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silica 2.2.2.4 Negatively charged derivatized silica 2.2.3 Non-silica phases 2.2.3.1 Amino phases 2.2.3.2 Sulfonated S-DVB phases 2.3 Commercial HILIC phases 2.3.1 Efficiency comparison 2.3.2 Retention and selectivity comparisons 2.4 Conclusions Chapter 3. HILIC Method Development 3.1 Introduction 3.2 General method development considerations 3.2.1 Method objectives 3.2.2 Sample consideration 3.2.3 Systematic method development 3.3 Method development strategies 3.3.1 Systematic approach to column screening 3.3.2 Optimization of method parameters 3.3.2.1 Final column selection 3.3.2.2 Organic solvents 3.3.2.3 Mobile phase pH 3.3.2.4 Buffer types and concentration 3.3.2.5 Column temperature 3.3.2.6 Sample solvents 3.4 Detection for HILIC methods 3.4.1 Mass Spectrometry detector (MS) 3.4.2 Charged aerosol detector (CAD) 3.5 Conclusions Chapter 4. Pharmaceutical Applications of Hydrophilic Interaction Chromatography 4.1 Introduction 4.1.1 Definition of the problem 4.1.2 Selection of conditions 4.1.3 Validation of the method 4.1.4 General references 4.2 Determination of Counterions 4.2.1 Salt selection and options for counterion determination 4.2.2 Specific counterion analysis 4.2.3 Counterion screening with gradient elution 4.2.4 Suitable reference standards for counterion analysis 4.3 Main Component Methods 4.3.1 Potency/assay methods 4.3.2 Equipment cleaning verification assays 4.3.3 Dissolution methods 4.4 Determination of Impurities 4.4.1 Impurity screening and orthogonal separations 4.4.2 Impurity identification 4.4.3 Specific impurity determination 4.4.3.1 Pyrimidines, purines, nucleosides 4.4.3.2 Hydrazines with ethanol as weak solvent 4.4.3.3 Neutral and charged polar impurities in a drug substance 4.4.3.4 Polar basic compounds and impurities 4.4.4 Statistical design of experiments (DOE) for optimization 4.5 Excipients 4.5.1 Parenteral and solution formulations 4.5.2 Tablets, capsules and inhalation products 4.5.3 Sugars 4.5.4 Stabilizers and antioxidants 4.6 Chiral Applications 4.6.1 Chiral selectors and HILIC 4.6.1.1 Cyclodextrins 4.6.1.2 Macrocyclic antibiotics 4.6.1.3 Chiral crown ethers 4.6.1.4 Cyclofructans 4.6.2 Conclusions for chiral separations 4.7 Conclusions Chapter 5. Hydrophilic Interaction Chromatography (HILIC) for Drug Discovery 5.1 Drug Discovery Model 5.2 HILIC Applications for in vitro Biology 5.2.1 Biological screening and hit finding 5.2.1.1 Target selection and assay validation 5.2.1.2 High-throughput screening 5.2.2 New drug discovery strategies 5.3 HILIC Applications and Advances for Discovery Chemistry 5.3.1 Lead identification 5.3.2 Lead optimization 5.3.2.1 ADME profile 5.3.2.2 Biopharmaceutics 5.3.2.3 Chiral purity 5.3.3 Candidate selection 5.4 Practical Considerations 5.5 Conclusions Chapter 6. Advances in Hydrophilic Interaction Chromatography (HILIC) for Biochemical Applications 6.1 Introduction 6.2 Carbohydrates 6.2.1 Mono- and disaccharides 6.2.2 Oligosaccharides and polysaccharides 6.2.3 Glycans 6.2.3.1 Glycan and glycopeptide analysis 6.2.3.2 HILIC for sample enrichment 6.3 Nucleobases and Nucleosides 6.4 Oligonucleotides 6.5 Amino Acids and Peptides 6.6 Proteins 6.7 Phospholipids 6.8 Conclusions Chapter 7. HILIC-MS for Targeted Metabolomics and Small Molecule Bioanalysis 7.1 Introduction 7.2 The role of HILIC-MS in targeted metabolomics versus other LC modes 7.3 Strategies for method development based on retention behavior of targeted metabolites on HILIC stationary phases 7.3.1 Retention behavior of metabolites on HILIC stationary phases 7.3.2 Robustness, mobile phase compositions, and matrix effects 7.4 Summary Chapter 8. HILIC for Food, Environmental, and Other Applications 8.1 Introduction 8.2 Food applications for HILIC 8.2.1 Review of HILIC analytical methods for food analysis 8.2.1.1 Sample preparation in HILIC methods applied to food matrices 8.2.1.2 HILIC methods applied to food

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