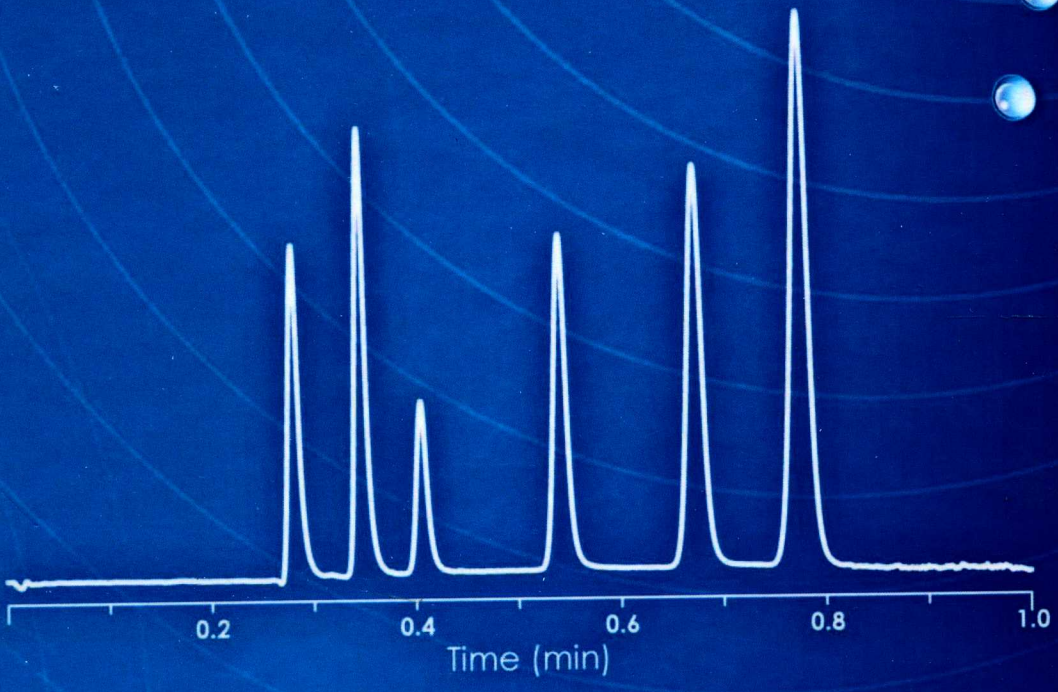
Hydrophilic Interaction Liquid Chromatography (HILIC) and Advanced Applications



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Preface

This book on hydrophilic interaction liquid chromatography (HILIC) applications is a result of the increasing interest among the separation science community in the latest chromatography technologies for isolation and purification of various chemicals. HILIC is a variation of normal-phase chromatography with the added advantage that organic solvents that are miscible in water can be used. It uses polar materials, such as amino, cyano, diol, and silanol, as its stationary phase and, thus, is sometimes referred to as "reverse reversed-phase" or "aqueous normal phase" chromatography. HILIC provides the following benefits compared to other chromatographic separation modes:

- High organic content mobile phases result in a lower operating back pressure, allowing higher flow rates to be used in high-throughput analysis.
- The high organic solvent concentration in the mobile phase leads to a higher sensitivity for LC/MS analyses due to significantly increased ionization.
- Significant improvement of peak shape and sensitivity results in more accurate and precise quantitation of polar compounds such as peptides and nucleic acids.
- Polar analytes that would be un-retained by reversed-phase chromatography are retained by HILIC.
- Capability of direct injection of solid phase extraction (SPE) or liquid–liquid extracts into the HILIC columns increases analytical throughput and facilitates sample preparation.

The HILIC concept was first introduced by Dr. Andrew Alpert in his 1990 paper. A large number of scientific papers on this subject have been published since then. This book comprehensively and systematically describes the new technology and provides detailed information and discussion on the most advanced HILIC applications in the fields of environmental sciences, food analysis, clinical chemistry, pharmaceutical research, and biotechnology discovery. Although the theory behind HILIC is not fully understood and commercial HILIC columns have limited availability, the extensive applications that we witness today have already made HILIC a unique device in the chromatography toolbox for most separation scientists. We hope that our readers will find this book to be a valuable resource for their projects ranging from academic research to industrial applications.

We are indebted to several people who assisted us during the preparation and editing of this book. We were extremely fortunate to have had the cooperation of dedicated, well-known contributing authors. Their relentless efforts and sincere scientific drive have made this book possible.

Editors

Dr. Perry G. Wang is a research chemist at the Office of Regulatory Science, Center for Food Safety and Applied Nutrition, Food and Drug Administration (FDA). His interests include analytical method development and validation for drugs and constituents in foods and cosmetic products using advanced instrumentation. His expertise focuses on high-throughput drug analysis by LC/MS/MS for the pharmaceutical industry.

Dr. Wang has recently published two books: *High-Throughput Analysis in the Pharmaceutical Industry* (published by CRC Press in October 2008) and *Monolithic Chromatography and Its Modern Applications* (published by ILM Publications in October 2010). He is currently coediting another book entitled *Identification and Analysis of Counterfeit and Substandard Pharmaceuticals* with ILM Publications, which is scheduled for publication in May 2011.

Dr. Wang has been invited to prepare, organize, and preside over symposia for the Pittsburg Conference (PittCon) and American Chemistry Society (ACS) annual meetings. He has been an invited speaker at numerous international conferences including the PittCon, the Federation of Analytical Chemistry and Spectroscopy Societies (FACSS), the Beijing Conference and Exhibition on Instrumental Analysis (BCEIA), and the International Symposium on Chemical Biology and Combinatorial Chemistry (ISCBCC). He has also been invited to teach short courses on high-throughput method development for drug analysis by LC/MS/MS at the PittCon, ACS, and at the Eastern Analytical Symposium (EAS). His current research focuses on developing analytical methods for the determination of constituents in cosmetics and dietary supplements.

Dr. Wang received his BS in chemistry from Shandong University, and his MS and PhD in environmental engineering from Oregon State University, Corvallis, Oregon.

Dr. Weixuan He is currently an associate director, Product and Process Development, at Meda Pharmaceuticals (formerly MedPointe Pharmaceuticals) located in North Brunswick, New Jersey. He is responsible for designing and conducting analytical investigations and experiments to support Meda Pharmaceuticals' product development, as well as providing technical services to ensure commercial manufacturing processes are in compliance with regulatory requirements. He also focuses on developing analytical methods using a variety of new technologies to support pharmaceutical product development.

Prior to joining Meda Pharmaceuticals in 2002, Dr. He was a senior research investigator at Bristol Myers Squibb, specializing in process development for isolation and purification of active pharmaceutical ingredient (API) from reaction mix, natural products from fermentation or biotransformation media, and diastereomer from stereoisomer mixtures. He successfully isolated and characterized various

process impurities, degradants, metabolites, and natural products using modern isolation technologies and spectroscopic methods.

Before starting his career in the pharmaceutical industry in 1994, Dr. He earned his doctorate degree in organic chemistry from Oregon State University in Corvallis, Oregon, and completed his postdoctoral training in biomedical research at The Johns Hopkins University in Baltimore, Maryland.

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