Thin Layer Chromatography in Drug Analysis

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Opinion Article

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INTRODUCTION

Pharmaceutical analysis is a very wide topic that includes drug identification, identity confirmation, checking quality of drug formulations, quantitative estimation in various matrices and decomposition studies. It also covers analysis of xenobiotics, toxins, and pesticides in various sources, including the environment. APIs, excipients (substances that act as the foundation of tablets or other formulations), breakdown products, and contaminants left over from drug manufacturing, and metabolites are all included in drug analysis. Many analytical methods are used in drug analysis, including separation techniques and Thin Layer Chromatography (TLC) can be used in a very broad context in drug analysis and plays an important role in drug control.

ABOUT THE STUDY

Thin layer chromatography is a separation technique in which the separation process occurs in a uniform planar layer of sorbent placed on a glass or aluminium plate or plastic sheet. The sorbent is called the stationary phase. The plate is immersed in the mobile phase, which is usually a mixture of two to four solvents, and developed vertically or horizontally during the analysis. Depending on the nature of the sorbent, the separation process might be caused by adsorption (e.g., hydrogen bond interactions), partitioning between the stationary and mobile phases, or ion exchange. After development, compounds can be visualized and identified by their natural color or fluorescence, quenching of fluorescence on a layer containing a fluorescent indicator, or by creating colored spots after treating the plate with a chromogenic detection reagent by spraying, dipping, or exposure to vapours. The fact that TLC does not require any expensive equipment and that commercially available plates can be manufactured in almost any laboratory is the fundamental reason for its continued popularity. The strength of retention is determined by a drug's structure, and variances in retention are the primary cause of separations. Because there's a minimal probability that two drugs in a well-chosen chromatographic system with the stationary phase and mobile

phase will have the same retention behaviour, the identity of the drug can be established by comparing the retention in many systems to a reference standard. Additionally, after spraying with detection reagents, the drug in the sample and the reference drug should produce spots of the same colour. Although a recent trend in TLC involves mass spectrometry detection as additional proof of the identity of a com-pound, this approach is used very rarely. If a pure reference standard is available, one can be almost certain about the identity of an unknown drug after examining retention and visualization behaviour. However, it is questionable which of the "many systems" should be used for identification. Despite the fact that several "standard TLC systems" for a broad range of compounds were presented in the literature, TLC's continual evolution led in studies recommending ideal TLC systems for separation and identification of all drug categories. TLC can also be used for purity testing. Recommended TLC conditions for purity testing can be found in the literature for practically any medication (separation of the API and impurities or degradants). The existence of degradants can be proven by seeing additional spots on the plate, and their identity can be confirmed as described earlier if the references are available.

CONCLUSION

TLC allows for quantitative examination by scanning the plate with a densitometer or videoscanner. This enables precise and accurate drug determination in tablets, capsules, solutions, ointments, and many other formulation types. The detection and quantification limits also have to be evaluated. In the vast majority of circumstances, it is easy to meet all needed validation requirements while achieving outcomes that are comparable to, or marginally worse than, those obtained using other, far more complicated procedures. The International Conference on Harmonization (ICH) sets the current requirements, and most of the methods in the literature are created and validated to meet these requirements. The analysis of biological material by TLC (e.g., examining the drug levels in plasma) is quite rarely reported, due to required complicated extraction and clean up procedures and some difficulties with insufficiently low detection limits.

One can separate and detect contaminants and drug degradation using a selective TLC technique, which is critical in drug quality monitoring. The selectivity (peak purity), precision, accuracy, linearity, robustness, and ruggedness of TLC analytical procedures must all be confirmed. TLC's principal application in drug analysis, aside from identification and purity tests, is drug formulation management. Small amounts of solvents can be used to perform TLC in the field. The major areas of interest in the use of TLC in drug control are resource-constrained countries, where a large number of innovative applications have been observed. In the case of applications not having quantitative analysis (e.g., drug identification), TLC can significantly outperform the other methods due to its low cost and simplicity.