

## Index

### a

- acetonitrile polymerization 304
- active inlet valve (AIV) 233, 304
- active pharmaceutical ingredients (API) 313
- adaptive thermal effect compensation (ATEC)
  - parallel dual-piston design 137
  - piston movement 135
  - retention time precision 137
- adenosine-5'-monophosphate (AMP) 256
- Agilent systems 277, 306
- Agilent Technologies 288
  - analytical range enlargement 321
  - autosampler techniques 319
  - bio-inert HPLC systems 327
  - biopharmaceutical applications 327
  - DAD techniques 319
  - dedicated and “specialized” UHPLC systems 326
  - detector linearity 327
  - established methods 323
  - faster separations 319
  - GPC 321
  - Heart-Cutting 2D LC 322
  - higher user-friendliness 323
  - HILIC 321
  - HPLC systems 319
  - IEX 321
  - 1290 Infinity II Multisampler 319
  - ISET 325
  - laboratory’s efficiency 321
  - multiple Heart-Cutting 2D-LC system 323
  - NP 321
  - “peak parking” technique 323
  - quaternary gradient systems 325
  - refractoric and thermal effects, elimination of 319
  - reversed phase chromatography 321
  - SEC 321
  - SFC-UHPLC hybrid system 322
  - smart software interface 323
  - software-controlled solutions 326
- Allotrope Foundation 277
- antineoplastic drugs 287, 295
- APCI, *see* atmospheric pressure chemical ionization (APCI)
- ApexTrack Integration Algorithm in Empower 272
- atmospheric pressure chemical ionization (APCI) 173, 204
- autosampler column compartment module (ACC-3000) 340
- autosamplers
  - advantages and disadvantages 40
  - design 35
  - fixed-loop 36
  - flow-through 38
  - injection valves 239
  - materials 238
  - practical aspects 241
  - sample needles, vails and closures 238
- axial mixing 105

**b**

- ballistic gradients 137
- binary pump 103, 338
- Blend Assist 326
- bovine serum albumin (BSA) 250, 255

**c**

- cam driven pumps 124, 125
- capillary tubing 243–245
- charged aerosol detection (CAD) 344
- chromatographic laboratory, UHPLC application
  - (bio)polymers, separation of 316
  - 2D-HPLC 315
  - analytes 312
  - conventional HPLC 312
  - dissolution tests, pharmaceutical industry 313
  - LOQs 312
  - method development and optimization 314
  - restrictions 313
  - solid phase extraction 312
  - typical “classical” liquid chromatographic analysis 314
- chromatography data systems (CDS) 333
  - data exchange 277
  - ease of use 274
  - functionality and handling 271
  - global network solution 278
  - import and export, data 278
  - instrument control 273
  - integration 272
  - multilingual 276
  - operating system 274
  - software placement 278
  - user interface 275
- Chromeleon software 216, 279, 346
- Chromeleon’s SmartPeaks Integration 272
- ChromSquare software 216
- column oven 41
- column performance testing 95
- column thermostats
  - equilibration 52
  - frictional heat

- band broadening 68
- concentration profiles 67
- decompression cooling 63
- HPLC separation 65
- hydraulic power 62
- isocratic UHPLC separation 63
- isothermal and adiabatic mode 67
- radial temperature gradient 64
- retention processes 67
  - temperature distributions 64
- mobile phase temperature 57
- radial temperature gradients 54
- separation efficiency 53
- separation temperature 52
- temperature control 53
- thermal modes 52, 55
- thermostatic control 68
- Comma-separated Values (CSV) 283
- coupled phase system 294
- crevice corrosion 226
- cryo-focusing technique 346
- cycle time 179
- cyclophosphamide 211

**d**

- dead volumes 2, 20
- diamond-like carbon (DLC) 240, 341
- diode array detectors (DAD) 309, 319
- Dionex 335
- Dionex UltiMate 3000 216
- direct nano-flow generation technique 335
- dispersion volume 2, 177, 288, 297, 345
- Dolan method 148
- Dual Needle Technology 320
- duty cycle time 179
- dwel volume, *see* gradient delay volume
- dynamic mixers 150

**e**

- EASY-nLC system 335
- Eksigent control software 216
- electrospray ionization (ESI) 86, 204, 297
- Empower® 308, 310, 333
- enrichment technique 293

- environmental screening analyses 214  
erosion corrosion 226  
erucamide 230  
ESI, *see* electrospray ionization (ESI)  
ethylene chloro-trifluoroethylene  
  copolymer (ECTFE) 230  
ethylene diaminetetraacetic acid  
  (EDTA) 256, 260  
ethylene-tetrafluoroethylene (ETFE)  
  240  
evaporative light scattering detectors  
  (ELSD) 344  
extra column volume 2, 30, 34, 43, 46  
extra-column dispersion, UHPLC  
  systems  
  column peak volume 76  
  column efficiency and resolution  
  74  
  column performance testing 95  
  factors 73  
  fast gradient separations 96  
  fittings and connections 83  
  gradient separations 92  
  heat exchangers 84  
  high gradient separations 96  
  injection system 79  
  isocratic separations 90, 95  
  mass spectrometers 86  
  optical detectors 85  
  sources 78  
  tubing 81  
  volume with column 89  
  volume without column 88
- f**
- fast chromatography 316  
fast gradient separations 96  
fast separation 2, 12  
ferrule-based systems 338  
fixed-loop autosamplers 36, 40, 41  
flow-through autosamplers 38, 40, 41  
flow-through-needle (FTN) design 79,  
  80, 89, 90, 95, 340  
fluorinated ethylene propylene (FEP)  
  230  
forced air principle 342  
forced air thermostats 55, 56
- g**
- gas osmosis 301  
GC Image software 216, 217  
gel permeation chromatography (GPC)  
  321  
“gel plot” 346  
good separation 2  
gradient delay volume (GDV) 34, 102,  
  342  
  autosampler fluidics 156  
  axial vs. longitudinal mixing 158  
  binary pumps 103  
  Dolan test 148, 156, 158  
  dwell volumes 161  
  dynamic mixers 150  
  gradient shaping 156  
  inlet-weaver 153  
  longitudinal mixing 152  
  marker pulse method 145  
  microfluidic mixers 153  
  mixer damping effectiveness 159  
  pump blocks 154  
  quaternary pumps 103  
  radial mixing 151, 152  
  rules 144  
  SpinFlow™ mixer 158  
  static mixers 150  
  trifluoroacetic acid (TFA) gradient  
  amplitude 163  
  baseline detector for mixers 164  
  baseline ripple amplitude 165  
  HPG pump 165, 166  
  LPG pumps 167  
  pre-mixing 166  
  UV-spectra 162  
UHPLC system  
  acetone 284  
  backpressure regulator 282  
  chromatogram 282  
  CSV 283  
  elevated temperatures 290  
  fused silica capillary 284  
  high pressure mixing system 281  
  high throughput separations 285  
  inline degasser 284  
  LVI 293  
  method transfer 287

- gradient delay volume (GDV) (*contd.*)
    - no-injection option 282
    - signal intensity 283
    - switching points 284
    - UHPLC separation 1 mm ID
      - columns 296
    - UV-absorbing substance 281
    - variable flow-through autosampler 282
  - gradient dwell volume, *see* gradient delay volume (GDV)
  - gradient elution
    - cam driven pump 124, 125
    - column stress and wear 115
    - discontinuous movement 126
    - excess volume in mixing solvents 107, 109
    - HPG pump
      - loop pre-compression 131
      - pulse damper 128, 129
      - stroke cycles 127
    - instrumental effects on outside pump 112
    - linear driven pump 124
    - LPG pump, immanent discontinuous generation 132
    - physicochemical effects, high
      - pressure on liquids 117
    - protein with mobile phase mixing
      - ripples 168
    - serial 1½-cylinder pump 122
    - single cylinder pumps 122
    - solvent degassing 120
    - speed up and down cycles 126
    - thermal effects in pumps 135
    - ultrafast method, steep/ballistic
      - gradients 137
  - gradient mixers 103, 126, 141, 150
  - gradient peak compression 115
  - gradient proportioning valve (GPV) 229, 231, 305
  - gradient separations 6, 9, 92
  - graphical user interface technique (GUI) 276
- h**
- heat exchangers 84
  - helium sparging 301
  - Hewlett Packard 1090 system 305
  - High Dynamic Range (HDR) 327
  - high gradient separations 96
  - high performance liquid
    - chromatography (HPLC)
      - autosampler, principles 306
      - conventional LC system 330
      - data processing 331
      - degasser, principles 301
      - different manufacturers and concepts 302
      - Ion Mobility 330
      - mass spectroscopic detectors 329
      - Peak Tracking 332
      - photodiode array detectors 330
      - pump, principles 303
      - 'ready to use' solution 331
      - stationary phases 329
      - supercritical fluid chromatography 331
      - UV detector, principles 308
      - web based application 333
  - high pressure gradient (HPG) pump 103, 105
  - high pressure mixing system 30, 32
  - human serum albumin (HSA) 255
  - hydrophilic interaction liquid
    - chromatography (HILIC) 293, 321
  - HyperCarb 205, 293
  - HyperCarb precolumn 294
- i**
- ifosfamide 211, 285
  - immobilized metal affinity
    - chromatography (IMAC) 256
  - 1290 Infinity II Multicolumn
    - Thermostat 320
  - inlet-weaver 153
  - inline degasser 302

- Instrument Control Frameworks (ICF) 273
- integrated modularity 336
- intelligent compensation algorithm, *see* adaptive thermal effect compensation (ATEC)
- Intelligent System Emulation Technology (ISET) 325
- iontrap mass spectrometry 213
- isocratic separations 5, 90, 95
- j**
- JetWeaver 153
- l**
- Laboratory Information Management System (LIMS) 278
- LabSolutions software 216
- large volume direct injection (LVDI) 205
- large volume injection (LVI) 293
- LC-MS hyphenation 176, 183, 185, 190
- linear driven pump 124
- liquid baths 54, 55
- liquid chromatographic laboratory, UHPLC application 316
- loop time 179
- low pressure gradient (LPG) pump 103, 105
- low pressure mixing system 30, 32
- lower limits of quantification (LOQ) 33, 312
- LVDI, *see* large volume direct injection (LVDI)
- m**
- marker pulse method 145
- matrix effect chromatogram 194
- metering pump 307
- microfluidic mixers 153
- Microsoft System Center Server 279
- mobile Chromeleon software app 337
- mobile *vs.* column phase temperature 57
- monolithic nano-HPLC column 190
- MRM, *see* multiple reaction monitoring (MRM)
- multi-channel gradient valve (MCGV) 305
- multiple reaction monitoring (MRM) 175, 179, 182, 185, 193
- multiple wave detector (MWD) 309
- Multiwash technology 320
- n**
- Nexera method scouting system 332
- Nexera series 216
- non-target screening 172
- normal phase chromatography (NP) 203, 253, 321
- o**
- OpenLab Laboratory Software Suite 327
- OpenLAB® 333
- “Open Source Software” 276
- optical detectors 85
- orthogonal separation system 215
- outgassing 121
- p**
- parallel pump 124, 125, 340
- passive layer
- BSA 250
  - chromium alloys
    - MP35N 252
    - stainless steel 251
  - corrosion resistance 249
  - titanium alloys 252
- PGC, *see* porous graphitic carbon (PGC)
- phosphate buffered saline (PBS) 251
- pitting corrosion 226
- poly aryl ether ketone (PAEK) 240
- polyether ether ketone (PEEK) 230, 246
- polytetrafluoroethylene (PTFE) 230
- porous graphitic carbon (PGC) 205, 293
- pre-column filters 114
- Proxeon 335

- pulled loop design 36, 37
  - pumps
    - higher compression heat 231
    - inlet- and outlet valves 231
    - piston seal 236
    - pistons 236
    - practical aspects 237
    - pump head
      - stainless steel 233
      - titanium alloys 235
  - pushed loop design 36, 37
- q**
- quality by design (QbD) models 332
  - quaternary pump 103
- r**
- radial mixing 105
  - radial temperature gradients 54, 59
  - retention time dependent MRM mode 181
  - retention time independent MRM mode 180
  - reversed-phase chromatography 293
  - Rheodyne 304, 306, 307
  - Ribbon Design 275
- s**
- screening approach, UHPLC with mass spectrometry 185
  - serial 1<sup>1</sup>/<sub>2</sub>-cylinder pump 122
  - shifted gradients 215, 323
  - Shimadzu i-Series/Controller Screen 333
  - single piston pumps 122
  - size exclusion chromatography (SEC) 321
  - SmartMix™ device 152
  - “software-islands” 273
  - solid phase extraction (SPE) 293, 348
  - solvent degassing 121
  - SpinFlow mixer 158, 160
  - static mixers 150
  - steep gradients 138
  - still air principle 343
  - stop-flow technique 202, 214
  - SunShell 205
  - supercritical fluid chromatography (SFC) 322
  - Supercritical Fluid Extractor (SFE) 332
  - suspected-target screening 172, 185
- t**
- target analysis 171
    - multicomponent method 179
    - multiple reaction monitoring (MRM) mode 179
  - Orbitraps 178
  - retention time dependent MRM mode 181
  - retention time independent MRM mode 180
  - target scan time 182
  - Teflon AF technology 345
  - thermal effect compensation 135
  - thermal modes 55
  - Thermo 277
  - Thermo Chromeleon software 274
  - Thermo Fisher Scientific
    - individual instrument components
      - column thermostating 342
      - fast and ultra-efficient UHPLC separations 344
      - flow delivery device 339
      - injector and liquid handling devices 340
      - 2D-LC and alternative ways 346
    - total system requirements
      - nanoLC systems 335
      - UltiMate 3000, Vanquish 336
      - viper based system tubing 338
  - thermostatic control 68
  - total ion current (TIC) chromatogram 186, 207
  - triple quadrupole mass spectrometers 178, 185
  - two-dimensional liquid chromatography
    - HPLC 193
    - instrument manufacturers
      - Agilent 216
      - Sciex 216
      - Shimadzu 216
      - Thermo/Dionex 216
      - waters 216

- method development and gradient programming 215
  - miniaturized LC x LC system
    - column dimension and modulation 205
    - gradient programming and overall analysis time 206
    - mass spectrometry 206
    - mobile phase and temperature 205
    - stationary phase 204
    - technical platform 204
  - modulation
    - comprehensive online 2D LC 200
    - online heart-Cut 2D LC 200
    - stop-flow and offline LC x LC 202
  - MS/MS functionality 211
  - multiple heart cut/selected LC x LC approach 214
  - offline LC x LC vs. online LC x LC 211
  - online LC x LC, practical problems of dilution 203
    - high flowrate 203
    - mass spectrometry 203
    - solvent systems 203
  - peak capacity
    - comprehensive 2D LC (LC x LC) 197
    - Heart-Cut 2D LC (LC-LC) 196
    - one-dimensional liquid chromatography 195
    - peak vs. 218
  - real sample measurement 209
  - reference standard 207
  - software 217
  - stop flow LC x LC 214
  - system set-up 217
- u**
- UHPLC hyphenation with mass spectrometry
    - chromatographic parameter 174
    - column selection and dimension 176
    - interface and flow rate 173
    - miniaturization 189
    - MS parameter optimization 174
    - non-target screening 172
    - screening approach
      - acquisition cycle 187
      - data dependent experiments 186
      - Orbitraps 186
      - source databases 186
      - system designs 187, 188
      - workflow 186
    - suspected-target screening 172
    - system design 177
    - target analysis 171
      - multicomponent method 179
    - multiple reaction monitoring (MRM) mode 179
    - Orbitraps 178
    - retention time dependent MRM mode 181
    - retention time independent MRM mode 180
  - UHPLC systems, *see* ultra high performance liquid chromatography (UHPLC)
  - UltiMate 3000 Corona Veo model 344
  - UltiMate 3000 RSLCnano 335
  - UltiMate 3000 system 346
  - ultra high performance liquid chromatography (UHPLC)
    - advantages 6, 22
    - analyte and
      - chemical modification 257
      - fused-silica and PAEK/PEEK 257
      - metal ions 256
      - phosphorylated analytes 256
      - protein adsorption 255
    - autosamplers
      - advantages and disadvantages 40
      - design 35
      - fixed-loop 36
      - flow-through 38
      - injection valves 239
      - materials 238
      - practical aspects 241
      - sample needles, vials and closures 238
    - baseline separation 4
    - capillaries and fittings 47

- ultra high performance liquid chromatography (UHPLC)
    - (*contd.*)
    - column oven 41
    - dead volumes 2, 20
    - delay volume 34
    - detection method requirements 254
    - detectors 44
    - disadvantages 22
    - dissatisfied users 18
    - extra-column-band-broadening
      - column peak volume 76
      - column efficiency and resolution 74
      - column performance testing 95
      - extra-column volume without column 88
      - factors 73
      - fast gradient separations 96
      - fittings and connections 83
      - frictional heating impact 73
      - gradient separation impact 92
      - heat exchangers 84
      - high gradient separations 96
      - injection system 79
      - isocratic separation impact 90
      - isocratic separations 95
      - mass spectrometers 86
      - mass spectrometric detection 74
      - optical detectors 85
      - sample dilution 73
      - solvent consumption 74
      - sources 78
      - tubing 80
      - volume with column 89
    - extra column volume 2
    - factors 7
    - fast separation 2, 12
    - fitting systems 246
    - flow paths
      - low-pressure and high-pressure 227
      - mobile phase and sample flow path 228
    - good separation 2
    - high-pressure flow path pumps, *see* Pumps
    - high pressure mixing system 30, 31
    - inertness 223
      - analyte-specific inertness 249
      - general inertness 248
    - isocratic and gradient separations 5, 6
    - low-pressure flow path 229
    - low pressure mixing system 31
    - mass sensitivity 13
    - material requirements
      - analyte compatibility/biocompatibility 226
      - chemical stability 225
      - mechanical stability 225
    - mechanical and physical integrity 253
    - microfluidic optimized Jet Weaver mixer 32
    - parameters and requirements 21
    - passivation strategies and methods 258
    - quality of separation 3
    - resolution 4
    - robust separations 15
    - satisfied users 18
    - solvent 33
    - tubing system
      - fused-silica tubing 246
      - materials 243
      - metal-based tubing 244
      - polymer-based tubing 246
      - wetted materials 223
    - ultra-high-molecular weight polyethylene (UHMW-PE) 230
    - ultrasonic degassing technique 301
- V**
- Vanquish system 336–338
  - various wavelength detector (VWD) 309
  - Viper technology 338
  - ViscoJet™ micro-mixer 152
- Z**
- zero dead volume union (ZDV) 281, 283