About the Editor

David S Hage

David S. Hage is the Hewett University Professor of Chemistry at UNL. His research interests involve the design and use of affinity-based separations in LC and miniaturized systems for clinical and pharmaceutical analysis. He has served as the editor for the *Handbook of Affinity Chromatography*, 2nd edition. He is an editor for the *Journal of Chromatography B* and is the lead author on a college textbook entitled *Analytical Chemistry and Quantitative Analysis*.

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Foreword

Advances in liquid chromatography: new developments in stationary phases and supports for drugs and bioanalytical applications

David S Hage

Liquid chromatography (LC) has been an important tool for the separation and analysis of drugs and biological molecules for decades. For example, this method is an essential component in drug discovery and in the characterization of drug metabolism and pharmacokinetics. In addition, LC is used to follow the treatment of patients with drugs and to monitor the purity and stability of drug formulations. Much of this previous work has been carried out by using particulate supports and the LC technique of reversed-phase chromatography (RPC). This book examines recent advances that have been made in both the supports and stationary phases that can be used in LC. Particular emphasis is given to newer LC methods that can be utilized for the separation and analysis of drugs, although some other applications are also considered.

Chapter 1 by Jim Taylor describes new developments that have taken place in RPC, which remains the most popular type of LC for many pharmaceutical and bioanalytical applications. Chapter 2 by Joseph Pesek examines the method of aqueous normal-phase chromatography, in which compounds can be retained through a combination of reversed-phase and normal-phase separation modes. In Chapter 3, Robert MacNeill discusses hydrophilic interaction liquid chromatography, which is complimentary to RPC in that it can be used to retain compounds that are ionizable or that have a relatively hydrophilic nature. In addition, the use of RPC with micelles added to the mobile phase, an approach known as micellar liquid chromatography, is reviewed in Chapter 4.

Several alternative separation modes in LC are also explored. One example is immunoaffinity chromatography (IAC, Chapter 5, David Hage), in which an immobilized antibody or antibody-related binding agent is used to selectively isolate or measure a given target. Another example is a chiral stationary phase (CSP, Chapter 6, Min Meng), which can occur in various forms and is used to separate chiral drugs or other chiral targets. Recent advances in ion exchange chromatography, such as used for the separation of biopharmaceutical agents based on proteins or oligonucleotides, are discussed in Chapter 7 by Ken Cook. Furthermore, the use of on-line restricted access media with LC and mass spectrometry for drug analysis is described in Chapter 8 by Kevin Schug.

Various developments in support materials for LC are also examined throughout this book. This includes the method of ultra performance liquid chromatography or ultra high-performance liquid chromatography, which is discussed in many of the chapters. Chapter 9 by Pranav Shrivastav focuses on the development of particles with diameters below 2 μm , as have been employed in ultra high-performance liquid chromatography. Chapter 10 by Samanidou discusses core-shell particles and fused-core particles, which have also been of interest in the creation of more rapid or efficient separations in LC.

An overview is provided throughout this book on the current status of these recent developments in supports and stationary phases, particularly as related to drugs and related targets. Besides acquiring background information on each topic and a description of current applications, the reader will obtain a glimpse of how these developments are expected to affect the future of LC by providing faster, more efficient or more selective methods for bioanalysis.

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