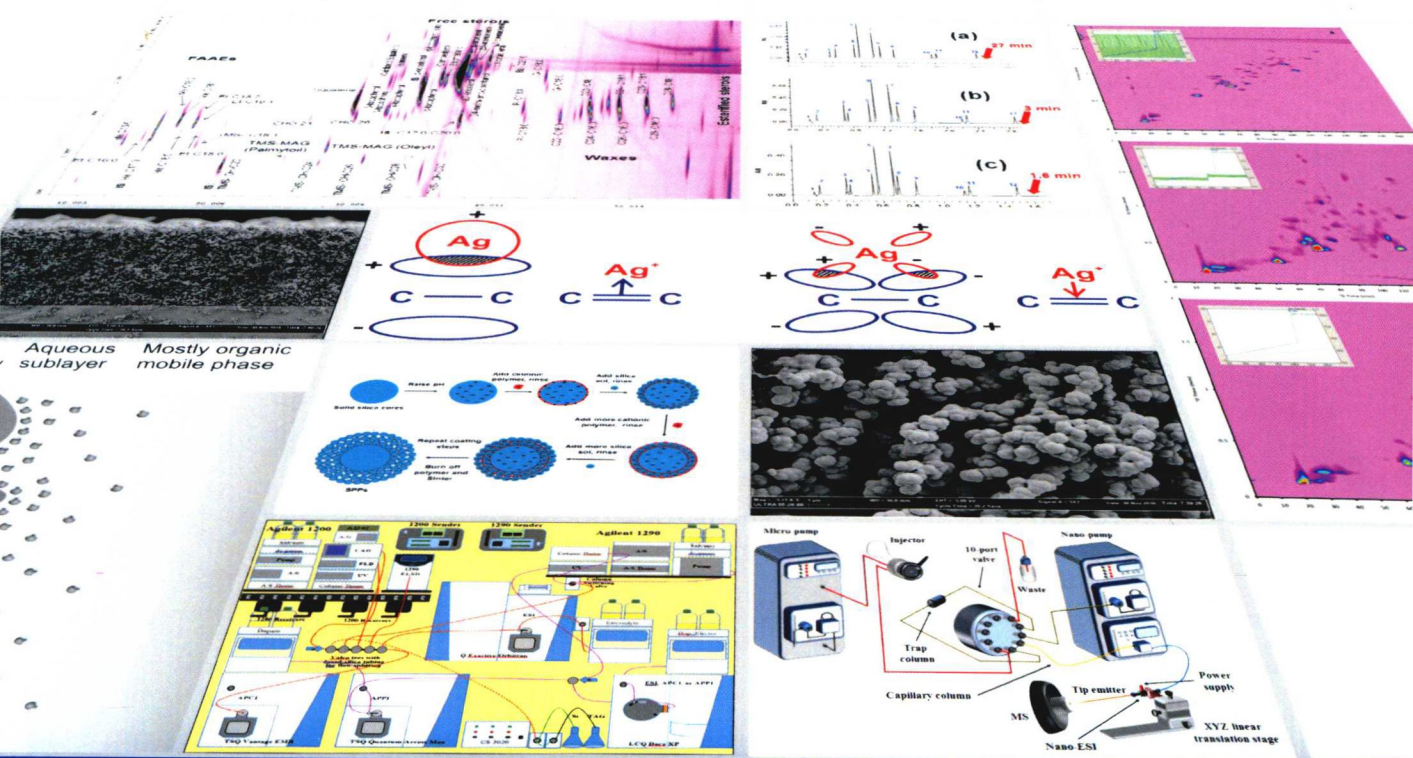


Handbook of Advanced Chromatography/ Mass Spectrometry Techniques



Handbook of Advanced Chromatography/ Mass Spectrometry Techniques

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Handbook of Advanced Chromatography/Mass Spectrometry Techniques is a compendium of new and advanced analytical techniques that have been developed in recent years for analysis of all types of molecules in a variety of complex matrices, from foods to fuel to pharmaceuticals and more. Focusing on areas that are becoming widely used or growing rapidly, this is a comprehensive volume that describes both theoretical and practical aspects of advanced methods for analysis. Written by authors who have published the foundational works in the field, the chapters have an emphasis on lipids but reach a broader audience by including advanced analytical techniques applied to a variety of fields.

Handbook of Advanced Chromatography/Mass Spectrometry Techniques is the ideal reference not only for those just entering the analytical fields covered but also for those experienced analysts who want a combination of an overview of the techniques plus specific and pragmatic details not often covered in journal reports. The authors provide, in one source, a synthesis of knowledge that is scattered across a multitude of literature articles. The combination of pragmatic hints and tips with theoretical concepts and demonstrated applications provides both breadth and depth to produce a valuable and enduring reference manual. It is well suited for advanced analytical instrumentation students as well as for analysts seeking additional knowledge or a deeper understanding of familiar techniques.

Key Features

- Includes UHPLC, HILIC, nano liquid chromatographic separations, two-dimensional LC-MS (LCxLC), multiple parallel MS, 2D-GC (GCxGC) methodologies for lipids analysis, and more.
- Contains both practical and theoretical knowledge, providing core understanding for implementing modern chromatographic and mass spectrometric techniques.
- Presents chapters on the most popular and fastest-growing new techniques being implemented in diverse areas of research.

Related Titles

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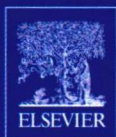
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*To my wife Martina and sons Filip and
David for their patience and continuous support of my scientific work.
— Michal Holčapek*

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Preface

Six years have already passed since the publication of our previous book *Extreme Chromatography: Faster, Hotter, Smaller*. New developments in the coupling of separation techniques with mass spectrometry (MS) have advanced quickly, therefore we have assembled this up-to-date compendium of new and advanced analytical techniques that have been developed in recent years for the analysis of various types of molecules in a variety of complex matrices. The major reason for this fast progress in our field is the instrumental advancements in both MS and chromatography. The liquid chromatography/mass spectrometry (LC/MS) market is extremely competitive, and multiple vendors are offering new or improved hardware and software solutions that are the basis for development of new analytical methods with better sensitivity, selectivity, high-throughput, and other important analytical characteristics. High-resolution mass spectrometers coupled to chromatographic systems were much less widespread a decade ago. Nowadays, it is a common standard for many analytical groups to have multiple LC/MS systems including high-resolution time-of-flight-based mass analyzers or ultrahigh-resolution Fourier transform analyzers, in the form of Orbitrap or ion cyclotron resonance mass spectrometers. High resolution is typically accompanied by high mass accuracy on the condition of proper calibration procedures. It is evident that such dramatic improvements in the quality of mass spectrometric data provide new possibilities for an analytical chemist in terms of qualitative and quantitative analysis, but on the other hand it requires a much higher level of expertise for an analytical chemist. Therefore, we have to put more emphasis on the education of analytical chemists to enable them to fully explore the complexity of studied samples.

Advancements in the field of chromatography have surely not lagged behind developments in the MS world. The transition from conventional high-performance liquid chromatography (HPLC) to ultrahigh-performance liquid chromatography (UHPLC) is continuing, and nowadays UHPLC systems are dominating the field because of clear advantages in terms of speed, chromatographic resolution, and overall performance of the system (Chapter 1). A very strong partner and competitor to liquid chromatography is supercritical fluid chromatography (SFC, Chapter 12). Theoretical advantages of this technique have been known for decades, but it has not been fully explored until recent years because of the limitations of lower reproducibility and insufficiently robust coupling with MS. Now these issues have been successfully solved, and reliable commercial systems are now available, so we can expect further increases in the number of applications of SFC, or more accurately stated, ultrahigh-performance supercritical chromatography. It has been generally realized that biological systems are more complex than initially anticipated, so researchers also need more dimensions in chromatography (i.e., multidimensional chromatography, Chapters 7, 8 and 11) and MS (i.e., multidimensional MS, Chapter 10) to describe such complex systems in more detail. Continuous progress has been observed in stationary phase design (Chapter 6) and also in the introduction of new separation modes, such as hydrophilic interaction liquid chromatography (Chapter 2). Biological complexity also includes various types of isomerism, which requires dedicated chromatographic systems for their resolution, such as chiral chromatography (Chapter 3) and silver-ion chromatography (Chapter 4). Another important trend of the last decade is miniaturization, which results in the use of capillary or chip-based separation systems (Chapter 9). Monolithic columns have proved to be very efficient for various applications, as summarized in Chapter 5.

This book includes 12 chapters prepared by scientific leaders in particular fields, who carefully prepared or updated their chapters. We believe that this collection of up-to-date LC/MS, gas chromatography/mass spectrometry, and supercritical fluid chromatography/mass spectrometry techniques should help both newcomers and advanced practitioners to improve their theoretical knowledge and also encourage them to implement new technologies in practice. Individual chapters show advantages and limitations of individual methodologies, illustrated by practical examples of where these methods can be useful. We believe that this book should be a practical guide for the laboratory rather than just another dust-covered item in the library.

Michal Holčapek and William Craig Byrdwell

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