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Thin-Layer Radiochromatography

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I. INTRODUCTION

Thin-layer chromatography (TLC) as it is applied today was developed in the 1950s. Standardization of sorbents and layer preparation led to wide application of TLC in analytical laboratories (1,2). The main advantages of this separation method are its simplicity, low cost, and flexibility, and therefore it is now a general laboratory tool similar to titration, crystallization, and so on. Instrumentation for TLC resulted in automated sample application and development and thus good reproducibility. Modern scanning and video instruments can achieve accurate and precise recording of the separated constituents and quantification of chromatograms.

With the advent of high-performance liquid chromatography (HPLC) in the 1970s, however, a competitive method became available that attained higher resolution and sensitivity. As a result, a decline in the use of TLC was experienced. This is also true for radiochromatography, because HPLC with radiodetectors provides a convenient quantification method. In the past, separation of radiolabeled compounds was quite often achieved with good resolution by TLC; nevertheless, separation without loss in resolution was feasible only with film autoradiography. Quantification was performed then by zonal analysis, which is a time-consuming and tedious procedure. So, in most cases, on-line radio-HPLC systems proved to be superior to the radio-TLC procedure.

Over the last few years, the technologies for detection of radioactivity in TLC have been greatly improved. Today, separated mixtures can be detected without a significant loss in resolution, enabling in situ quantification of chromatograms. Moreover, these new radioimaging detectors provide higher sensitivity than that of HPLC detectors. A number of advantageous characteristics of TLC can be utilized; namely, in each experiment fresh sorbent is used, and it is suitable for fast method development and serial analysis. In addition, during TLC no sample loss due to irreversible absorption on the column can take place; therefore, the entire sample is detected (with the exception of infrequent cases when volatile constituents are present). As a result of this, a combination of planar chromatography or overpressured layer chromatography (TLC/OPLC) with radioactivity detection can be successfully used as an independent method for the analysis of radiolabeled mixtures or can serve as an excellent complementary method to radio-HPLC.

A number of recent publications have reviewed radiochromatography, including detection in TLC (3–11). This chapter reviews the development and current status of planar radiochromatography. The advantages and disadvantages of the various detection methods are outlined, plate characteristics and handling of the layers are discussed briefly, and a few applications of TLC using radioactivity detection are illustrated.

Hyphenated techniques of planar radiochromatography and other radiochromatographic techniques are also reviewed, including a multiaspect comparison of techniques for different detection possibilities from soft beta- to gamma-emitting isotopes (6,11,12).