ni and ^{14}C.

The activity composition is determined from both the double and triple coincident count-rates, combined with the triple-to-double coincidence efficiencies. The efficiencies are calculated from theoretical expressions which are fucntions of the "figure of merit", which is determined experimentally from a pure β-emitting tracer standard: along the lines of the CIEMAT/NIST method.

Application of method to other combinations were discussed, including various two-component mixtures of ^{32}P, ^{33}P and ^{35}S.

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ICRM: LS Session : Presentations

P025: Grau-Carles, A (CIEMAT) and Kossert, K (PTB)

"Determination of the shape-factor of ^{90}Sr by the cut-off energy yield method"

Kurie plots are commonly used to analyse β shape-factor functions measured by magnetic and semi-conductor spectrometers: however self-absorption within samples modifies the emission spectrum.
LS counting reduces the problems of self-absorption, but exhibits poor energy resolution.

A new technique for shape-factor determination was proposed, using two resolution invariant observables: maximum point energy and the cut-off energy yield.

- *calibration of a LS counter using β-emitters with well-known shape factor functions.*
- *Spectral Interpolation Method is used to generate pulse height spectra Spectral Quench Parameter of the External standard (SQP(E)), from neighbouring SQP(E) pulse height spectra.*

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ICRM: LS Session : Presentations

P081: Cassette, P. and Phuc Do (LNHB)

“The Compton source efficiency tracing method in LS counting. A new standardisation method using a TDCR counter with a Compton spectrometer”

Efficiency tracing methods for activity measurement (i.e.: the CIEMAT/NIST technique), provide useful “long-term” reference sources for pure-beta or low-energy emitting nuclides. But ^{3}H a 12.32 year half-life, and its primary standardisation is not trivial !
For LSC, primary standardisation method is TDCR, but this requires a correct description of the non-linearity of the scintillator (depending on the LS source), which is not easily reproducible over time.

A new method was proposed: LS counter coupled to a Compton spectrometer, where the reference source is internally created into the LS cocktail via the Compton effect, based on the use of an external ^{241}Am source: the energy of the scattered Compton photons (germanium detector) and the energy of the Compton electrons (LS vial) are used to calculate the free parameter of the LS counter via the TDCR model.

ICRM: LS Session: Poster Presentations

"Design and construction of a TDCR system at ANSTO"
ANSTO, Australia

"A performance comparison of nine selected LS cocktails"
SCK-CEN, Belgium

"The ionisation quenching function for coincident electrons"
CIEMAT, Spain

"General data analysis code for TDCR LS counting":
CNEA, Argentina

"Radioactivity determination of individual radionuclides in a mixture by LS spectral deconvolution":
IRMM, Belgium

"Some remarks on photon statistics in the LS counter"
POLATOM, Poland

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ICRM 2007: Conference Proceedings

- Will be published in:
  “Applied Radiation and Isotopes”

early 2008 ?

Come on Australia !!

Wallabies

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