METHODS FOR RADIOTOXICOLOGICAL ANALYSIS

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Keywords: In Vitro Bioassay; internal individual monitoring; biological sample.

The measurement of radioactivity concentrations in excreta samples is an important tool for the monitoring of possible radionuclide intakes by occupationally exposed workers, especially for those emitting alpha or beta radiation radionuclides. The In Vitro Bioassay Laboratory (LRT) of IPEN, in activity since 1981, is in constant development to follow the necessities of internal monitoring for the people involved in work with non-sealed sources of radiation. For this purpose, new techniques are developed and implemented in accordance with the institute radioprotection program. In the years 2002/2004 the following studies have been performed: (in progress).

Determination of 241Am and 238Pu in urine by alpha spectrometry: Analyses of plutonium and americium in bioassay samples are normally achieved by radiochemical separation from samples to which tracers have been added. Samples of urine and faeces are ashes prior to separation of the actinides by ion exchange (Pu) or separated by extraction chromatography on Eichrom TRU Spec (Am) (FIG.1). The actinides are then electroplated on stainless steel discs for analyses by alpha spectrometry.

Determination of thorium isotopes in excreta samples by alpha spectrometry: Thorium is separated by Eichrom resins prior to the measurement by alpha spectrometry. A calcium phosphate precipitation technique is used to concentrate and remove actinides from excreta samples. Tracers are used to monitor chemical recoveries and to correct results in order to improve precision and accuracy. The LRT aims in near future to include these methodologies in its routine program. Beside this purpose, intercomparison exercises help to validate the applicability of new methodologies.

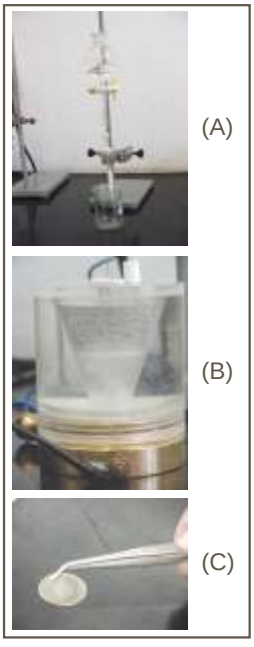

FIGURE 1 - A) Americium separation in TRU-spec resin;
B) Electrodeposition cell at work;
C) Planchet after the electrodeposition process.

METHODS IN INTERNAL DOSE CALCULATION

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Keywords: dosimetry; internal dose; internal monitoring.

The use of a dosimetric system related to the evaluation of internal doses of radiation contributes to the safety of occupational activities with potential intake of radionuclides. Estimation of doses to people exposed to ionizing radiations due to inhalation or ingestion of radioactive materials is often based on calculations following a given intake. Comparison between these calculations and laboratory measurements of the activity in excreta or in body tissues enables estimation of the amount of radioactive material absorbed by the body and hence the expected committed doses. A comprehensive study was proposed to identify the main radionuclides that potentially contribute to the internal dose of the workgroup at the radiopharmacy facilities. This task was carried out for compounds of 131I, 99Mo, 99mTc 97Ga, 51Cr, 201Tl, 153Sm, 35S and 45Ca. The main intake pathways and the appropriate frequencies of monitoring were established for all mentioned compounds. Furthermore, an appropriate computer program for internal dose assessment and also a data bank for management of the routinely exposed workers are in progress. The control of the internal exposure is established according to the radiation protection program, which states that the internal dose should be included in the effective dose.

METROLOGY IN DIAGNOSTIC RADIOLOGY

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Keywords: Radiation metrology; calibration; quality control; diagnostic radiology.

Standard X radiation qualities were established at the Calibration Laboratory of IPEN, in order to calibrate instruments used in diagnostic radiology measurements. During the period of 2002-2004 the established calibration methods were improved. The performance of two flat ionization chambers (112 cm3), designed for dose measurements behind phantoms, was studied to verify the possibility of their use as monitor chambers in the Neo-Diagnomax X radiation system. The behaviour of the radiation detectors (ionization chambers) received for gamma calibration was also analysed in standard X radiation qualities. The transfer system utilized at the procedures for calibration of diagnostic radiology instruments developed at IPEN as an alternative to calibrate the instruments that measure kVp and air kerma values was evaluated in the standard beams of two X-ray equipments. The beam spectrometry of the Siemens X radiation system (model Stabilipan) was performed in order to determine the real kVp values as part of its characterization. This X-ray system will be used to calibrate survey meters.