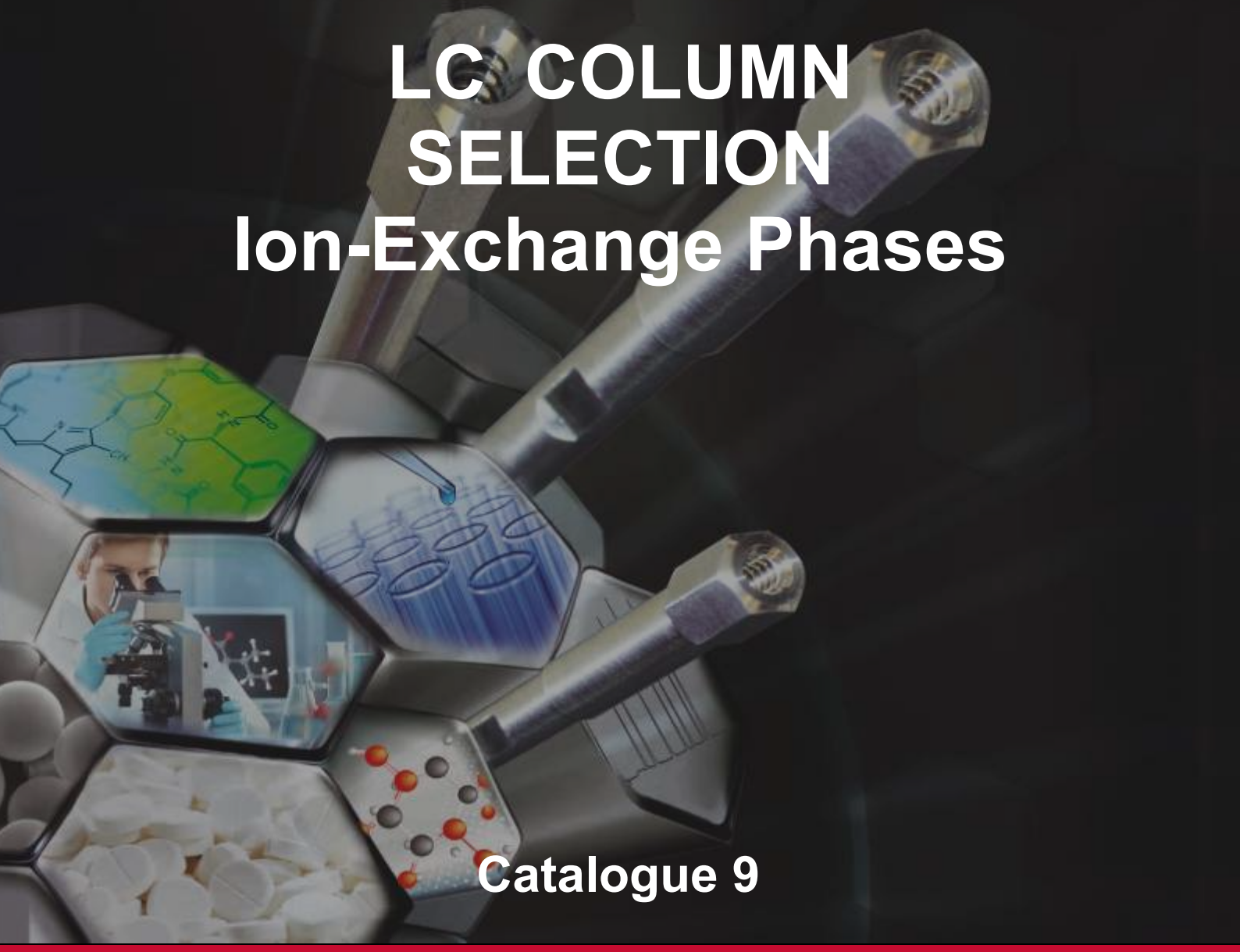
HICHROM

Chromatography Columns and Supplies

LC COLUMN SELECTION Ion-Exchange Phases



Catalogue 9

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ION-EXCHANGE PHASES

Introduction

Ion-exchange phases separate solutes on the basis of differences in ionic charge. Retention in ion-exchange chromatography is determined by the pH of the eluent, the nature and ionic strength of the buffer and temperature. Column efficiencies are lower than in reversed-phase HPLC. Eluents are normally aqueous but can contain some organic component.

Base Material

Both silica based and polymer based ion-exchangers are available. For the former, ionic species are attached to the silica surface, whereas for the latter the ion-exchange groups are distributed throughout the matrix. Silica based materials maintain a mechanical strength and higher efficiency advantage, whereas the polymer based materials have greater pH stability.

Applications

Ion-exchange is used for the analysis of small ions but the key application area of the technique is the separation of biomolecules such as peptides, proteins and oligonucleotides. Weak ion-exchangers are used for the analysis of inorganic ions, a technique more specifically termed ion chromatography (see page 52).

Ion-Exchange Capacity

The exchange capacity of an ion-exchanger is an important measure of its retentivity (typically measured in milliequivalents per gram material). For any one column the packing density of the phase must also be taken into account. Wide pore materials will typically have lower ion-exchange capacities.

Cation-exchange phases contain negatively charged functional groups and retain positively charged cations. Conversely, anion-exchange phases retain negatively charged analytes by their positively charged functional groups. In the schematics below, the ion strength of the counter ions can be adjusted to shift the equilibrium position and thus the retention times of the analytes.

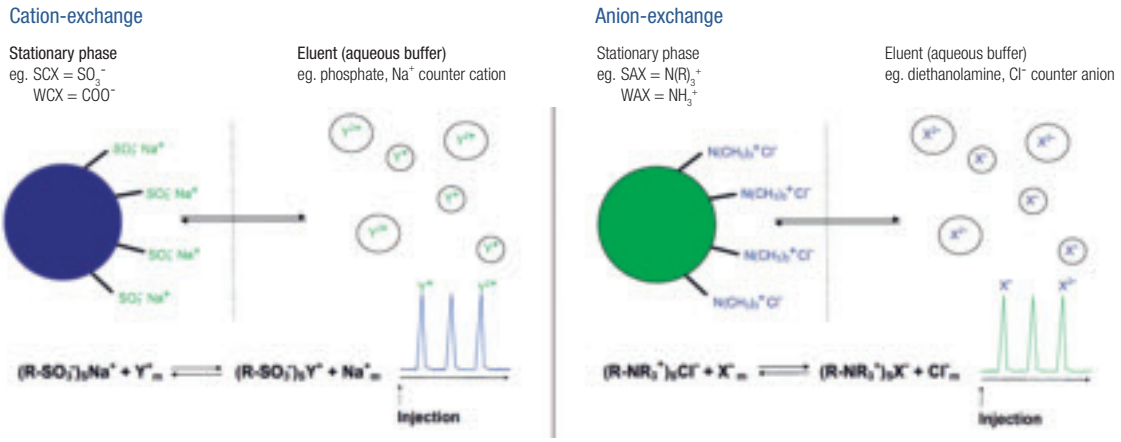

Figure 1. Mechanisms of ion-exchange

Classification

	Type	Strength	Nomenclature	Typical Functionality	pH Ionisation Range
Ion-Exchange	Anion	Weak	WAX	Amine	Ionised at specific pH
		Strong	SAX	Quaternary Ammonium	Ionised over complete pH range
	Cation	Strong	SCX	Sulphonic Acid	
		Weak	WCX	Carboxylic Acid	Ionised at specific pH

Ion-Exchange Phases

Phase	Manufacturer	Base Material	Classification	Particle Size (µm)	Pore Size (Å)	Applications and Features	Page
BioBasic AX, SCX	Thermo Scientific	Silica	SAX, SCX	5	300	Proteins, peptides, nucleic acids	239, 242
CAPCELL PAK UG SCX	Shiseido	Silica	SCX	5	80	Small molecules	79, 80
COSMOGEL IEX Type Q, Type S	Nacalai Tesque	Polymer	SAX, SCX	5	1000	Proteins, DNA	94
COSMOGEL IEX Type Q-N, Type S-N			SAX, SCX	5	Non-porous		

Ion-Exchange Phases (continued)

Ion-Exchange Phases (continued)

Phase	Manufacturer	Base Material	Classification	Particle Size (µm)	Pore Size (Å)	Applications and Features	Page
Epic SCX	ES Industries	Silica	SCX	1.8, 3, 5, 10	120	Small molecules	100
Eprogen AX300, CM300	Eprogen	Silica	WAX, WCX	6	300	Small molecules	99
Eprogen Q300, S300			SAX, SCX	6	300		99
Exsil SAX, SCX	Grace	Silica	SAX, SCX	5	100	Small molecules	104
Hamilton PRP-X100, PRP-X200	Hamilton	Polymer	WAX, WCX	10	100	Inorganic ion analysis	130, 131
Hamilton PRP-X500		Polymer	SAX, WAX	7	-	Proteins, DNA oligomers	130, 131
Hypersil GOLD AX, SAX	Thermo Scientific	Silica	WAX, SAX	1.9, 3, 5	175	AX – small proteins and peptides SAX- small molecules	228-230
Inertsil AX, CX	GL Sciences	Silica	SAX, SCX	5	100	Small molecules	108, 112-114
MCI GEL ProtEx-DEAE, -SP	Mitsubishi Chemicals	Polymer	WAX, SCX	5	-	Proteins	-
MCI GEL CQA Series			SAX, WAX	10			172
MCI GEL CQK Series			SCX, WCX	10			172
NUCLEOSIL SA, SB	Macherey-Nagel	Silica	SCX, SAX	5, 10	100	Small molecule analysis	163, 164
NUCLEOGEN DEAE			WAX	7	60, 500, 4000	Bioanalytical	168
Partisil SAX, SCX	Hichrom	Silica	SAX, SCX	5, 10	-	Small molecule analysis	189-193
Partisphere SAX, SCX			SAX, SCX	5	-		190, 191
PolyCAT A	PolyLC	Silica	WCX	3, 5, 12	300, 1000, 1500	Aspartic acid functionality	196, 197, 199
PolySULFOETHYL A			SCX		200, 300, 1000	Sulfoethylaspartamide	196, 198, 199
PolyWAX			WAX		100, 300, 1000, 1500	Proteins with isoelectric point <6.0	196-199
PL-SAX, PL-SCX	Agilent Technologies	Polymer	SAX, SCX	8, 10	1000	Protein applications	200
ProPac WCX-10, SCX-10, WAX-10, SAX-10	Thermo Scientific	Polymer	WCX, SCX, WAX, SAX	10	Non-porous	Proteins variants	239, 240, 242
Asahipak ES-502N, ES-502C	Shodex	Polymer	WAX, WCX	9	-	Proteins, peptides, oligonucleotides	212
Shodex IEC QA			SAX	12	-		212
Shodex IEC DEAE, SP, CM			WAX, SCX, WCX	8	-		212
TSKgel DEAE-2SW, CM-2SW	Tosoh Bioscience	Silica	WAX, WCX	5	125	Nucleotides, drug molecules, catecholamines	251, 253
TSKgel DEAE-3SW, CM-3SW			WAX, WCX	10	250		251, 253
TSKgel SuperQ-5PW, DEAE-5PW, SP-5PW, CM-5PW		Polymer	SAX, WAX, SCX, WCX	10, 13	1000	Enzymes, proteins, DNA, nucleic acids	251, 253
TSKgel BioAssist Q		Polymer	SAX	10, 13	~4000	Plasmids, antibodies and other large proteins	251, 253
TSKgel BioAssist S		Polymer	SCX	7, 13	~1300		251, 253
TSKgel Q-STAT, CM-STAT, SP-STAT		Non-porous resin	SAX, WCX, SCX	7, 10	Non-porous	Nucleic acids, mAb variants, protein aggregates	251-253
TSKgel DNA-STAT			SAX	5			251-253
Waters Spherisorb SAX, SCX	Waters	Silica	SAX, SCX	5	80	Small molecules	262, 263
YMC-BioPro QA, SP	YMC	Hydrophilic polymer	SAX, SCX	5	1000	Peptides, proteins, nucleic acids, other biomolecules	273
YMC-BioPro QA-F, SP-F			SAX, SCX	5	Non-porous		273
ZirChrom SAX, WAX	ZirChrom Separations	Zirconia	SAX, WAX	3, 5	300	Inorganic and organic anions, biomolecules	276-278
ZirChrom SHAX, WCX			SAX, WCX			Proteins	276-278