

Subject Index

- α value, *see* Separation factor
- A solvent, 75
- Absorption unit, 88
- Accuracy, 277
- Acetonitrile for HPLC, 163
- Acidity of solvents, 75
- Activated gel, 224
- Adsorption chromatography, 146
 - applications, 154
 - test mixture, 136
- Adsorption isotherm, 149
- Affinity chromatography, 222
 - applications, 225
- Agarose, 123
- Alumina, 122
- Amino phase, 118, 179
- Amperometric detector, 92
- Analysis, 255
 - qualitative, 255
 - quantitative, 261
 - trace, 257
- Antioxidant, 59
- APCI, 102
- APESI, 103
- Apparatus test, 276
- Asymmetry of peaks, 40, 131, 342
- Atmospheric pressure chemical ionization, 102
- Atmospheric pressure electrospray ionization, 103
- AU, 88
- Autosampler, 69
 - test, 332
- B solvent, 75
 - and peak height, 269
- Balanced-density method, 345
- Band broadening, 16
- Band width, spectral, 90
- Baseline drift, 85, 274, 341
- Basicity of solvents, 75, 153
- Bed reactor, 281
- Bimodal columns, 217
- Binary mixture, 149, 163
- Boiling point, table, 74
- Bonded phases, 115
 - chemical stability, 118, 171
- Bonded-phase chromatography, 178
- Books, 12
- Breakthrough time, 21, 133
- Brush-type CSP, 301
- Brush-type phase, 116
- Buffered silica, 156
- Buffers, 76, 191
 - volatile, 79
- Cadmium lamp, 90
- Calibration chromatogram in SEC, 210
- Calibration graph, 261
 - errors, 264
 - in SEC, 211
- Calibration, 261
- Capacity factor, *see* Retention factor
- Capillaries, 63
 - cutting, 65
 - maximum allowed length, 63, 325
 - pressure drop, 64
- Capillary HPLC, 311
- Capillary reactor, 281
- Carbon peek, 65
- Carbon phase, 123
- Carry-over problems, 340

- Cartridge, 107
- Cavity CSP, 306
- Cell volume, 86, 324
 - maximum allowed, 324
- Check valve, 53
- Chemical stability of bonded phases, 118, 171
- Chemical suppression, 203
- Chemical tailing, 39, 158, 169
- Chemically bonded phases, 115, 178
- Chemically modified silica, 115
 - stability, 118, 171
- Chiral liquid stationary phases, 300
- Chiral mobile phases, 299
- Chiral separation, *see* Enantiomer separation
- Chiral stationary phases, 301
 - table, 302
- Choice of method, 228
- Chromatogram, 20
 - from random numbers, 44
 - reduced, 36
- Chromatography
 - definition 14
 - processes, 15
- Cibacron blue, 226
- Column packing, *see* Stationary phase
- Column switching, 241
- Column, 106
 - care, 126
 - coupling, 33, 215, 253
 - diameter, 106, 107, 258, 321, 326
 - dimensionless parameters, 138
 - direction of flow, 128
 - emptying, 128
 - guard, 108
 - micro, 313
 - packing procedure, 345
 - permeability, 131, 139
 - pressure-optimized, 47
 - regeneration, 126
 - repair, 128
 - scavenger, 108
 - terminator, 107
 - tests, 130
- Columns, coupled, 215, 241, 253
- Compressibility, 10
- Computer simulation of a separation, 249
- Concentration at peak maximum, 257, 260, 326
- Concentration sensitivity, 82
- Conductivity detector, 96
- Constant-systematic deviation, 264
- Control chart, 277
- Controlled-pore glass, 122
- Corrosion, 59
- Coulometric detector, 94
- Counter ions, 196
- Coupling with spectroscopy, 99
- CPG, 122
- Crown ether phase, 307
- CSP, 301
- Cyano phase, 118, 179
- Cyclodextrin phase, 306
- Cylinder pore model, 208
- Deactivators, 154
- Dead time, 21, 134
- Dead volumes, 37
- Deflection refractometer, 91
- Degassing, 60
- Demonstration experiment, 4, 14, 26
- Derivatization, 279
 - for enantiomer separation, 308
- Detection
 - indirect, 98, 199
 - multiple 97
- Detection limit, 84, 265, 327
- Detector cell volume, 86, 324
 - maximum allowed, 324
- Detector
 - linear range, 85
 - overload, 292
 - properties, 82
 - requirements, 82, 276
 - test, 333
 - time constant, 85, 272, 324
- Detectors, 82
 - amperometric, 92
 - amperometric, pulsed, 94
 - bulk property, 83
 - concentration-sensitive, 82
 - conductivity, 96
 - coulometric, 94
 - diode array, 99
 - electrochemical, 92
 - fluorescence, 92
 - infrared, 96
 - light scattering, 94
 - mass spectrometers, 102
 - mass-sensitive, 83
 - NMR, 105

- photoconductivity, 96
- radioactivity, 97
- reaction, 280
- refraction index, 90
- UV, 87
- Deuterium lamp, 89
- Diffusion, 18
- Diffusion coefficient, 143
 - of macromolecules, 144
- Dilution factor, 325
- Dimensionless parameters, 138
- Diode array detector, 99
- Diol phase, 118, 178
- Dipole character of solvents, 75
- Directed optimization, 249
- Displacement chromatography, 260, 294
- Distribution coefficient, 15, 22, 148
- DNBPG phase, 301
- Double peaks, 342
- Drift, 85, 274, 341
- Dual-column ion chromatography, 203
- Dwell volume, 63

- Eddy diffusion, 16
- Efficiency, 139
- Electrochemical detector, 92
- Electrochromatography, 318
- Electronic suppression, 203
- Electrospray ionization, 103
- ELSD, 94
- Eluent, *see* Mobile phase
- Eluotropic series, 74, 149
- Elution problem, 235
- EMG function, 41
- Enantiomer separation, 297
 - as diastereomers, 308
 - indirect, 308
- End cut, 241
- End-capping, 117
- ESI, 103
- Evaporative light scattering detector, 94
- Exclusion, 207
- Exponentially modified Gauss function, 41
- External standard, 261
- Extra-column volumes, 37

- Ferrule, 66
- Fittings, 66
- Flow direction, 128
- Flow distribution, 17

- Flow rate and peak area, 269
- Flow resistance, dimensionless, 139
- Flow velocity, optimum, 20, 141, 321
- Fluorescence detector, 92
- Four-solvent optimization, 244
- Fraction collection, 292
- Frit, 107
- Front cut, 241
- Fronting, 38, 41
- FTIR, 102

- Gas chromatography, 10
- Gaussian curve, 20
- Gaussian peak, 20, 28
- Gel filtration chromatography, 218
- Gel permeation chromatography, 218
- GFC, 218
- Ghost peaks, 87, 237, 256, 282, 342
- Glass phase, 122
- GPC, 218
- Gradient
 - high-pressure, 62
 - low-pressure, 62
 - profiles, 238
 - separation, 235
 - separation, of macromolecules, 240
 - system, 61
 - test, 334
- Guard column, 108

- H/u-curve, 19
- Hagen-Poiseuille equation, 64
- Heart cut, 241
- Height of a theoretical plate, 26
- Helical polymer CSP, 306
- HETP, 26
- High-pressure gradient, 62
- High-speed HPLC, 313
- HPLC, 4
 - analytical, 255
 - capillary, 311
 - enantioselective, 297
 - high-speed, 313
 - instrument, 8
 - limits, 47
 - micro, 311
 - separation modes, 7
 - super-speed, 313
 - supercritical, 316
 - theory, 14, 130, 320
- HPLC-FTIR, 102

- HPLC-MS, 102
HPLC-NMR, 105
HPLC-UV, 99
Hydrophobic interaction chromatography, 175
Hydroxyalkylmethacrylate gel, 122
Hydroxylapatite, 123
- Immuno affinity chromatography, 227
Indirect detection, 98, 199
Indirect separation of enantiomers, 308
Inflection tangents, 24
Infrared detector, 96
Injection, 67
 problems, 340
 technique, 67, 68, 69
 volume, 71, 259, 323
 volume, in preparative HPLC, 290
 volume, maximum allowed, 259, 323
Injector, 67
 repeatability, 276
 test, 332
Instrument, 8
 requirements, 276
 test, 330
Integration errors, 270, 272
Integrator test, 332
Integrator threshold, 274
Interferometer, 91
Internal standard, 261
Interstitial volume, 211
Ion chromatography, 202
 applications, 206
 phase systems, 203
Ion exchangers, 121, 184
 abbreviations, 185
 capacity, 185
 change of form, 192
Ion-exchange chromatography, 183
 applications, 192
 mobile phase, 186, 191
 sample size, 190
Ion-exclusion chromatography, 189
Ion-moderated partition chromatography, 188
Ion-pair chromatography, 195
 applications, 198
 counter ions, 196
Ion suppression, 203
IR detector, 96
Ishikawa diagram, 279
Isocratic separation, 228, 236
- Journals, 12
- k* value, *see* Retention factor
Knox equation, 141
Kozeny-Carman equation, 133
- Lamp 89
 cadmium, 90
 deuterium, 89
 mercury, 90
 replacement, 341
 tungsten-halogen, 90
 zinc, 90
Leaks, 339
Lectins, 226
Length units, 11
Ligand-exchange chromatography, 188
Ligand-exchange CSP, 307
Light scattering detector, 94
Limit of detection, 84, 265, 327
Limit of quantification, 264
Limits of HPLC, 47
Linear flow velocity, 21, 133, 321
Linear range, 85
Linearity of calibration, 277
Localization, 152
LOD, 264
Loop valve, 67
LOQ, 264
Low-pressure gradient, 62
- Macrocyclic antibiotic phases, 307
Macromolecules, 115, 144, 213, 220, 240
Magnesium silicate, 122
Mass overload, 38, 291
Mass sensitivity, 83
Mass transfer, 18
Measurement uncertainty, 278
Mercury lamp, 90
Methanol for HPLC, 162
Method
 choice, 228
 optimization, 233, 244
 ruggedness, 253, 277
 transfer, 234
 validation, 276
Method development, 233, 235
 computer simulated, 249

- in NP-HPLC, 153
- in RP-HPLC, 170
- with four solvents, 244
- Micro HPLC, 311
- Microcolumn, 313
- MIP, 308
- Miscibility, 76
- Mixed stationary phases, 253
- Mixing cross, 79
- Mobile phase, 14
 - additives, 40, 59, 78, 154, 165, 192, 218
 - binary, 139, 163
 - chiral, 299
 - choice, 58, 153, 163, 217
 - compressibility, 10
 - degassing, 60
 - heating in column, 47
 - mixing cross, 79
 - optimization in NP-HPLC, 153
 - optimization in RP-HPLC, 163
 - preparation, 60
 - properties, 58, 73
 - selection, 58, 153, 163, 217
 - shelf-life, 79
- Molecular imprinted polymer, 308
- Molecular mass determination, 213
- Monolithic phase, 112
- MS, 102
- Multiple detection, 97
- Multidimensional chromatography, 241

- Negative peaks, 98, 342
- Nitrile phase, 118, 179
- Nitro phase, 118, 182
- NMR, 105
- Noise, 83, 274, 340
- Normal-phase HPLC, *see* Adsorption chromatography

- Octadecylsilane, 117, 159
- ODS, 117, 159
- Optimization
 - directed, 249
 - systematic, 249
- Overlapping peaks, 270
- Overloading, 259, 289

- P', 164, 245
- Packing of columns, 345
- Particle size, 19, 109, 327
 - determination, 132
 - distribution, 110
- PC data system test, 332
- Peak capacity, 42
- Peak maximum concentration, 257, 260, 326
- Peak Separation Index, 23
- Peak, 20, 28,
 - area, 268
 - asymmetry, 40, 131, 342
 - double, 342
 - ghost, 87, 237, 256, 282, 342
 - height, 268
 - images, 27
 - negative, 98, 342
 - overlap, 270
 - unexpected, 282, 342
 - width, 21, 24
- Peek, 65
- Perfusion chromatography, 112
- Perfusible particles, 112
- Permeability, 131, 139
- PGC, 123
- Photoconductivity detector, 96
- Pirkle phase, 301
- pK_a values, 78
- Plate, *see* Theoretical plate
- PLB, 111
- Polarimeter detector, 298
- Polarity, 7
- Polyether ether ketone, 65
- Polystyrene, 118
- Pore structure, 18, 112, 120, 125
 - of perfusion particle, 112
 - of restricted surface access phase, 125
 - of styrene-divinylbenzene, 120
- Pore volume in SEC, 211
- Pores, 111, 115, 120
- Porosity, 134
- Porous graphitic carbon, 123
- Porous layer beads, 111
- Post-column derivatization, 280
- Pre-column derivatization, 280
- Precision, 277
- Precolumns, 108
- Preparative HPLC, 285
- Pressure drop, in capillaries, 64
- Pressure drop, in columns, 131, 139, 141, 328
- Pressure problems, 337
- Pressure units, 11
- Pressure-optimized column, 47

- Proportional-systematic deviation, 264
Protein CSP, 307
psi, 11
PSI, 23
Pulsed amperometric detection, 94
Pump, 52
 maintenance, 55
 membrane, 56
 pneumatic amplifier, 57
 requirements, 276
 short-stroke piston, 52
 syringe-type, 56
 test, 331
- Qualitative analysis, 255
Quantitative analysis, 261
- Radioactivity detector, 97
Reaction detectors, 280
Recovery, 266
Recycling, 294
Reduced chromatogram, 36
Reduced plate height, 138
Reduced velocity, 138
Refractive index
 detector, 90
 peak, 256
 table, 74
Regeneration of columns, 126
Relative retention, *see* Separation factor
Repeatability, 277
Reproducibility, 277
Resolution, 23, 27, 32
 equation, 32
 probability, 42
Restricted surface access phase, 125
Retention factor, 15, 22
Retention time, 20, 22, 322
 problems, 339
Retention volume, 159
Reversed-phase chromatography, 173
 applications, 170
 method development, 161
 mobile phases, 167
 stationary phases, 136
 test mixture, 90
RI detector, 69
Rotor seal, 253, 277
Ruggedness, 241
- S value, 118
- S-DVB, 9
Safety, 39
Sample mass, 71
Sample preparation, 190
Sample size, 71, 259, 323
 in ion exchange, 190
 in trace analysis, 259
Sample solution, 71, 265
Sample volume, 71, 259, 323
 in preparative HPLC, 290
 maximum allowed, 259, 323
Scaling up, 285
Scavenger column, 108
Segmented reactor, 281
Selectivity, 23, 32, 75
 of detectors, 83
 of method, 276
 of wavelength, 89, 274
Selectivity triangle, 75, 163, 244
Sensitivity, 277
 of detectors, 82
Separation factor, 23
Separation impedance, 139
Separation modes, 7
Separation processes, 15
SFC, 316
Shelf-life of mobile phase, 79
Silanol activity, 167
Silanol group, 114
Silica, 114, 146
 buffered, 156
 chemically modified, 115
Siloxane group, 114
Simplex method, 249
Single-column ion chromatography,
 203
Six-port valve, 68
Size-exclusion chromatography, 207
 applications, 218
 calibration, 210
 molecular mass determination, 213
 phase systems, 217
 temperature effects, 215
Solvatochromic parameters, 75
Solvent
 for the sample, 71, 265
 for the sample, in preparative HPLC,
 291
 gradients, 235
 reservoir, 61
 selectivity, 75

- strength, 73
- table, 74
- Spacer group, 224
- Specific resolution in SEC, 215
- Specific surface area, 115
- Spectroscopy, 99
- Standard addition, 263
- Stationary phase, 14, 109
 - chiral, 301
 - choice, 232
 - conformation, 163
 - for basic analytes, 170, 171
 - for ion chromatography, 205
 - general properties, 109
 - micrographs, 119
 - mixed, 253
 - monolithic, 112
 - non-porous, 111
 - perfusible, 112
 - PLB, 111
 - porous, 111
 - porous layer bead, 111
 - restricted access, 125
 - temperature stability, 47
- Statistical resolution probability, 42
- Step gradient, 237
- Stop depth, 66
- Styrene-divinylbenzene, 118
- Super-speed HPLC, 313
- Supercritical HPLC, 316
- Suppression techniques, 203
- Suppressor, 203
- System peaks, 99, 199, 282, 342
- System suitability test, 275, 277
- Systematic optimization, 248

- Tailing, 37, 40
- Temperature effects, 45
- Test gradient, 236
- Test mixture, 135
- Tests for columns, 130
 - in size-exclusion chromatography, 215
- Tests for instruments, 330
- Tetrahydrofuran for HPLC, 163

- Theoretical plate, 15
- Theoretical plate height, 19, 26
 - minimum, 20, 141
- Theory, 14, 130, 320
- Theoretical plate number, 25, 130
- Thin-layer chromatography, 153
- Threshold, 274
- Time constant, 85, 272, 324
- Titania, 124
- TLC test, 153
- Total permeation, 207
- Total porosity, 134
- Trace analysis, 257
- Transfer of method, 234
- Troubleshooting, 337
- Tubing, *see* Capillaries
- Tungsten-halogen lamp, 90

- Ultrapek, 65
- Uncertainty of measurement, 278
- UV cutoff, 73
 - detector, 87
 - table, 74

- Validation, 276
- Valve (injection), 67
- Valve (pump), 53
- Van Deemter curve, 19, 141
 - in size-exclusion chromatography, 209
- Van Deemter equation, 141
- Variance, 37
- Viscosity, 58, 162
 - table, 74
- Void volume, 22, 211
- Volume overload, 289, 323

- Water as deactivator, 154
- Water for HPLC, 162, 205
- Wavelength selectivity, 89, 274
- Wilke-Chang equation, 143
- Window diagram, 249

- Zinc lamp, 90
- Zirconia, 125