High-performance thin-layer chromatography with a controlled eluent velocity – possibilities, limitations, and future

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Pharmaceutical or biomedical research requires a simple but functional tool for rapid and parallel analysis of numerous samples. More and more complex biomedical analyzes force the continuous development of separation techniques. Among them, chromatographic techniques occupy a very important place. In screening-type analysis, thin-layer chromatography is chosen more willingly than other chromatographic techniques because of the simplicity, high throughput and multiple detection. On the other hand, thin-layer chromatography has limitations e.g. chromatograms cannot be developed at optimal mobile phase velocity necessary for maximum efficiency. Initially the mobile phase velocity is too fast, then (with increasing development distance) it becomes too slow. An alternative may be the new approach to the development of thin-layer chromatograms: flexible mobile phase delivery onto the surface of the adsorbent layer by the prototype device with moving pipette combined with precise syringe pumps. The pipette is driven into movement by computer controlled modified 3D printer mechanism. Delivery of the mobile phase to the adsorbent layer could be equal to or lower than that of conventional development. Therefore chromatograms can be developed with optimal mobile phase velocity, adjusted to its absorption rate by the adsorbent layer. It is especially advantageous for short development distances. Thin-layer isocratic and gradient (also a pH gradient) chromatograms of tested substances with biological activity were obtained with a controlled eluent velocity with the prototype device. The advantages, disadvantages, and prospects for the future of the presented device will be discussed.

Recent Publications:

1. Hałka-Grysińska, A. Cyrta, T.H. Dzido, Reversed-phase stepwise gradient thin-layer chromatography of test dye mixtures with controlled developing solvent velocity, J. Chromatogr. A. (2020).
2. Hałka-Grysińska, K. Skop, A. Klimek-Turek, M. Gorzkowska, T.H. Dzido, Thin-layer chromatogram development with a moving pipette delivering the mobile phase onto the surface of the adsorbent layer, J. Chromatogr. A. (2018).
3. R.L. Gwarda, A. Halka-Grysinska, K. Pawelek, T. Baj, T.H. Dzido, Stepwise gradient thin-layer chromatography of chamomile anthodium essential oil with the single void volume of the mobile phase, J. Planar Chromatogr. - Mod. TLC. (2017).

4. Halka-Grysińska, R.L. Gwarda, K. Pawelek, T. Baj, T.H. Dzido, Reversed-phase stepwise gradient thin-layer chromatography of 19 test dye mixtures with a single void volume of the mobile phase, J. Planar Chromatogr. - Mod. TLC. (2017).
5. Hałka-Grysińska, T.H. Dzido, E. Sitarczyk, A. Klimek-Turek, A. Chomicki, A new semiautomatic device with horizontal developing chamber for gradient thin-layer chromatography, J. Liq. Chromatogr. Relat. Technol. (2016).

Biography

Adrian Szczyrba, student of the sixth year of pharmacy, member, and leader of Student Research Group. He is interested in separation techniques, advances in chromatography, and the application of chromatography techniques in pharmaceutical sciences.