Radioanalytical measurement

Radioanalytical techniques underpin every aspect of radioisotope and radiotracer research by providing the tools and techniques to characterise the radiolabelled products from radiochemistry research and delivery. We employ a gamut of techniques that include:

Radio-LCMS

Radio-Liquid Chromatography Mass Spectrometry (Radio-LCMS) utilises the resolving power of High Performance Liquid Chromatography (HPLC) and combines it with a sensitive radiation detector, UV/visible light absorption and mass spectrometric determination. This specialist technique can yield important information: the identification of product peaks (radioactive and non-radioactive), the incorporation of radionuclides into radiolabelling products / side products as well as the metabolites formed *in vivo* or *in vitro* (cell). Radio-LCMS can provide information on the specific radioactivity of radiolabelled products and also product confirmation by atomic mass.

Gamma spectrometry

Gamma Spectrometry is an indispensable technique for the identification of gamma-emitting radionuclides. The sensitivity of the technique can provide important information about the types and quantities of radionuclides present. Typically small amounts of the material are placed in a shielded chamber and the instrument detects and discriminates the various gamma-ray energies interacting with the High Purity Germanium (HPGe) crystal. Beta spectrometry is a similar technique that can discriminate the energies of beta particles. Access to this type of detector is available when required through other ANSTO-based capabilities.

Gamma counting

Gamma counters are sensitive instruments designed to quantify the amount of gamma-emitting radionuclides in a sample, usually contained in sealed vials. Multiple radioactive samples are placed in racks and the gamma counter can be set to run each sample for a predetermined amount of time, automatically. Gamma counting is an excellent technique when large numbers of samples require analysis such as binding assays and Radio-TLC strip fractionation.

Radio-TLC

Radio-Thin Layer Chromatography (Radio-TLC) is a well-established low resolution method of analysing a radioactive product or reaction. Typically, a small amount of an analyte-containing liquid sample is spotted on a chromatography strip, dried and left to develop in a TLC tank with an appropriate developing solution (mobile phase) designed to afford separation of the analytes in question. After a given time the strip is removed, dried, and placed on the Radio-TLC scanner for direct reading and conversion into a radio-chromatogram. Alternatively the strip can be cut into pieces for separate measurements in a gamma counter if the product profile is known - as is the case with many kit-based radiopharmaceuticals. When whole TLC plates are used or when multiple lanes require analysis, a more convenient method is to expose the TLC plate to phosphor plates and then have the plates read on a phosphor imager, where the exposures can be readily quantified.

Radiometabolite analysis

The combination of the high sensitivity of Radio-TLC and the high sensitivity of the equipment we use in Radio HPLC and Radio LCMS allows us to characterise very low levels of radioactivity as is required for evaluating the stability of a radiotracer and analysis of the metabolism of a radiotracer. This allows us to understand the fate of the radiotracer and better understand the *in vivo* kinetics of the radiotracer. It can also direct the design of a radiotracer to meet the requirements of the research.

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