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Basic TLC Techniques, Materials, and Apparatus

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I. INTRODUCTION AND HISTORY

The purpose of this chapter is to present an overview of all important aspects of thin-layer chromatography (TLC). It briefly reviews information and provides updated references on topics covered in the remaining chapters in Part I and refers readers to the specific chapters. It treats topics that are not covered in separate chapters, such as sampling and sample preparation and the more classical procedures of TLC, in more detail. A suggested source of additional information, both basic and advanced, on the practice and applications of TLC is the primer written by Fried and Sherma (1).

A. Introduction to TLC

Thin-layer chromatography and paper chromatography comprise "planar chromatography." TLC is the simplest of all the widely used chromatographic methods to perform. A suitable closed vessel containing solvent and a coated plate are all that are required to carry out separations and qualitative and semiquantitative analysis. With optimization of techniques and materials and the use of available commercial instruments, highly efficient separations and accurate and precise quantification can be achieved. Planar chromatography can also be used for preparative-scale separations by employing specialized layers, apparatus, and techniques.

Basic TLC is carried out as follows. A small aliquot of sample is placed near one end of the stationary phase, a thin layer of sorbent, to form the initial zone. The sample is then dried. The end of the stationary phase with the initial zone is placed into the mobile phase, usually a mixture of two to four pure solvents, inside a closed chamber. If the layer and mobile phase were chosen correctly, the components of the mixture migrate at different rates during movement of the mobile phase through the stationary phase. This is termed development of the chromatogram. When the mobile phase has moved an appropriate distance, the stationary phase is removed, the mobile phase is rapidly dried, and the zones are detected in daylight or under ultraviolet (UV) light with or without the application of a suitable visualization reagent.

Differential migration is the result of varying degrees of affinity of the mixture components for the stationary and mobile phases. Various separation mechanisms are involved, the predominant forces depending upon the exact properties of the two phases and the solutes. The interactions involved in determining chromatographic retention and selectivity include hydrogen bonding, electron-pair donor/electron-pair acceptor (charge transfer), ion–ion, ion–dipole, and van der Waals interactions. Among the latter are dipole–dipole (Keesom), dipole–induced dipole (Debye), and instantaneous dipole–induced dipole (London) interactions.

Sample collection, preservation, and purification are problems common to TLC and all other chromatographic methods. For complex samples, the TLC development will usually not completely resolve the analyte from interferences unless a prior purification (cleanup) is carried out.