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Short Communication

Applications of Radio Thin Layer Chromatography in Pharmaceutical Analysis

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ABOUT THE STUDY

Thin Layer Chromatography (TLC) is a technique for separating chemical components of a mixture and determining its composition. TLC can be used to assess purity and yield in chemical synthesis, differentiate species in biological assays, and analyze radiopharmaceuticals used in PET, SPECT, or targeted radiotherapy when used in association with a radiation detector. Radio-TLC is especially useful for determining radionuclide incorporation into the target radioactive product during synthesis development and optimization, as well as for Quality Control (QC) testing of the final formulated radiopharmaceutical to ensure radiochemical purity and radiochemical identity prior to patient administration. Radio-High-Performance Liquid Chromatography (radio-HPLC) is another chromatography technique for analysis, which is particularly useful when distinct separation of several compounds is required. Easy implementation, quantitative detection of (18F) fluoride concentration (which can be overestimated in HPLC due to column retention), relatively quick measurement time, and ease of maintenance, radio-TLC is sufficient and preferable over radio-HPLC in many radiopharmaceutical analytical applications.

A radio-TLC scanner is used to examine a TLC plate (spotted with a small amount of the sample and then developed with a mobile phase), which moves a radiation detector along the plate to obtain measurements of generated radiation as a function of distance. Most radio-TLC scanners (such as Eckert and Ziegler's AR-2000) use gas-based radiation detectors that can detect both gamma and beta radiation. Constant gas supply and repeated calibrations are drawbacks of such systems. Instead of gas, some radio-TLC scanners (such as miniGITA and Raytest) employ crystal scintillators and photodiodes. Depending on the radionuclides of interest, different detectors may be deployed. The range of the type(s) of radiation of interest is connected to spatial resolution. Using detectors sensitive and particular to short-ranged particles, high resolution may be attained (e.g. alpha, beta). Resolution is substantially lower for a longer-ranged radiation (e.g. gamma rays), but it can be slightly enhanced if the collimator is attached (at the expense of sensitivity). TLC plates are typically 60–100 mm long and require 10–30 minutes to develop. The TLC plate's length is essential to provide sufficient chemical separation as well as optimal readout resolution.

The scanning duration is dependent on the intensity of activity, however each TLC lane may usually be analyzed in 1–3 minutes [1,2]. Despite the fact that some scanners, such as the AR-2000, offer capacity to insert numerous TLC plates that may be scanned automatically in sequence, the overall analysis time is cumulative and continues to be long [3]. Researchers investigated different ways for reading TLC plates to minimize readout time. Aside from scanning detectors, other strategies have been utilized to read radio-TLC plates more effectively. Electronic autoradiography is one such technology. Instant Imager (Canberra Packard), for example, a large area multi wire proportional counter detector that can photograph several radio-TLC plates at the same time. This technique has been demonstrated to be accurate and capable of imaging a wide variety of isotopes (Tc-99m, I-124, F-18, Cu-64, C-11). In a more time-consuming two-step procedure, radio-TLC plates have been photographed by first exhibit a phosphor screen, which is then scanned using a phosphor imaging equipment (e.g. Perkin Elmer Cyclone Plus). Additional types of detectors have been utilized to read many points along a TLC plate simultaneously, eliminating the requirement for scanning [2]. For example, measured samples detected at numerous locations with different radioisotopes (Tc-99m, F-18) utilizing a 641 array of scintillator crystals over a photodiode array and found great agreement with an AR-2000 scanner. Maneuski, et al. [4] used a pixelated solid-state Timepix silicon detector to obtain a 2D image of a partial radio-TLC plate spotted with an unspecified 18F-containing compound, but the detector size is small, and multiple expensive detectors would be required to image a full radio-TLC plate or multiple plates.

Cerenkov Luminescence Imaging (CLI), in which radiation is detected indirectly *via* Cerenkov light emission and the entire detection area may be scaled with an appropriate optical system rather than bigger detectors, is a more scalable technique.

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Cerenkov light is emitted by radiation particles with enough energy to exceed the speed of light in the medium through which they are flowing in this CLI method. Compounds containing a wide range of radionuclides, including H-3, C-11, C-14, F-18, P-32, Cu-64, Ga-68, I-124, and I-131, have been detected using CLI. CLI was first reported as a technique for observing radioactivity in microfluidic chips, but it is now being employed for *in vivo* optical imaging, intraoperative imaging, and radio-TLC plate reading [5].

When the thickness of the transparent material is similar to the range of radiation particles, CLI has a substantial advantage in terms of spatial resolution.

For positrons from F-18, the spatial resolution was proven to reach hundreds of microns when employing poly-dimethylsiloxane (a transparent polymer with a comparable index of refraction to glass). (Even though the positrons eventually lead to the production of 511 keV gamma rays, gamma rays passing through the thin transparent layer produce minimal Cerenkov light.)

CONCLUSION

Due to the long range of gamma rays, scanners based on gamma detection have spatial resolution of at least several millimetres, even with the smallest collimators possible. Another appealing characteristic of this technology is that it may be used to image particles that do not release gamma rays and do not emit gamma rays.

REFERENCES

1. Decristoforo C, Zaknun J, Kohler B, Oberladstaetter M, Riccabona G. The use of electronic autoradiography in radiopharmacy. Nucl Med Biol 1997;24: 361–5.
2. Jeon SJ, Kim KM, Lim I, Song K, Kim JG. Pixelated scintillator-based compact radio thin layer chromatography scanner for radiopharmaceuticals quality control. J Instrum 2017;12: T11003.
3. Othman N, Talib Y, Kamal WHBW. Imaging Scanner Usage in Radiochemical Purity Test. Nucl Tech Conv 2011.
4. Maneuski D, Giacomelli F, Lemaire C, Pimlott S, Plenevaux A, Owens J, et al. On the use of positron counting for radio-Assay in nuclear pharmaceutical production. Appl Radiat Isot 2017;125:9–14. 10.1016/j.apradiso.2017.03.021.
5. Park JC, An GI, Park S-I, Oh J, Kim HJ, Ha YS, et al. Luminescence imaging using radionuclides: a potential application in molecular imaging. Nucl Med Biol 2011;38:321–9. 10.1016/j.nucmedbio.2010.09.003.