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Analytica-2015: LC/MS method transfer surprises and troubleshooting - Eduard Rogatsky - Yeshiva University

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Different chromatographic and mass spectrometry instrumentations are used in modern bioanalytical laboratories. We noticed that transfer of existent liquid chromatography-mass spectrometry method from one LC/MS system to another is not a simple task. In addition, even adoption of an already published and well validated method is not as straightforward as one would expect. On real world examples, we will discuss instrument-dependent, sample-dependent, and method-dependent variability and implications. To solve these issues, it requires detailed understanding of the method, hardware, assay parameters and analyte nature.

Liquid chromatography–mass spectrometry (LC-MS) is an analytical chemistry technique that combines the physical separation capabilities of liquid chromatography (or HPLC) with the mass analysis capabilities of mass spectrometry (MS). Coupled chromatography - MS systems are popular in chemical analysis because the individual capabilities of each technique are enhanced synergistically. While liquid chromatography separates mixtures with multiple components, mass spectrometry provides structural identity of the individual components with high molecular specificity and detection sensitivity. This tandem technique can be used to analyze biochemical, organic, and inorganic compounds commonly found in complex samples of environmental and biological origin. Therefore, LC-MS may be applied in a wide range of sectors including biotechnology, environment monitoring, food processing, and pharmaceutical, agrochemical, and cosmetic industries.

In addition to the liquid chromatography and mass spectrometry devices, an LC-MS system contains an interface that efficiently transfers the separated components from the LC column into the MS ion source. The interface is important because the LC and MS devices are fundamentally incompatible. While the mobile phase in a LC system may be a pressurized liquid, the MS analyzers commonly operate under high vacuum (around 10−6 torr / 10−7 "Hg). Thus, it's impossible to directly pump the eluate from the LC column into the MS source. Overall, the interface may be a mechanically simple a part of the LC-MS system that transfers the most amount of analyte, removes a major portion of the mobile phase utilized in LC and preserves the chemical identity of the chromatography products (chemically inert). As a requirement, the interface shouldn't interfere with the ionizing efficiency and vacuum conditions of the MS system. Nowadays, most extensively applied LC-MS interfaces are based on atmospheric pressure ionization (API) strategies like electrospray ionization (ESI), atmospheric pressure chemical ionization (APCI), and atmospheric pressure photo-ionization (APPI).These interfaces became available within the 1990s after a two decade long research and development process.

Liquid chromatography is a technique for physical partition wherein the segments of a fluid blend are circulated between two immiscible stages, i.e., fixed and portable. The act of LC can be separated into five classifications, i.e., adsorption chromatography, partition chromatography, ion-exchange chromatography, size-exclusion chromatography, and affinity chromatography. Among these, the most broadly utilized variation is the reverse phase (RP) method of the partition chromatography strategy, which utilizes a non-polar (hydrophobic) fixed stage and a polar portable stage. In like manner applications, the mobile phase is a blend of water and other polar solvents (e.g., methanol, isopropanol, and acetonitrile), and the fixed lattice is set up by joining long-chain alkyl gatherings (e.g., n-octadecyl or C18) to the surface of irregularly or spherically shaped 5 µm diameter silica particles.

Biography

Eduard Rogatsky is a senior faculty member at Albert Einstein College of Medicine (Bronx, NY). He is also the Director of mass spectrometry at the Biomarker Analytical Resource Core as part of the Harold and Muriel Block Institute for Clinical and Translational Research at Albert Einstein and Montefiore medical centers. He has been in the field of chromatography for more than 20 years and has 14 years of experience in clinical mass spectrometry. Currently, he serves as the Editorin- Chief for the Journal of Chromatography and Separation Techniques (OMICS Publishing Group). During the last 10 years (from 2005), he has published over 30 scientific papers in per-reviewed journals (mostly as the first author) and has presented over 50 posters and lectures. Overall, he has made more than a hundred scientific presentations and publications. He completed his MSc in Physical Chemistry at Belarus State University (former USSR) in 1990. He completed his PhD in Bioanalytical Chemistry (Bar-Ilan University, Israel) in 1998. At the end of 1999, he started his Post-doctorate at Albert Einstein College of Medicine and became a faculty member is 2001. Presently, he holds the title of Research Associate Professor of Medicine.

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